PLANNING WITH UNCERTAINTIES

AN EXPLORATIVE RESEARCH ON POLICY-MAKING FOR SUSTAINABLE URBAN LOGISTICS

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COLOPHON

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PREFACE

Dear reader,

I am very pleased to present to you the master thesis that I have written as final course in the Master of Environmental and Infrastructure Planning at the faculty of Spatial Sciences, University of Groningen. In this small preface I would like to take this opportunity to express my gratitude to everyone who assisted me in conducting this research.

To begin I would like to thank all the research participants from twelve European cities who greatly supported the outcome of this study by taking the time and effort to contribute to this study. Secondly, I would like to thank Arianna Americo for making my participation in the study visit of ULaaDS possible and for the time she has taken to invite her network to participate in the study. Finally, I would like to thank my supervisor, dr. Ward Rauws and dr. Paul Plazier for introducing this study topic and providing helpful direction when I was writing this Master thesis. I have been able to learn many new abilities, such as performing exploratory research, conducting interviews and above all connecting theory with practice. Thank you.

Maaike A. Buser

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ABSTRACT

Increasing the sustainability and liveability of urban centres has become a challenge for cities in Europe. Urban logistics is one of the sectors that significantly contributes to negative externalities since it contributes to CO_2 emissions, noise pollution, and traffic congestion. Cities are therefore developing a long-term policy strategy to make their urban logistics system more sustainable. However, the urban logistics sector demonstrates to be a dynamic industry where a diverse network of stakeholders, technological advancements, and a drive for sustainability lead to complexity making the policy field prone to uncertainties.

According to academic literature, the relatively new field of policy faces knowledge and resource gaps that make it difficult for local policymakers to understand the complex logistics system in their cities. By addressing the question of how local policymakers in European cities deal with the uncertainties of long-term planning for sustainable urban logistics, this study attempts to analyse the first steps for addressing uncertainties in policy-making.

With the help of a qualitative research design, the results of this study indicate that local policymakers are aware of the complexity of urban logistics systems and the uncertainties that surround this policy field. Combining the data from the literature review, the questionnaire and the semi-structured interviews, the findings reveal that local policymakers make use of four exploration techniques in order to create an understanding of the uncertainty types and their consequences. Furthermore, the results show that organisational support, resources and inspiration can boost the strategies of local policymakers for dealing with uncertainties. This study concludes that the current political culture and institutional procedures restrict local policymakers in incorporating uncertainties in their policy plans, making room for flexibility and time essential in transition toward sustainable urban logistics.

Keywords: Dealing with uncertainties in policy-making, sustainable urban logistics, exploring uncertainties, complex urban logistic systems

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SUL = Sustainable Urban Logistics
SULP = Sustainable Urban Logistics Plan
SUFT = Sustainable Urban Freight Transport

INTRODUCTION

1.1 Background of the research

1.1.1 The growing sector of urban logistics

The world of urban logistics is developing at a high speed. With an estimated growth of 78 percent in parcel delivery demand up to 2030, the urban logistics systems will become more advanced in the future (WEF, 2020). The demand of freight delivery increases due to the change in shopping behaviour preferring e-commerce over physical shopping, accelerating the parcel delivery in urban environments (Morganti et al., 2014). Although the expansion of the urban logistics industry makes it possible for citizens, companies, and organisations to access a wide range of on-demand delivery services, the industry also makes a sizable contribution to traffic congestion, noise pollution, and CO_2 emissions (Bertolini et al., 2008 Demir et al., 2022).

With a cut of 90 percent in CO_2 emissions, the European Union has set her ambition to achieve cleaner cities in 2050 (European Commission, 2021). By increasing the percentage of green energy every 5 years used to power vehicles, the EU aims to reduce the CO_2 emission originating from urban transport significantly (European Commission 2021; European commission, 2013b). Cities are encouraged to limit the CO_2 emission within inner centres through regulating the transport in their urban logistic systems - which can be defined as “the transportation of goods by and for commercial entities in urban areas “(Plazier & Rauws, 2021a, p8) - and following the targets as set by EU.

1.1.2 Need for policy attention

The growth in both population density and urban logistics systems in cities requires the attention from local city planners to facilitate the last mile delivery without compromising the liveability of cities (Bjørgen & Rughaug, 2022). Urban transportation planning in previous decades incorporated solitary transportation of people, for example with installing good infrastructure and providing public transport connections. Currently the growth in urban logistics systems and its negative externalities, have led to awareness and acknowledgement of local authorities to include urban freight transport in their planning approach (Ballantyne et al., 2013). Within the EU, municipalities are now requested to develop a vision for sustainable urban freight transport (Bjørgen & Rughaug, 2022).

With the desire to create sustainable urban freight transport (SUFT) systems, which according to Behrends et al. (2008) includes the three pillars of sustainability (social, economic and environmental), the attractiveness and quality of the urban environment can be enhanced and retained for future generations. To assist local governments, guidelines to develop an urban logistics policy plan – also referred to as a Sustainable Urban Logistics Plan (SULP) – have been provided by Aifandopoulou and Xenou (2019). However, despite the existing SULP guidelines, urban logistic systems remain difficult for local authorities to organise (Plazier & Rauws, 2021a, p8).

1.1.3 Urban logistics: A complex and dynamic sector

Local policymakers in the field of sustainable urban logistics (SUL) are confronted with a complex and dynamic policy field, due to four trends. As a result of globalisation and urbanization, the demand of freight transportation and last-mile logistics in urban centres is growing (Bosona, 2020; Plazier & Rauws, 2021a). The urban logistic system is consisting of “very different transport operations and logistics activities and requirements'' (CIVITAS, 2015, p9), including a web of stakeholders with conflicting interests and continuously changing composition which characterises urban logistics as a complex domain (Bosona, 2020). Furthermore, the speed in which new innovations and technologies arise in the field of urban logistics is unintelligible and is another reason for the dynamic and complex character of the policy field (Plazier & Rauws, 2021b). The fourth trend represents the urgent requests for cleaner, healthier and safer urban environments. Local officials have been appointed to decrease their carbon footprint and use an integrated approach to increase the sustainability of urban freight

systems and urban environments (Plazier & Rauws, 2021a). In summary, the difficulty of urban logistics planning is to provide policies that accommodate the growing sector, balance the interest of varying stakeholders and support upcoming technologies all in combination with improving the quality of the urban environment and enhancing the liveability for the current and next generation citizens.

1.2 Problem in current SUL planning

The current status of urban logistics planning of local authorities implies that cities are motivated to enhance their policy plans in order to improve the sustainability of urban logistics together with the liveability of their cities (Bjørgen et. al., 2019; Morfoulaki et al., 2016). Nevertheless, cities are experiencing a scarcity in resources to prioritise urban logistics (Akgün et al., 2019; Ballantyne et al., 2013). The insufficient understanding of the cities' urban logistics system by local policymakers alongside the absence of a coordinated planning strategy and a responsible department within the local authorities (Behrends et al., 2008; Bjørgen et. al., 2019), are formulated examples of the missing resources local policy makers in the field of urban logistics have to deal with.

The framework of guidelines (the SULP guidelines), provide local policymakers with a tool to simplify the first attempt of developing a logistics plan and to grasp the complexity of urban logistics systems (Plazier & Rauws, 2021b). However, because the complex and dynamic character of urban logistics systems can cause (unexpected) change, the long-term aim for sustainable urban logistics policy can become prone to uncertainties. Creating tension between the desire for a long-term policy visions and the sustainable transition of complex urban logistics systems.

The acknowledgement of uncertainties by policymakers is argued to be important as first step in dealing with uncertainties, as well as the incorporation of uncertainties in the planning process (Marchau et al., 2010; Termeer et al., 2015; Walker et al., 2010; Walker et al., 2019; Warmink et al., 2017). Nevertheless, steps to explore uncertainties in the field of urban logistics are not made explicit in the SULP guidelines and it is unknown if and how local policymakers deal with uncertainties during the development or implementation of SUL policy making.

1.3 Societal relevance

Two factors emphasise how important it is that local authorities undergo the difficult process of creating SUL policy. First of all, urban freight transport is describes as being "the engine of the economy" in urban areas (Amaya et al., 2020, p329). The transportation flows increase the economies vitality by providing services and delivering goods to businesses and citizen who are accommodated in the urban centre (Akgün et al., 2019; Lindholm, 2013; Paddeu et al., 2018). Furthermore, private logistic stakeholders are incompetent to enable a transition to SUL without the help of policies (Anderson et al., 2005). The sector of urban logistics which counts various stakeholders and differentiating interests requires guidance in developing a SUFT system and is in need of an intermediary (Paddeu et al., 2018). The various developments that are currently surrounding the field of urban logistics ask local authorities to generate a vision for the SUL objectives of the city. Complementary, local policymakers can operate in accordance with the central policy vision and mediate conflicting interests.

One of the reasons why the relative new policy field of urban logistics is often undervalued is the absence of information and data at city level (European Commission, 2013). For example, local authorities miss out on expertise to deal with the challenges of urban logistics and experience a lack in knowledge on stakeholder relations and sustainable measures (Bjørgen et. al., 2019). Hence, this study is exploring how to deal with the challenges of the complex and dynamic policy field of urban logistics by mapping the practices of European local policy makers in the field of urban logistics. With a particular focus on how local policy explore uncertainties, this master thesis can contribute to the information provision on strategies that can be used to explore unforeseen challenges in addition to

gaining knowledge about potential instruments that could help them with the SUL policy-making process.

1.4 Scientific relevance

In academic literature, strategies for dealing with uncertainties are suggested in the form of dynamic and adaptive approaches designed to respond to uncertainties over time (Walker et al., 2010). Academic articles have already researched how local officials deal with the uncertainties in complex and open planning processes (Bjørgen et al., 2019; Warmink et al., 2017; Woodruff, 2016), however, this study is still underdeveloped in the policy area of sustainable urban logistics. By developing an uncertainty typology, Plazier & Rauws (2021b) have started to apply this study to the field of sustainable urban logistics policy, their development of an uncertainty typology forms the first step in the process of conducting an uncertainty scan. By exploring the current practice of European local policymakers, this master thesis can generate knowledge to inform the development of a strategic approach which includes uncertainties in the process of sustainable urban logistic plans.

To research how local policymakers could explore uncertainties in their daily practice, theories will be consulted to create an understanding of potential strategies. Hence, Höllerman & Evers (2017) point at the gap between in how scientists and practitioners deal with uncertainties and express the possible difficulty this gap tends to present for the efficient transfer of knowledge. Scientists argue that the main cause of uncertainty is a lack of the essential knowledge, and that attempts to expand the knowledge that is already available can be used to reduce uncertainties (Maxim & van der Sluijs, 2011). As a result, scientists' reason that the potential uncertainties and their influence from significant topics like climate change to smaller-scale studies, whereas practitioners' reason from the opposite direction from a bottom-up approach to be able to deal with the uncertainties present (Höllerman & Evers, 2017). This study can contribute to this knowledge gap and suggest how practise and science can benefit from one another by contrasting the suggested tactics for examining uncertainties in literature with the routine practises of local authorities in the field of urban logistics.

1.5 Research Objective

The aim of this research is to investigate the types of uncertainty that local policymakers encounter on a daily basis and the approaches they employ to explore those uncertainties in order the deal with long-term uncertainties in SUL policy-making. As part of this analysis, the study provides a general review of the various types of uncertainties that may be found in the subject of urban logistics and looks into the uncertainties that local policy makers are aware of and the strategies they employ to address them. By using a mixed method approach, the study identifies the potential contradictions and complementarities between science and practise in used strategies to explore uncertainties in long-term SUL policy-making. By addressing potential opportunities and bottlenecks European local policymakers encounter in their strategies to include uncertainties in their policy-making, insight in needed assistance or resources can be provided.

1.6 Research Question(s)

The following research question has been developed in accordance with the research objective:

> How do local policymakers in European cities deal with the uncertainties of long-term planning for sustainable urban logistics?

In order to generate and answer to the main research question, six sub-questions are identified:

1. Which developments cause uncertainties related to sustainable urban logistics policies and which types of uncertainties can be distinguished in theory?
2. Which policy strategies are suggested in urban policy literature to explore uncertainties?

3. To what extent are local policymakers of European cities confronted with uncertainties in developing and implementing Sustainable Urban Logistics Plans?
4. Do local policymakers explore uncertainties that may affect policies for sustainable urban logistics and in which ways?
5. Which conditions can be observed to cause opportunities or barriers for local authorities in dealing with the uncertainties of sustainable urban logistics?
6. Which first steps can be identified to enhance the strategies of local policy makers to deal with uncertainties in long-term planning for sustainable urban logistics?

1.7 Reading Guide

The structure of this master thesis follows the order of sub-questions and will work towards an answer on the main research question of this study. Chapter two will present the theoretical framework which extensively explains why the complex and dynamic policy field of urban logistics is surrounded with uncertainties. Furthermore, a typology of uncertainties is presented alongside an approach on how uncertainties can be explored, and which opportunities and barriers local policymakers might experience. The methodology of this research is presented in chapter three in which data collection methods and their analyses are demonstrated. Complementary, in chapter four an overview is presented of the uncertainties that confront local policymakers in practice alongside the used approaches to explore these uncertainties and the observed conditions that can hamper or enable local policymakers. This master thesis ends with providing insight in how policymakers can improve their strategy to deal with uncertainties, the answer to the main research question and future recommendations.

2 LITERATURE REVIEW & THEORY

The following chapter will provide the theoretical framework for this study. Academic literature is consulted to identify which developments cause the SUL policy field to be surrounded with uncertainties and how these uncertainties can be categorized. Furthermore, insight is provided in how local policymakers can plan for sustainable urban logistics and which strategies are suggested in urban politics literature that they can use to explore the unforeseen developments of long-term urban logistics planning. This chapter is concluded with a conceptual model that provides an overview of the suggested steps for local policymakers to deal with uncertainties in SUL policy-making.

2.1 The complex system of sustainable urban logistics

In academic literature, urban logistics is frequently described as a sector which contributes significantly to negative environmental externalities, however, it also provides opportunities for local authorities to decrease the city's carbon footprint and improve the living conditions in their urban centre (Russo et al., 2020; Škultéty et al., 2021). Urban logistics is part of logistics management and refers to the distribution of goods in, through, and out of the city (Ballantyne et al., 2013; Behrends et al., 2008; Demir et al., 2022). These goods can be subdivided in to five themes: 1) retail; 2) express, courier and post; 3) hotel, restaurant and catering; 4) construction and road services; and 5) waste (CiViTAS, 2015), which demonstrates how dynamic and multifaceted the industry, and, by extension, the policy field is. Chapter 2.1 outlines four trends that, in addition to the various goods flows, explain the complex and dynamic nature of the urban logistics policy domain.

2.1.1. Planning for Sustainable Urban Logistics

In addition to urban logistics being a significant contributor to negative environmental impacts, it has positive social and economic impacts on the urban environment too (Morfoulaki et al., 2016). The delivery of goods is an essential service for both final consumers and commercial activities, and a key component in enabling the city to function appropriately (Morfoulaki et al., 2016; Russo et al., 2020). Admittedly, the transition to sustainable urban logistic developments should incorporate both the economic and social pillars of sustainability in addition to reversing the negative environmental impacts (Behrends et al., 2008; Russo et al., 2020). As an example, integrating the three sustainability pillars into urban logistics development, should include accessible transport systems for everyone, deduction of negative impacts such as air pollution and improvement of the "resource- and energy efficiency and cost-effectiveness" (Behrends et al., 2008, p704).

With the aid of the guidelines as described in paragraph 1.1 on page 10, which form the SULP planning process, it is expected that local authorities can more easily make trade-offs between the three pillars of sustainability – e.g., improving accessibility, reducing environmental externalities, and stimulate economic development. These guidelines are in line with the EU sustainability guidelines on mobility (Morfoulaki et al., 2016). Multiple cities in Europe, for example Groningen (The Netherlands) and Stockholm (Sweden), are implementing a policy plan dedicated to the sustainable development of urban logistics including policy measures such as operational regulations – e.g., time windows, low and zero emission zones – and green delivery vehicles (Morfoulaki et al., 2016; Plazier & Rauws, 2021b). Nevertheless, planning for sustainable urban logistics is directed to be a difficult task for local policymakers due to several reasons which are explained in the following paragraphs.

2.1.2 Long-term vision for sustainable urban logistics

Urban logistics plans that target the increase of sustainability should include a long-term vision of approximately 20 to 30 years, securing the existence of attractive and liveable cities for the next generation(s) (He & Haasis, 2020). Provided that the policy field needs integrated choices that include economic, social and environmental objectives complementary to a long-term perspective, indicates the complexity of urban logistic systems. For this reason, the concept of sustainability itself presents

the first challenge for policymakers. As previously stated, a long-term viewpoint is necessary for an urban logistics strategy that satisfies the sustainability objectives. Nevertheless, creating a long-term vision for the sustainable development of urban logistics is fraught with uncertainty due to two reasons. To begin, short-term actions are required in order to accomplish long-term objectives, however, decisions made in the past have unpredictable long-term effects on the transportation network (Marchau et al., 2010). Secondly, long-term planning indicates that local policymakers should make decisions for the future which is unpredictable and therefore surrounded with uncertainties (Walker et al., 2010).

2.1.3 Interrelated web of stakeholders

The responsibility to develop sustainable urban logistics plans is one of the local authorities. Cities are encouraged to listen to the desire of residents, community organisations and special advocacy groups to improve the quality of life and to achieve the (inter)national goals set in the field of climate – e.g., reducing their carbon footprint (Plazier & Rauws, 2021b). Having a sustainable urban logistics plan at one's disposal can contribute to achieving these goals, however, the development and implementation of a SULP is more difficult than initially thought. The task of defining, designing and implementing an urban logistics policy which satisfies the three-pillar concept of sustainability becomes even more challenging for local policy makers because it also has to receive the satisfaction and acceptance from the majority of the stakeholders (Gatta & Marcucci, 2016).

Policymakers at the local level have to identify, balance and incorporate the different stakes to formulate a policy in order to achieve an effective implementation (Stathopoulos et al., 2012). Due to the diversity of the current players operating in the sector of urban logistics, this is a challenging assignment (Marcucci, Marini, & Ticchi, 2005). In comparison to initial thoughts, each stakeholder or stakeholder group operates from a different objective along the three dimensions of sustainability (Janjevic et al, 2019), instead of from a rational scientific perspective (Woerkum et al., 2011). Because stakeholders act in their own best interests, there is a significant difference between their activities. As a result of their unique positions in the logistical chain, stakeholders such as retailers and couriers, act on behalf of other interests. Retailers can take measures to guarantee the sustainability of their own supplies, however, transport companies (couriers) must improve their business strategies to continue making money on sustainable deliveries (Gatta & Marcucci, 2016).

To understand the stakeholders' personal interest and the existing variety in perspectives indicates the need for tools to create an overview of the web of logistical stakeholders. In recent years, approaches for researching the demands and viewpoints of supply chain stakeholders have been suggested, for example Stathopoulos et al., (2012) stated that a clear overview of the stakeholder relations can assist policy-making with more effective implementation. In figure 1, a model is presented in which the stakeholders involved in the urban logistics field of Stockholm (Sweden) and their relationships are represented. The figure forms an interrelated web of stakeholders and reflects the perspective of local policy makers to which the policy field of urban logistics seems to be unfamiliar and difficult to understand (Holguïn-Veras et al., 2017). Following this, the development of these assisting tools provided insight in the existing stakeholders and also revealed the complexity of the relationships between the stakeholders (Amaya et al., 2020).

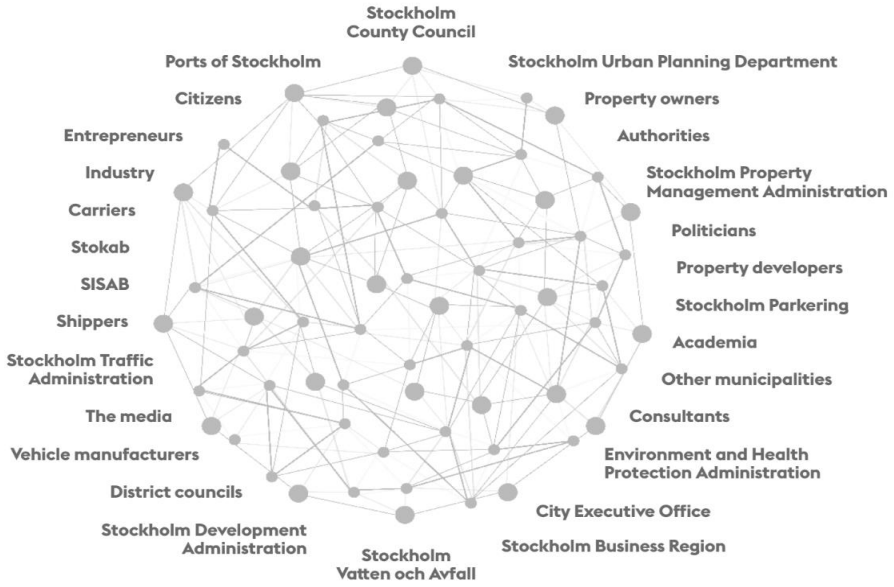


Figure 1 visualisation of the interrelated web of stakeholders in the city of Stockholm, Sweden.

The complexity and the heterogeneity of the urban logistics policy field causes not only difficulties by the identification of stakeholders and the policy problem, but it also increases the uncertainty of policy outcomes. The dynamic framework of urban logistics actors makes the reactions to policy measures within the entire system hard to predict (Holguïn-Veras et al., 2017). Therefore, a number of studies stress the significance of integrating stakeholders and understanding the diverse interests, views, and needs (Amaya et al., 2020) considering that doing so enables policymakers to create plans with a lower risk of disagreement and a higher likelihood of successful implementation (Bjørgen & Rughaug, 2022; Stathopoulos et al., 2012). Nevertheless, it is important to recall that the variation of stakeholders indicates the incompetence of a one-size-fits-all urban logistics policy plan (Amaya et al., 2020; Holguín-Veras et al., 2017). Although it can be argued that involving stakeholders in the policy-making process is a good way to reduce uncertainty in SUL planning, this does not mean that all uncertainty that affects urban logistics throughout time is resolved.

2.1.4 Innovations and technologies

New invented technologies and innovations that enter the field of urban logistics at a “dazzling” speed confront local policymakers and highlight the dynamic nature of logistics in urban areas (Plazier & Rauws, 2021b, p7). Bjørgen & Ryghaug (2022) observe a transition in goods distribution in and around city centres. With a change in quantity, nature and destinations, the urban environment both impacts and is impacted by urban logistics, indicating an increase in interaction between the delivery of goods and citizens. Logistics operators have started the transformation and created new technologies to improve the sustainability of their services and lower the CO_2 emissions of various transport modes (He & Haasis, 2020). Examples of the improved delivery services contain city hubs and platforms like parcel lockers, automated delivery services such as self-driving vehicles and drones and e-mobility – e.g., SEDV’s and electric cargo bikes (Bosona, 2020; Bjørgen & Ryghaug, 2022; He & Haasis, 2020; Plazier & Rauws B, 2021; Rieck et al., 2019).

The variety of new and upcoming technologies and innovation demonstrate the dynamic character of urban logistics operations. With innovations to be initiated at any time, the world of urban logistics is continuing to change. It is therefore that Plazier & Rauws (2021b) argue that innovative technologies and increasing knowledge cause the field of urban logistics to be surrounded by uncertainties. Planning for sustainable urban logistics provides the opportunity to stimulate economic growth and decrease environmental impacts in addition to enhancing the liveability of urban environments. Nevertheless, the need for a long-term perspective, the heterogeneous web of stakeholders and the (technical)

innovations, challenge local policy makers to deal with the complex character of urban logistic systems and the possible uncertainties that could arise during the planning process.

2.2 Acknowledging change as key component in urban logistic systems

Decision making about long-term urban logistics includes the ability to understand that the future is unpredictable and thereby accepting the existence of uncertainty and managing the impact that uncertainties could have on the planned environment. Ignorance of uncertainties in guiding urban logistic development into a sustainable direction, can have conflicting consequences for "people, countries and the earth's ecosystems" (Walker at al., 2010, p917). Considering the existence of uncertainty is therefore of great importance in the field of SUL. Research has shown that some uncertainties in the form of demographic or economic developments are being explored with the help of scenarios, however more uncertainties remain to be denied in policy-making (Marchau et al., 2010).

2.2.1 The unfamiliar policy field of urban logistics

A possible explanation for policymakers' limited attention for dealing with uncertainties is the unfamiliarity of the policy field to local city planners. Research and projects, for example the European project called Urban Logistics as an on-Demand Service (ULaaDS) and other (academic) research has been initiated to assist policymakers in getting a grip on the complex field of urban logistics and its impacts on the environment (Amaya et al., 2020; CiViTAS, 2015; Holguín-Veras et al., 2017; Plazier & Rauws, 2021ab). Accordingly, the transportation department of local authorities, at municipalities for example, focused predominantly on passenger transportation leaving freight transportation to be regulated by private parties (Lindholm, 2013). With an increase in awareness of the significant contribution local authorities can make complementary to the activities of single logistics operators in the sustainable development of urban logistics, public officials of different departments start to work together on the topic of urban freight transport (Anderson et al., 2005).

With only recently adopting the topic of urban logistics, local authority departments have little to no expertise or experience in urban freight planning and need to increase their knowledge on the complexity of urban logistics to be able to coordinate urban logistics planning and to collaborate with multiple stakeholders (Bjørgen & Rughaug, 2022). Local authorities have little understanding of the current scope of the cities freight transportation system and experience a lack in existing relationships between public and private stakeholders and available data (Akgün et al., 2019; Lindholm, 2013). Furthermore, the incompetence of city officials to enhance their understanding of urban logistics systems due to unavailable resources causes cities to depend on experts (Akgün et al., 2019; Ballantyne et al., 2013). The missing information of the current urban logistics system and the absence of essential resources to enhance policy makers' understanding of SUL surround the development of new SUL policies with uncertainties.

2.2.2 Planning and (un)planned change

Compared with the short history on planning for SUL, regional planning in general has a more extensive archive of research that explains how uncertainties surround the subject of planning. The paragraph below elaborates on the theory behind uncertainty that arises in planning processes in general and illustrates the interaction between planning and change.

Starting the development of regional or urban plans begins with the identification of the planning problem, a conception which is affected by context, time, and place, also known as the environment. The environment, for this study particularly the urban environment, is a dynamic interplay of multiple factors which changes constantly. Change can be defined as the outcome of a new connection being made in the current world as presented by Woerkum et al. (2011). The possibility to apply the concept of change to a variety of systems in the existing environment, for example ecosystems, new

connections are constantly made giving planning a continuously changing and thereby highly unpredictable character. Woerkum et al. (2011) distinguishes three sources of change: I) chance, like unexpected events; II) social interaction, such as between cultures and in languages; and III) "track-bound", change as the result of a series of actions.

The process of public planning entails developing and considering alternative futures in order to change the future. Planning is thereby not only surrounded by change, as Woerkum et al., (2011) described, planning is also creating change. The theory of Abbott (2005) explains how change is working in a two-way direction with planning which is visualised in figure 2. On the one hand causes the changing environment, the planning context, for the planning process to be surrounded by uncertainty and on the other hand produces the planning process uncertainty for the environment (Abbott, 2005). Two categories can be distinguished, process and environmental uncertainties.

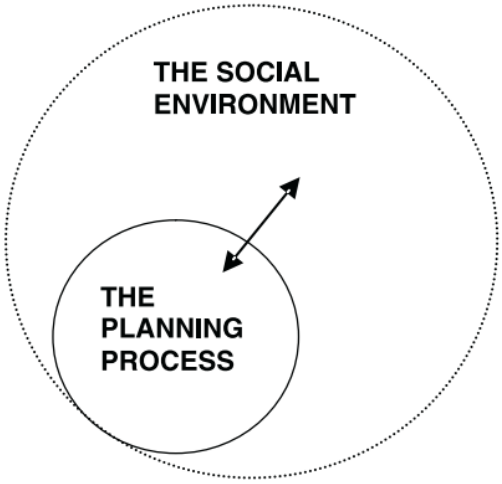


Figure 2 The interrelation between the social environment and the planning process both responsible for initiating change (Abbott, 2005)

By drafting and implementing a plan, the planning process attempts to explore various possibilities and impacts thereby the relationships between the present and a desired future. The moment planners begin to consider alternate futures, uncertainties for the direct involved stakeholders start to arise. These uncertainties can be distinguished as process uncertainties that "arise from planning". Environmental uncertainty refers to the uncertainty for everyone in one region that is produced by simply thinking about the future or attempting to foresee or adapt to it. Environmental uncertainties form "uncertainty for planning". With environmental planning being initiated to enhance the quality of a specific place, or urban area, every urban logistics plan has to deal with a unique framework of possible environmental uncertainties (Kato & Ahern, 2008). It is (thus) important to understand that the planning process itself creates uncertainties, and that both dimensions – environmental and process uncertainties – can occur at different levels and change during the planning process (Abbott, 2005).

By combining this information with the theories explained in chapter 2.1, it becomes clear which developments in the field of urban logistics cause uncertainties. To begin, a lack of knowledge on the cities' urban logistic system including the involved stakeholders and ongoing innovations in this sector, results in uncertainties regarding the effectiveness of policies and the reactions of stakeholders. Furthermore, the difficulty for policymakers to define long-term policies which guarantee sustainability, reduce the environmental impact and enhance economic development is high and becomes another cause of uncertainties related to sustainable urban logistics. Lastly, the relationship between planning and change shows that city planning, and by extension, planning for urban logistics, is fraught with uncertainty and therefore necessitates a strategy that can adapt to unforeseen developments. Nevertheless, local authorities experience a lack in resources and expertise to get a grip

on the complex and dynamic policy field of urban logistics, making it challenging to develop sustainable urban logistic plans.

2.3 Planning for complex urban logistics systems

The following chapter describes strategies that can be used to incorporate change and create the ability to deal with uncertainties in the process of policy-making.

2.3.1 The changing position of dealing with uncertainty: towards safe-to-fail planning

The perspective on how to deal with uncertainties has changed throughout the years in which planners have been challenged by the unforeseen developments of reaching sustainability. Previously, it was thought that achieving sustainability was equivalent to creating stability (Ahern, 2011; Rauws 2017). Clear objectives and a carefully chosen strategy which focussed on limiting risks was the obvious way to reach effectiveness, efficiency and stable situations (Rauws, 2017; Woerkum et al., 2011).

In the classical planning approaches, plans were designed upon the idea that the practice of planning was unambiguous and that stakeholders handled and responded from a scientific rational interest (Woerkum et al., 2011). The planning situation was well-known, and the future was one desired world which could be predicted and achieved by a static plan (Ahern, 2011; Woerkum et al., 2011). In terms of transport policy, this entailed that the available knowledge created the confidence to estimate the policy outcomes, or the interest stakeholder would attach to them. Furthermore, it was assumed that the gathered knowledge provided enough input to predict future transport system changes (Marchau et al., 2010). The idea that growth and change could be controlled with effective management strategies originated from the 'fail-safe' mentality as Ahern (2011) describes the classical planning mindset. According to this viewpoint, sustainability was viewed as something that needed to be accomplished and once it was, it would continue forever. Nevertheless, as described in chapter 2.1 and 2.2, causes sustainability complexities and is the planning environment described to dynamic instead of a static systems as is implied with the fail-safe approach.

The four trends of urban logistics described in the introduction chapter of this thesis indicate that the field of sustainable urban logistics is complex and dynamic. The growing demand and supply, the dynamic web of heterogeneous stakeholder, innovations and new technology and the demand for higher liveability of urban areas are all developments which reveal the unstable planning practice of urban logistics which responds and adapts to fit within the changing context. Studies on the extensive and still growing web of heterogeneous stakeholders indicate that their interests are not formed from scientific rationality, on the contrary, stakeholders express en safeguard their personal interest when it comes to new policy measures in the field of sustainable urban logistics (Woerkum et al., 2011). Secondly, the changing demand and supply of logistics in combination with the call for improved liveability in urban areas, contribute to the challenge of balancing interests and priorities to achieve more sustainable urban logistics. In times of increased urbanisation and less available urban space, several scenarios of possible futures can be designed in order to examine the different directions of a future vision. Thirdly, newly upcoming innovations and technologies also indicate that the available knowledge will be broadened over time. More and more it is acknowledged that being able to predict the future with the currently existing and available knowledge is unrealistic and denies that urban logistics is a rapidly evolving field that offers an infinite number of potential possibilities (Walker et al., 2013).

To enhance the current state of the urban environment and obtain the ability to adjust to newly available knowledge and time, flexibility in planning is needed to guide the future developments to fit within the changing context. Static plans, and one carefully chosen strategy will be unable to adjust to the changing context and newly available knowledge. This realisation has as result that the methods

from the traditional planning approach are not able to deal with the dynamic and complex planning world (Rauws, 2017; Woerkum et al., 2011). Strategies to deal with change, which arose in the second half of the twentieth century, originate from a new perspective which recognizes that predicting and establishing one future is undesirable (Ahern, 2011; Rauws, 2017). New plans should acknowledge that "planning is about change but not all change is planned" (Woerkum et al., 2011, pp 145).

Reaching stability is not the goal of ensuring the longevity of planning systems. On the contrary, the new perspective emphasises systems to be surrounded by variability, (unexpected) change and uncertainty (Ahern, 2011). The development of static plans is determined to be incompetent to deal with the complex situations and should instead provide opportunities for learning and adaptation (Woerkum et al., 2011). A proposed strategy is to design planning systems with a "safe-to-fail" character, which describes a system that can adapt, return to its formal state and function after the occurrence of an unforeseen development in the planning context (Ahern, 2011) alongside how systems can evolve by responding to the developments and/or changes (Rauws, 2017). Since the arrival of this new perspective, multiple strategies to prepare planners for dealing with change by the means of adaptation have been established.

2.3.2 Approaches for dealing with uncertainties

From the "safe-to-fail" mentality and the need for strategies to be able to deal with uncertainty, the adaptive management approach arose in 1978 and had multiple applications in the field of "natural resource and ecosystem management'' (Kato & Ahern, 2008, p543). Adaptive management is developed to accept uncertainty and manage complex systems in an adaptive manner (Light et al., 1995 in Kato & Ahern, 2008). With the belief that policies incompetent of adapting to environmental changes would fall short to reach their policy objective and have to ability to worsen things, it is suggested that public policy should become more adaptive (Barg & Tyler, 2009). The desire to anticipate changing conditions and to prevent the risk of policy failure in environmental planning had as result the introduction of adaptive planning and adaptive policy making.

Embracing uncertainty in adaptive management includes acknowledging that uncertainty is present in each step of the planning process, indicating the high variety of possible uncertainties. Kato & Ahern (2008) argue in their article that, due to the high range of rising uncertainties, planners should extend their knowledge of uncertainties whenever possible and create tactics and strategies to deal with them before, during and after the planning process. Complementary to this argument, a guide to develop and implement adaptive policies written by Barg and Tyler (2009), introduces four steps local policymakers can take to build an adaptive policy cycle. The four steps include the understanding of the policy environment: the fostering of a variety of policy measures; learning from shared experiences; monitoring the implementation; and improving policies when required (Barg & Tyler, 2009). Furthermore, the need for including the concept of 'learning-by doing' is extensively argued, since knowledge extends over time and both existing plans as newly developed plans can be adjusted to incorporate the learned lessons (Kate & Ahern, 2008). 'Learning-by-doing' is an approach that can be employed in the field of SUL policy-making to experiment with a policy measure and adjust when results are not what was anticipated.

Another approach that builds on the same foundation as the "safe-to-fail" perspective as described in paragraph 2.3.1, is the dynamic adaptive policy making approach of Marchau et al. (2010). With the recognition that uncertainty in a dynamic and constantly changing world can "lead to policy failure" (Marchau et al., 2010, p940), the DAP approach proposes a strategy that policymakers can follow to develop a policy which includes urgent short-term actions and presses policymakers to create a flexible long-term framework that can be adjusted over time (Marchau et al., 2010). The DAP approach incorporates both the developing phase and the implementation phase of a policy alongside a step in which the vulnerabilities, consisting of disruptions or opportunities, are identified. With this process,

DAP provides policymakers and planners to continuously adapt their strategy to reach the predefined goals instead of developing a strategy that loses its significance after the occurrence of one unforeseen vulnerability.

With a chance in perspective on how to deal with uncertainties, new strategies are proposed which embrace the safe to fail mentality. Three approaches have been discussed and indicate the need to incorporate strategies that deal with uncertainties during the development phase and the implementation of policies. Furthermore, the suggested strategies should include flexibility to learn from and adapt do unforeseen development that may occur in the future. However, the strategies do address how local authorities could respond to uncertainties in the policy field of urban logistics but skip over the step of understanding and exploring uncertainty as a policy maker.

2.4 A typology for assessing uncertainty

Barg & Tyler (2009) and Woodruff (2016) argue that increased awareness of uncertainty in future planning by policymakers can improve the utilisation of tools and enhance the policy's quality for adaptation. With the limited knowledge and resources that local policymakers have available to develop and implement urban logistics policy it is questionable if the awareness of uncertainties is also underdeveloped. Since improving the awareness of local policymakers begins with the identification of uncertainties, chapter 2.4 will provide typology of uncertainties to identify the different uncertainty types that surround SUL policy-making.

2.4.1 A classification of uncertainties in planning

To enhance the understanding of uncertainties, academic literature presents an extensive number of categorising uncertainties and distinguishing different types of uncertainties based on their level of uncertainty (Derbyshire, 2020; Thiele, 2020; Walker et al., 2010) or their origin (Abbott, 2005; Kato & Ahern, 2008). In the paragraph below some of the frameworks are discussed to show the differentiation between the frames, however, these sections will be a short summary since a full explanation of every categorisation is beyond the scope of this study.

<u>The uncertainty scheme</u>

A frequently mentioned deviation in uncertainty has been introduced in 2002 by Donald Rumsfeld, he explained that with combining the known and unknown in a contingency table as shown in table 1, four categories of uncertainty will appear (van der Steen, 2018). Within this categorisation, uncertainty is connected to knowledge, hence the four types of uncertainty express three knowledge relationships indicating the difference between unpredictability, lack of knowledge and existing knowledge (Brunach et al., 2008). The three categories that entail four forms of uncertainty can be explained as followed:

1. Known - knowns is a form of uncertainty of which we know that we know of their existence and of which its probability can be calculated (Thiele, 2020; van der Steen 2018).
2. Known - unknowns are uncertainties of which we know that they are unknown, which means that the impacts are known however the probability is not (Thiele, 2020; van der Steen 2018).
3. Unknown – knowns are uncertainties that arise from the statement that anyone cannot know everything. This categories hints at thing that we personally would not know but our colleagues or other people would have known (van der Steen, 2018).
4. Unknown - Unknowns refer to uncertainties of which we do not know that we don’t know, and in comparison, with the other two forms of uncertainty hereby the probability and the impact are unfamiliar (Thiele, 2020; van der Steen, 2018).

Table 1 The uncertainty scheme as presented by Donald Rumsfeld

	known	***Unknown***
Knows	*Known – knowns*	*Knows – unknowns*
Unknown	*Unknowns - knowns*	*Unknown – unknowns*

Applying this framework to the policy field of urban logistics, indicates that local policymakers can experience uncertainties in three different levels. Firstly, known developments of which local policymakers know that they will occur. Secondly, unknown developments of which local policymakers know that they will happen in the future. Lastly unknown developments of which local policy makers have no knowledge that they will occur in the field of urban logistics.

Epistemological or Ontological uncertainty

Another distinction between different types of uncertainty, is made by Derbyshire (2020). This author formulates two categories and distinguishes epistemological uncertainty and ontological uncertainty also in relation to the existing knowledge of humankind. Epistemological uncertainty refers to the "known and bounded inaccuracy of our knowledge" (Derbyshire, 2020, p711). The production of spatial and geographical knowledge, interpretation and definitions in addition to subjectivity are examples of epistemological uncertainty and are products risen from the current existing knowledge. Ontological uncertainty represents the category of unforeseen disruptions that change our present knowledge. Surprising unforeseen events are an example of these uncertainties together with changing "beliefs, attitudes and behaviours" as reaction to new developments and the responses of others (Derbyshire, 2020, p710). This category does address the unknown uncertainty and originates from the open planning systems in which the environment is constantly changing, exchanging and interacting

Defining the difference between epistemological and ontological uncertainties remains however difficult due to the complexity with which the extent of current knowledge is determined. In the field of sustainable urban logistics, technologies, innovations, and knowledge are increasing at a remarkable rate, making it challenging to distinguish between existing and non-existent knowledge as this depends on the perspectives employed. As a result, this specific typology provides little basis for a more specific uncertainty typology which can be implemented in the field of sustainable urban logistics. Nevertheless, this is the second categorization of uncertainties that demonstrates the relevance of knowledge in dealing with uncertainties, an element that will be included in the rest of the research.

The levels of uncertainty

The relationship between knowledge and uncertainty, as the two categorizations are an example of, is not an unexpected combination as the definition of uncertainty simply implies "the lack of knowledge" (Walker et al., 2010). In their article, Walker et al. (2010) integrates the concept of uncertainty policy-making and define uncertainty as "the gap between available knowledge and the knowledge policymakers would need in order to make the best policy choice" (p917). Knowledge exists in different levels and is also prone to subjectivity, since every policymaker can individually assess the needed knowledge to make a policy decision. To generate a comprehensive overview of the distinctive levels of uncertainty, Walker et al. (2010) developed a spectrum in which the different levels of uncertainty are presented (figure 3).

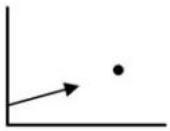
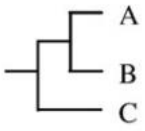
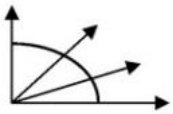
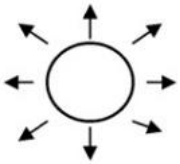
	Level 1	Level 2	Level 3	Level 4
			Deep Uncertainty	
Context	A clear enough future	Alternate futures (with probabilities)	A multiplicity of plausible futures	Unknown future
				

Figure 3 The spectrum of levels of uncertainties (Walker et al., 2010)

Level 1 and 2 uncertainties indicate that the future either exists of one single projection which can be calculated through statistical data or of multiple futures that can be researched with the help of scenario planning. Level 3 and 4 uncertainties form the deep uncertainties which implies that the information needed to hypothesise a future projection is unknown indicating that the future cannot be predicted. These latter two levels of uncertainty could represent the long-term uncertainties with which local policymakers have to deal with in SUL policy-making.

In light of three categorizations that show how uncertainties connect to knowledge of, for example, local policy makers This master's thesis will examine whether local policymakers are aware of various uncertainties. Therefore, the following article introduces an uncertainty typology that is more pertinent to urban logistics policy-making.

The framework of Abbott

John Abbott (2005) uses the distinction in sources of change in regional planning as the starting point for his uncertainty classification (paragraph 2.2.2). As planning is both affected by and causing change, Abbott explained that uncertainties surrounding planning originate from the planning process – process uncertainties – and from the social environment – environmental uncertainties. In a next step to further operationalize the two categories of uncertainties, the origins of both categories are evaluated more deeply, and other theories are used to decrease the abstraction level. Abbott (2005) argues that the uncertainties from the social/ external environment exist in multiple dimensions, differentiating in predictability level. The category of environmental uncertainty, resulting into four subcategories: causal uncertainty, human and organisational uncertainty, external uncertainty and chance uncertainty. On the other hand, process uncertainty has its roots in the varying perspectives and values of the individuals and groups involved in and impacted by the planning process. The subcategory that arises from this evaluation is referred to as value uncertainty.

In further definition of the subcategories of uncertainties in planning, Abbott states that the five types of uncertainties can be designated to either the external environment, to the planning process or to both. Figure 4 provides an overview of the described operationalization of uncertainty types in planning and visualises the deviation between environmental uncertainty and process uncertainty.

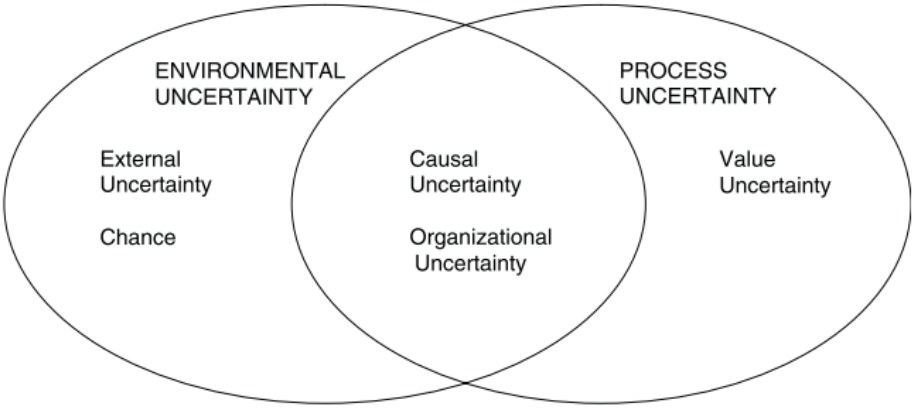


Figure 4 The operationalization of uncertainty types including the deviation in environmental and process uncertainty (Abbott, 2005)

With multiple developments causing the field of urban logistics to become surrounded by uncertainties, a differentiation in uncertainty types can provide assistance in defining the possible consequences and/ or response strategy for local policymakers. Plazier and Rauws (2021b) have made the first step in integrating the uncertainty framework of Abbott in the field of sustainable urban logistics. Their implementation is presented in figure 5 and shows how the types of uncertainties relate to the sustainable urban logistics domain and also indicate a short definition of each uncertainty type.

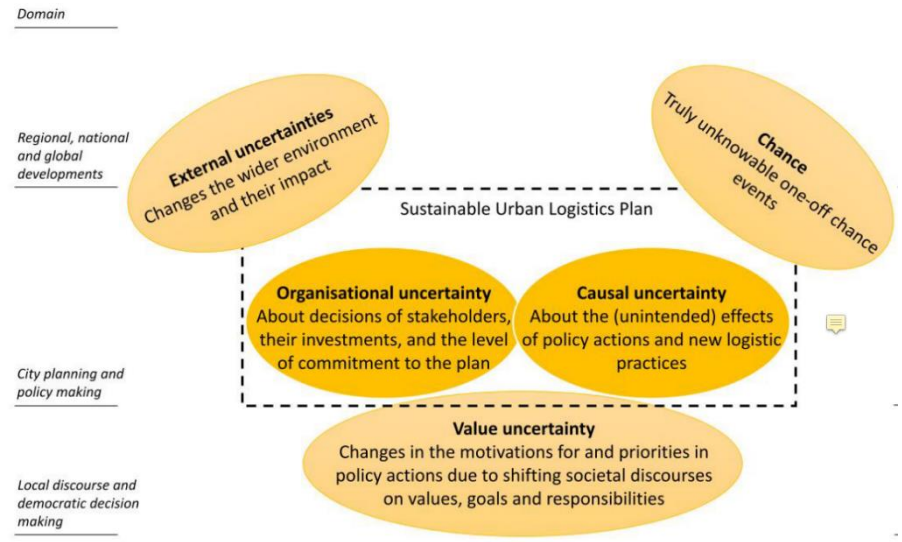


Figure 5 Typology of uncertainties in the field of SUL policy-making (Plazier & Rauws, 2021b)

2.4.3. The typology of uncertainties surrounding policy making for sustainable urban logistics

In the following paragraph, the typology of uncertainties will describe an extended explanation including examples of organisational -, causal -, value -, external uncertainty and uncertainty by chance.

Organisational uncertainty

Organisational uncertainties arise from the actions and interactions performed by players, people and organisations, who engage in developments and implementation of a SULP (Plazier & Rauws, 2021B). Within the dynamic field of urban logistics organisational uncertainties are always occurring. Stakeholders' actions reflect their interests, priorities, support to measures/policies and decisions they make and thereby influence the development and implementation of a SULP. Furthermore, existing uncertainty can also cause changes in behaviour of actors and thereby influence the organisational

actions an actor will take (Bonsall, 2004). New implemented policy measures, such as appointing a new transit authority, can result in organisational uncertainty for example the responses of existing organisations (Abbott, 2005). Another example would be businesses that are unable to function within the current policy framework and file for bankruptcy. In order to deal with these uncertainties, close cooperation and coordination across the heterogeneous web of stakeholders is required to come up with solutions (Plazier & Rauws, 2021B).

Value uncertainty

Value uncertainty arises from planning activities and refers to the shift in social values, objectives and responsibilities as well as to the changing of political agendas and interests. Policymakers may in this case alter their agenda as a result of both changes in politics and public values (Plazier & Rauws, 2021b). Value uncertainty can appear at an urban and regional level and in order to better comprehend the sort of value uncertainty, understanding the values and aspirations of stakeholders is necessary (Abbott, 2005; Plazier & Rauws, 2021b). Examples can refer to the chance in trust relationships or in the national political agenda which influences the local priorities. The fundamental values and goals can be defined through ongoing stakeholder interaction in which sense-making is done collaboratively. Stakeholders and policymakers might use simulations to assess new innovations or request a critical analysis, arising value uncertainties can be explored in advance in this way (Plazier & Rauws, 2021b).

Causal uncertainty

Causal uncertainties can originate from both the planning process as well as from the external environment (Abbott, 2005). As Bonsall (2004) describes how the variety in urban logistics is context-dependent in two different ways, of which the following components of cause and effect are the first. He mentioned a shift in capacity or demand as an example which eventually determines the magnitude of the effects on the quality of the environment. Operational hick-ups in the freight transportation flows or change in costs due to restrictions are other examples of this uncertainty type (Anderson et al., 2005). Causal uncertainties describe how the effects of a new policy implementation, or a new development affects the liveability of a city, they refer thus to uncertainties arising from the cause-effect relationship (Plazier & Rauws, 2021b).

External uncertainty

External uncertainty can be the potential for or limitations of developments that lay outside the control of a city in transition to influence or affect the impacts. External uncertainties can occur on city level, regional level, national level or global scale and find their origin in economic, social or environmental processes (Abbott, 2005; Plazier & Rauws, 2021b). To explore the presence of external uncertainties, pilots containing the test of a new policy measure can assist policy makers in discovering the potential opportunities and consequences.

Uncertainties by chance

Complementary to external uncertainties arise uncertainties by chance in every scale level from local to global. The difference between the two environmental uncertainty types, lies in the nature of the possible effect. Uncertainties by chance have a single and unannounced effect on the environment and lie beyond the control or influence of authorities or other stakeholders (Plazier & Rauws, 2021b). Plazier and Rauws (2021b) describe the possibility of using serious gaming to provide insights in reactive and recovery strategies a city can use.

The uncertainties that surround urban logistic policymakers either arise from the planning process or from the external environment and can be distinguished in five different types (table 2). In order to investigate whether local policymakers in the field of urban logistics are aware of uncertainties or have an understanding of uncertainties, this uncertainty typology will be used to map which uncertainties confront local policymakers in their daily practice.

Table 2 Operationalisation of uncertainties in policy-making for urban logistics

Dimensions	Subdimensions	Indicators
Process	Value uncertainty	Developments which arise by a change in community values and goals or as result of changing political values or priorities
Process & Environmental	Organisational uncertainty	Developments which are initiated by the actions and interactions of urban logistics stakeholders
	Causal Uncertainty	Developments that are caused by policies
Environmental	External Uncertainty	Developments in the contextual environment that are beyond the scope of influence of involved actors.
	Uncertainty of chance	Developments in the form of one-off chance events

2.5 Exploring uncertainties in planning for more sustainable urban logistics systems

In the previous chapter (chapter 2.4) several authors argued that uncertainties relate to the available knowledge or that they reflect the existing knowledge of local policymakers. This could suggest that as the knowledge on uncertainties grows, the understanding of local policymakers on how to address those uncertainty in urban logistics policy-making will also improve. In order to equip local policymakers with strategies to enhance their awareness of uncertainties, chapter 2.5 will present the clear and simple description of the trilogy of van der Steen (2018) which forms the basic framework of strategies to explore uncertainties.

Within the discussed theories on uncertainty, the level of uncertainties was foremostly connected to the degree of existing and available knowledge (Brunach et al., 2008; Derbyshire, 2020; Thiele, 2020; Walker et al., 2010). Hence, it is not surprising to learn that strategies to increase the level of knowledge are advised to use in exploring uncertainties. Since new uncertainties arise continuously as new decisions or developments are initiated over time and uncertainties originate from multiple causes (Termeer et al., 2015), strategies to explore the different types of uncertainty in sustainable urban logistic plans (SULPs) can therefore become a useful building block for local policymakers to be able to deal with uncertainties. Van der Steen (2018) distinguishes three different ways in which local policy makers can anticipate the future and unforeseen developments, including forecasting, foresight, and exploring by testing.

The first approach is *forecasting*, in which causal models are used to prepare quantitative scenarios that are based on stimulation of factors (van der Steen & Twist, 2020). This method makes use of models or forecasts to “calculate” possible outcomes, which enables an analysis of several scenarios to determine and estimate the future effects of a certain policy measure. The outcomes of a policy measure in addition to triggers to detect unforeseen developments can be analysed with the help of models, improving the preparation for a policy response to ensure that the required actions can be taken. The incorporating monitoring programs in policies is argued to be a necessity when it comes to effectively using adaptive policies (Barg & Tyler, 2009) but can also provide useful input for forecasting techniques. The use of monitoring is argued to be improving the knowledge of the urban logistics systems, which reduces uncertainty in policymakers’ understanding and strengthening the basis for decision making (Kato & Ahern, 2008). Additionally, enhancement of available data on for example local freight transport flows is necessary to create city developments that ensure a sustainable and an attractive urban environment (Bjørgen & Ryghaug, 2022). Thus, forecasting offers a chance to calculate the effects of (future) trends while simultaneously offering a method for analysing the data obtained by monitoring present policy implementations.

Nevertheless, forecasting has its limitations and might not be able to account for all potential uncertainties. The first restriction on examining uncertainty is reflected in the design and implementation of calculating programmes. Since the model's designer(s) can determine the included factors, indicators, stakeholders, and relationships in the form of numerous values, the model used will make computations on possible future paths within the inbuilt boundaries of the model (van der Steen & Twist, 2020). In consequence, a simulated range of potential outcomes will be generated because information from the past and the present predefine the data on which the model will run (Van der Steen, 2016). Correspondingly, the requirement for quantitative data input restricts the flexibility of potential outcomes and generates numerical future presentations in which the 'hard' numbers have not yet been translated into visual predictions (Van der Steen, 2016; Van der Steen & Twist, 2020).

The second approach to identify possible future outcomes is called '*foresight*'. The input used in a foresight analysis can be scenarios, which are created in a process in which stakeholders can question and imagine the future, resulting in visualizations or future narratives (Neef et al., 2020). These future visions are established via discussions, storytelling, debates and thinking out loud (van der Steen, 2018; van der Steen & Twist, 2020), and can take the form of "stories, pictures, movies, mood boards or other creative expressions (van der Steen, 2016, p32). Another conception which describes the method of foresight is scenario planning, broadening the viewpoints of stakeholders alongside providing room to rethink the perceived reality, provides local officials "with more confidence" to deal with uncertainties (Burt & van der Heijden, 2003). In contrast to forecasting, the results of a foresight analysis might originate from either the present or a future perspective in which the scenario is projected back into the present (van der Steen, 1016; Van der Steen, 2018). Foresight is a method which adheres less closely to a strict models and allows non-linear thinking, qualitative data and more radical imagined futures to be used and developed in the process. Additionally, more room is available for interpretation of judgements and clues, diversity in the outcomes and desirability (van der Steen & Twist, 2020), elucidating the vast range of potential futures that can be created (van der Steen, 2016).

The third strategy is called '*exploring by testing'*, in which you try a policy measure, for instance, through piloting and experience the developing uncertainties or unforeseen consequences with the aid of an experiment (van der Steen, 2018, p77). Piloting or testing a policy measure is expressed as an essential step since it provides planners to test and map the potential risks and consequences without disturbing the complete urban environment (Kato & Ahern, 2008). Monitoring a pilot can provide insight into the cause-and-effect relationship of a policy measure and also allow for the investigation of the perceptions and responses of citizens and other stakeholders. Hence, pilots give city planners and local policy makers the chance to make mistakes and learn from the test by bringing the future forward and gaining insight and experience (van der Steen 2018), this exploring approach therefore resembles another adaptive approach called learning by doing (Kato & Ahern, 2008). This method of exploring uncertainties can be done with the help of a pilot in the physical environment but on a smaller scale or be performed in an online environment. In order to experience the effects of a policy measure or change the policy implications in order to optimize the policy measure or objective, policy makers can use a 'Digital twin' of the urban environment in which the cities environment is replicated (Marcucci et al., 2020).

The three methods distinguished by van der Steen (2018) forecasting, foresight and exploring by testing demonstrate how local policymakers can explore uncertainties in multiple ways. Each method is represented in table 3 alongside the differentiation in data (quantitative or qualitative) and examples of activities which can be used to explore the unforeseen developments of a logistics policy measure. This trilogy of approaches to explore uncertainties in SUL policy-making will be used in the primary data collection of this study to distinguish in which way local policymakers explore uncertainties in their daily practice.

Table 3 Overview of the three strategies to explore uncertainties

	Sort data	Methods addressed in literature	Results
Forecasting	Quantitative, numerical data	Model calculations	Numerous visualisations, future scenarios, unforeseen developments
Foresight	Qualitative, data in a narrative manner	Discussions, storytelling, debates, thinking out lout	Narrative visualisations of the future, network relationships.
Exploring by testing	Quantitative and Qualitative	Pilots, tests, experiments in physical or online environment.	Test of appliance of the policy measure, consequences and opportunities

2.6 How to equip policy practices to get uncertainties on the radar?

Identifying uncertainty types that surround SUL policy-making and distinguishing approaches to explore these uncertainties can be used as a first step by local policymakers to get a grip on the complex urban logistics systems in order to deal with uncertainties. However, academic literature indicate certain conditions under which local policymakers are (un)able to take this step. In the following chapter barriers and opportunities that enable or hamper local policymakers in dealing with uncertainties are identified.

2.6.1 Organizational limitations for local policymakers in the field of SUL

The responsibility of the urban logistics policy domain lies at the local authorities, however, the topic of urban logistics is typically fragmented and split between different agencies or departments within the local city administration (Bjørgen & Ryghaug, 2022). As an example, the study of Bjørgen et al. (2019) shows how freight plans are seldom implemented at the municipal level, and how urban logistics is not well included into urban transportation and economic development goals. Urban logistics policymakers can be challenged by the differentiation in cultures and/or working styles between the different departments and mis management systems to develop integrated SUL policies (Hull, 2008). However, to create integrated SUL policies, departments of the local authority should be working together instead of hindering the transition toward sustainable urban logistics by prioritising the agendas and management strategies of their own department (Hull, 2008).

With the need to explore uncertainties, the question rises if local policy makers possess the capacity to address uncertainties and initiate more sustainable policy measures. In a study performed by Höllerman and Evers (2017) practitioners in the field of water resource management acknowledged the relevance of uncertainty, however, the study also highlights a variety in the implementation of uncertainties in the process of planning and decision-making. The political environment in which local policymakers operate makes it difficult for them to analyse uncertainties and establish the essential adaptive plans to deal with unforeseen changes (Barg & Tyler; 2009; Warmink et al., 2017). Furthermore, despite the shortage of resources that prevent local policymakers from addressing the complex situations of urban logistics, decision-makers ask policymakers to submit clear goals written in a formal plan that includes a fitting time frame (Bjørgen et al., 2019; Hull 2008; Höllerman & Evers, 2017). As a result, the development of integrated and sustainable policies for urban logistics is difficult for local policymakers due to the lack of resources to address uncertainties and the mismatch between needed flexibility to adjust policy plans over time and the precise demands of political institutions.

A complete overview of the organisational circumstances that are now described in a way in which they form barriers for SUL policy making are presented in table 4. With reversing the presented

conditions, opportunities for local policymakers to deal with uncertainties in SUL policymaker can be distinguished.

Table 4 Overview of organizational conditions for dealing with uncertainties

Organizational conditions	Become a barrier when	Is an opportunity when
Urban logistics as an integral policy field	SUL policymakers are hindered by difference in cultures and/or working styles of different administration departments	Policymakers from different departments collectively work on a policy for SUL.
Institutional procedures	Decisionmakers request a static plan including set objectives and unchangeable timeframe	SUL policymakers can create flexible and/or adaptive policy plans
Availability of resources	There is a lack in resources	There are resources available

2.6.2 Uncertainty in relation to the personal abilities of local policymakers in the field of SUL

Studies have been conducted to explore how local officials in the field of water resource management and climate change adaption, perceived, coped with and managed uncertainty in their planning practises (Höllerman & Evers, 2017; Warmink et al., 2017; Woodruff, 2016). According to their results, addressing uncertainties in the planning process is a strength considering the enhancement of the quality of policy plans and strategies instead of a weakness (Warmink et al., 2017; Woodruff, 2016), however, not all policy plans seem to reflect this (Woodruff, 2016). On the one hand can this be explained by the fact that local policymakers acknowledge the importance of integrating uncertainties, but they are nonetheless pressured to deliver specific plans. On the other hand, it can result from the personal abilities of a local policymaker such as experience, expertise and mindset (Höllerman & Evers, 2017; Warmink et al. 2017).

Policymakers' own experience is considered a major factor in their ability to deal with uncertainties Höllerman & Evers (2017). This ability to try to foresee environmental change depends on the individual perception of lacking critical information on the environment (Ashill & Jobber, 2013). Ashill & Jobber (2013) state that increased experiences, in for example the policy field of urban logistics, can help reduce personal uncertainty because the knowledge of and the ability to assess what the unforeseen developments are and how the developments will affect the organisation will be improved over time. In order to investigate this influence, this study will use the research performed by Ashill & Jobber (2010 & 2013) on the role of decisionmakers experience in addressing and managing uncertainty as input for the data collection methods.

In their article, Ashill & Jobber (2013) distinguish three personal conditions, which originate from the personal perception of abilities one has at its disposal, which can enhance policymaker’s skills in dealing with uncertainties. The first condition arises from the lack of confidence in understanding what the unforeseen developments are or the chance of its occurrence. The second condition refers to the lack of skill in predicting the nature of the unforeseen development. The inability in choosing the right response strategy for the unforeseen development formulates the third and final condition (Ashill & Jobber, 2013). The three personal condition which have an effect on the perceived ability of local policymakers to deal with uncertainties are presented in table 5 and will be included in the introductory questionnaire of this master thesis. The reason behind the incorporation of these three scales, is to create an understanding of how local policymakers in the field of urban logistics perceive their own ability to collect information for and interpret uncertainties in SUL planning (Ashill & Jobber, 2010).

Table 5 Overview of the three personal conditions influencing the abilities of policymakers to deal with uncertainties

Personal conditions	Definition
Understanding the uncertainty	lack of confidence in understanding what the unforeseen developments are
Predicting the uncertainty	the lack of skill in predicting the nature of the unforeseen development
Chosen response for the uncertainty	the inability in choosing the right response strategy for the unforeseen development

2.7 conceptual model

The theoretical framework demonstrates that the first step in addressing uncertainties in SUL policy-making is for local policymakers to gain a better understanding of the uncertainties that surround SUL policy-making. This theoretical framework serves as the foundation for the conceptual model, which is represented in figure 6. The model represents a three-step cycle on how local policymakers could get a better grip on the complexity of urban logistic systems, on the basis of two identified steps. Firstly, an understanding is required of the five uncertainty types that surround SUL policy making by local policymakers of European cities. Secondly, policymakers need to explore uncertainty in SUL to make sense of the uncertainties and their effects. Getting uncertainties on the radar of local policy makers by enhancing their understanding and sensemaking of the uncertainties that surround sustainable urban logistics policy measures could improve the capability to deal with uncertainties and might result in managing complex urban logistics systems.

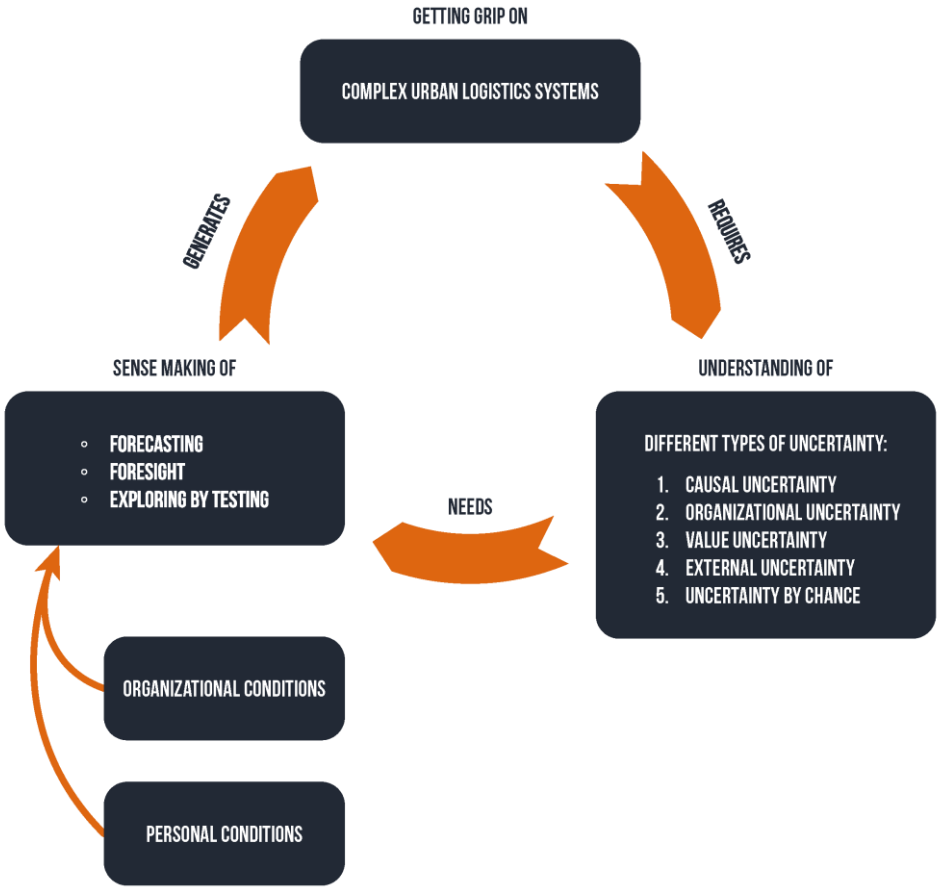


Figure 6 The conceptual model: Getting grip on complex urban logistics systems

3 METHODOLOGY

3.1 Research Approach/design

The aim of this study is to investigate to what extent local policymakers are aware of uncertainties in long-term policy-making and in what way they explore these uncertainties. The relatively new policy domain of urban logistics provides an excellent practice to analyse the written strategies in academic literature and to probe the experiences of local policymakers. To answer the main research question a mixed methods research design is used to collect the needed data, in the paragraph below the different data collection methods are individually described.

3.2 Data collection methods and analyses

This study makes use of five different data collection methods, which are all described in more detail in their corresponding paragraph. To provide a general overview of the data collection methods and their contribution to the research, appendix 1 and figure 7 are created to visualise the research design of this study.

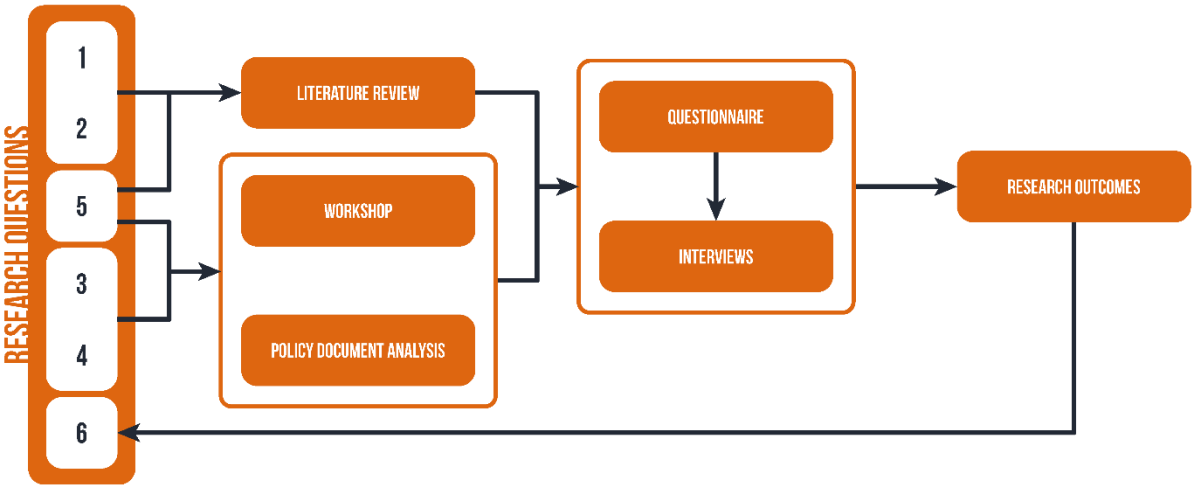


Figure 7 Schematic overview of the research design

3.2.1 A literature review

The review of academic literature gives this study the background knowledge on urban logistics and its developments. The used theoretical publications are collected via the use of keyword searching and snowballing in the data bases of Scopus, Google Scholar and university archive called Smartcat. Academic articles from the logistics, urban planning and public policy domain are used to collect data for answering sub-question one and two. The gathered information is presented in chapter two, the theoretical framework of this study. Hence, the literature review gathers theories and that address the complex and dynamic character of SUL and analyses studies that discuss strategies for exploring and dealing with uncertainties of long-term planning. The theoretical framework forms, the foundation to answer sub question one and two of this master thesis and thereby provides this study of knowledge and information upon which the other data gathering techniques, like the questionnaire and interview questions, are drawn.

3.2.2 Workshop during a Study Visit in Mechelen

The workshop on "Future scenarios and lessons for local policymakers" provided information on uncertainties, their significance, and their impact on policy initiatives in SUL policy-making. The understanding of local officials on uncertainties and their experiences in dealing with uncertainty were put to the test in a two-round workshop. Fifteen local policymakers (table 6) and five consultants were

split in pairs and presented with an unforeseen development and asked to explain the possible effect of this uncertainty and describe a strategy to respond to this uncertainty. In appendix 4 are the workshop materials presented to show an impression of the workshop. The workshop's findings mainly shed light on how local policymakers react to uncertainties that surround urban logistics and how much of the conception of uncertainty is present in this field. The workshop participants responded enthusiastically to the activity but already indicated that there is little room both in time and in experience to think about the uncertainties of the long term.

Table 6 Overview of the participating local policymakers of the workshop

Participating city	Total of local policymakers participating
The city of Groningen, NL	2
The city of Edinburgh, UK	1
The city of Leuven, BE	2
The city of Bergen, NO	2
The city of Milan, IT	2
The city of Mechelen, BE	1
The city of Helmond, NL	1
The city of Bremen, DE	2
The city of Gdynia, PL	2

3.2.3 Policy document analysis

The analysis of policy papers was held to inform the researchers about the status of policy documents in the area of urban logistics prior to conducting the interviews. The analysis examined the proposed vision for sustainable urban logistics and the methodology cities would use to accomplish their objectives. Conducting the policy document analysis, the gathered information was organized in a excel-file in which the policy goals were described per city in addition to the defined timeframe.

3.2.4 Introductory Survey

With the collected insights from theory, the workshop and the policy document analysis, the inexperience of European policymakers revealed itself. Therefore, a choice was made to collect data using a combination of a questionnaire and an interview, which tackled the necessary time to introduce the subject of uncertainties to local policymakers. Respondents were asked to fulfil a questionnaire of a total of 20 questions which functioned as an introduction of uncertainties that surround urban freight policy plans. The survey questions are divided into five components which addressed the following topic: respondent information; uncertainty in policy-making; types of uncertainty and personal barriers and incentives. The aim of this survey is to collect data that will answer sub-question three and five, in combination with the data collected in the interviews. This survey created using the Qualtrics software and an overview of the questionnaire design is presented in appendix 2.

As can be seen in appendix 2, question nine until thirteen present three examples of each of the five uncertainty types. In the question, respondents are asked to indicate if they keep an eye on this uncertainty type during the preparation/ development of the policy or during implementing the policy. To evaluate the respondents' experience with different types of uncertainties, the three examples work as a proxy and can indicate the awareness of local policymakers on these exact types of uncertainty. In the questionnaire, the category label of the uncertainty types is made invisible, and the examples will be placed in random order.

The data collected with this survey will be analysed with the use of descriptive statistics. This analysis aims to create insight in the understanding of local policymakers in the concept of uncertainty and the

different types that surround SUL policy-making. Furthermore, the data collected with the questionnaire could provide an overview of personal barriers or opportunities.

3.2.5 Semi-structured interviews

The combination of a questionnaire and the interview offered the participant to ask questions about the topic and clarify their responses. Furthermore, it allowed the researcher(s) to question the given answers in the survey to ask follow-up question to further investigate the topics. In order to conduct the research in this manner, a semi-structured interpretation of the interviews was chosen, granting the researchers to inquire about the relevant information. The collected data is used to answer sub question three, four, five and six and could provide an inside to sub question five.

The participants of the questionnaire and the interview (table 7) are local policymakers of different European cities in the field of urban logistics and recruited during the workshop and via the ULaaDS network. The interviews are being held in the online environment of Google Meet, if the interviewee would prefer to use another software can this be arranged as well. With the help of the audio recorder software Dictaphone the audio of the interviews is recorded after permission of the interviewee in order to transcribe the interview afterwards. The interview guide is presented in appendix x.
The audio recordings of all interviews are firstly transcribed with the use of the software TRINT after which the author analysed the data with the use of coding in the program of Atlas.ti. A deductive code tree was established prior to the interviews and used to analyse the interviews. Both the deductive code tree as an inductive code book is presented in appendix 5.

Table 7 Overview of the participants of the survey + semi-structured interviews

	City	Function	Policy department	Participated in survey & interview	Participated in workshop
1	Antwerp	Consultant	Mobility	Yes	No
2	Bergen	Policymaker	Urban environment	Yes	Yes
3	Budapest	Director	Strategic Planning at transportation centre	Yes	No
4	Groningen	Policymaker	City development	Yes	Yes
5	Leuven	Project coordinator	Mobility	Yes	Yes
6	Mechelen	Project coordinator	Mobility	Yes	Yes
7	Milan	Consultant	Mobility	Yes	Yes
8	Munich	Coordinator Urban Logistics	Mobility	Yes	No
9	Oslo	Advisor	Environment and mobility	Yes	No
10	Stockholm	Project manager	Environment	Yes	No
11	Turku	Project Manager	Mobility and transport	Yes	No
12	Wiesbaden	Project management	Civil engineering and geodesy agency	Yes	No

3.3 Case studies

In table 8, an overview is presented of the European cities that participated in this research and greatly supported the outcome of this study. The table provides information on the cities demographics and their main sustainable urban logistics goals which are collected via the policy document analysis. Twelve cities have participated in the research and are located in Europe.

Table 8 Overview of the case studies

	European City	**Surface (km2)**	**population size**	**Urban logistics policy**
1	Antwerp (BE)	205	530.000	
2	Bergen (NO)	445	287.000	Topic addressed within the Green Strategy, development of a SLP is being discussed
3	Budapest (HU)	525	1.752.000	In development
4	Leuven (BE)	57	101.000	Topic addressed within the climate action plan
5	Mechelen (BE)	65	87.000	No
6	Milan (IT)	182	1.371.000	
7	Munich (DE)	460	2.230.600	No
8	Oslo (NO)	426	700.000	Topic addressed in the climate strategy/ climate budget
9	Stockholm (SE)	187	979.000	Yes, the Stockholm Freight Plan
10	Turku (FI)	246	195.000	
11	Wiesbaden (DE)	204	279.000	Yes
12	Groningen (NL)	185	235.000	Yes

3.4 Ethical considerations

The following measures ensure an appropriate research environment throughout the research process. At the beginning of both the workshop, the questionnaire and the interviews, respondents are asked to give permission for the use of the collected data which will only be analysed by M. A. Buser, dr P. Plazier and dr W. Rauws. Furthermore, the participants of the survey and interview are requested to give their voluntary consent indicating their understanding of the implications of their participation in the research. It is thereby actively emphasised that the respondents can halt their collaboration without giving any reason to do so (Punch, 2014).

Throughout the study process, privacy and confidentiality will be ensured by removing personal information from the final report, ensuring that no non-public information will be shared with third parties or be traceable in the research report. The link between personal information and given responses in the questionnaire will be maintained because of its introductory function. This is done by giving each participant a respondent ID that will be used as a code. The data will be stored in a locked data file which can only be entered by the researchers involved in this project: Maaike Buser, dr Ward Rauws and dr Paul Plazier.

3.5 Operationalization of the concept uncertainty

Due to the young policy field of urban logistics and the use of professional terms in academic literature, the possibility arises that local policymakers are unenlightened of the concept ‘uncertainties and its meaning. It is therefore this methodology chapter consists of operationalization paragraphs in which examples of the different categories of uncertainties are collected and explained since the workshop, questionnaire and interview makes use of this concept. Table 9 provides and overview of a general collection of uncertainty type examples, the examples used in the questionnaire can be found in appendix 2. Furthermore, the concept ‘uncertainties’ is replaced by ‘unforeseen developments’ in the

communication towards research participants to tackle the difficulty or in experience with this concept.

Table 9 Operationalization of uncertainty types

	Value uncertainty	**Organisational uncertainty**	**Causal Uncertainty**	**External Uncertainty**	**Uncertainty of chance**
1	Struggles over data	Bankruptcy	Operational hick-ups due to safety issues	Self-driving vehicles	Pandemic
2	Safety issues of night-time deliveries, parcel lockers	Reorganisation	Change is costs and operations due to restrictions	3D printing	Flooding
3	Intervention of other levels of government	Increase in vehicle load factor, due to consolidation of urban freight	Environmental impacts	Big Data	Extreme weather event
4	Involvement of other stakeholder groups	Route and scheduling software	Unexpected delays	Smart containerization	Economic crisis
5	Conflicting desired outcomes/wish	Night-time deliveries	Capacity local businesses to adapt	Online Marketplace	War
6	Change in mobility mindset - more active e.g.,	Shared mobility	Decisions by global logistics operators	Increased growth of demand	
7	Decisions by global logistics operators	Level of support for policy measures	Change in demand and supply	New business concepts for freight transport	
8	New societal goals	Fragmentation or centralisation of freight transport		Electrification	
9	Change in trust relationships			Energy/fuel supply	

4 RESULTS

In this chapter the sub-questions will be addressed, by examining the gathered data. The combined data analysis of the workshop, questionnaire, and interviews will be used to provide insight in which uncertainties confront local policymakers in developing and implementing SUL policy. Furthermore, this chapter clarifies which approaches local policymakers use to explore uncertainties and whether these correspond to the suggested trilogy of van der Steen. The results chapter continues with an overview of the organizational and personal conditions that form barriers or opportunities for local policymakers. A review of the initial steps which local governments can help to better understand and make sense of the complex urban logistics systems concludes this chapter.

4.1 Data collection attributes

Twelve European cities took part in the study by completing an online survey and taking part in semi-structured interviews in the months of July, August and September 2022. With the help of the ULaaDS network and the snowballing effect, the cities were invited to participate in this research. As can be seen in table 8, the cities are spread across Europe, and can be categorised into three regions: Western Europe, Southern Europe, and Scandinavia.

The first survey questions are designed to gain insight into the working conditions of the local policy makers in the field of urban logistics. The results are presented below and give an indication of the research participants. Twelve respondents were asked to identify in the survey how many full-time equivalent (FTE) hours they personally spend working on the subject of urban logistics and how many FTE are spend in total on the topic within the municipality. As can be seen in figure 8, the personal amount of FTE of the participants varies and indicate the difference per city, however, only two local policymakers can fully focus their time on the topic of urban logistics since they answered the question with 1 FTE. Nevertheless, indicated the majority of the respondents to collaborate on the topic with (an)other colleague(s).

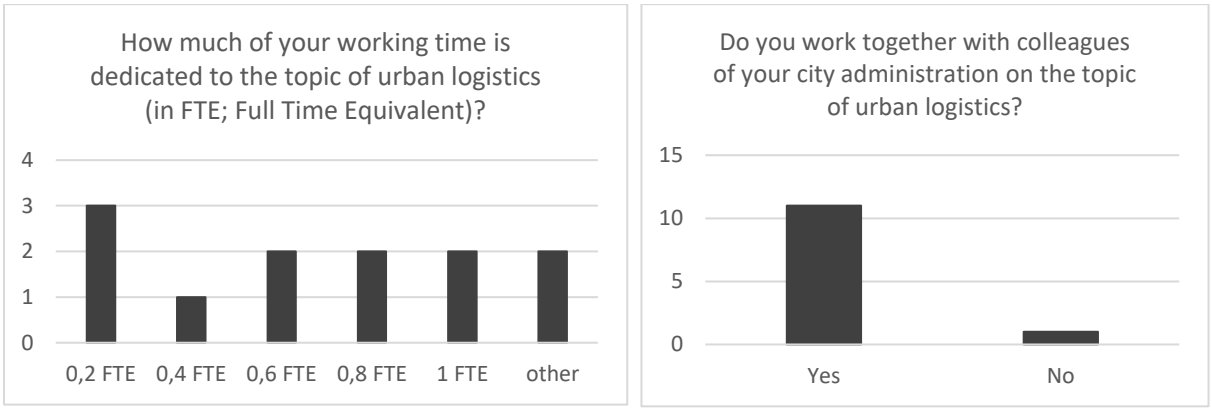


Figure 8 Overview of the personal FTE spend on the topic of urban logistics (left), Indication of participants that collaborate with other colleague(s) (right)

The total amount of FTE spent working on the topic of urban logistics within European local authorities differentiates between the 1 and approximately 4 FTE. The interviewees indicated that depending on the priorities chosen, the hours available to work on the subject of urban logistics may change from week to week. For example, one participant answered the survey question on "How much of your working time is dedicated to the topic of urban logistics (in FTE; Full Time Equivalent)?" with:

> *"It varies – between 0.1 and 1 of my time depending on which project I work in. The topic is actually the responsibility of a different department, but often they lack resources to work on it and we step in if project funds are available."*

What becomes clear from this data is that only a few interviewed policymakers (n=2) can focus their entire working week on the topic of urban logistics. The residual of the research participants (n=10) divides their working hours between projects and explain that the reserved hours for urban logistics vary by week. Furthermore, participants explained that urban logistics does not belong to one department, however, colleagues from different departments worked together on the topic of logistics. This means that when reading the following paragraphs in this results chapter, it should be borne in mind that the understanding of the different types of uncertainties and exploring these uncertainties should take place in the limited time available to local policymakers in the field of urban logistics.

4.2 Being confronted with uncertainties

The results presented in this paragraph are obtained with the help of the uncertainty typology that was introduced in chapter 2.4 of the theoretical framework. Furthermore, this chapter (2.4) highlighted that being aware of the different uncertainty types that surround urban logistics policy-making is the first step in dealing with uncertainties. The gathered information from the workshop, questionnaire, and interview is combined and analysed to create insight in the awareness and understanding of practitioners in the field of SUL policy-making. The results are presented below and formulate an answer to sub question 3: 'To what extent are local policymakers of European cities confronted with uncertainties in developing and implementing Sustainable Urban Logistics Plans?'.

4.2.1 First impression provided by the workshop

The study visit in Mechelen provided a first insight in the practice of SUL policy-making. During the workshop, an exploration has been made on the understanding of local policymakers on the meaning of the concept uncertainty and the different categories as described by the framework of Abbott (2005). Figure 9 indicates that the majority of the present local policymakers had already observed an unforeseen development which had an effect on their city's mobility and/or logistics plan. Uncertainty by chance and value uncertainty were the most observed categories.

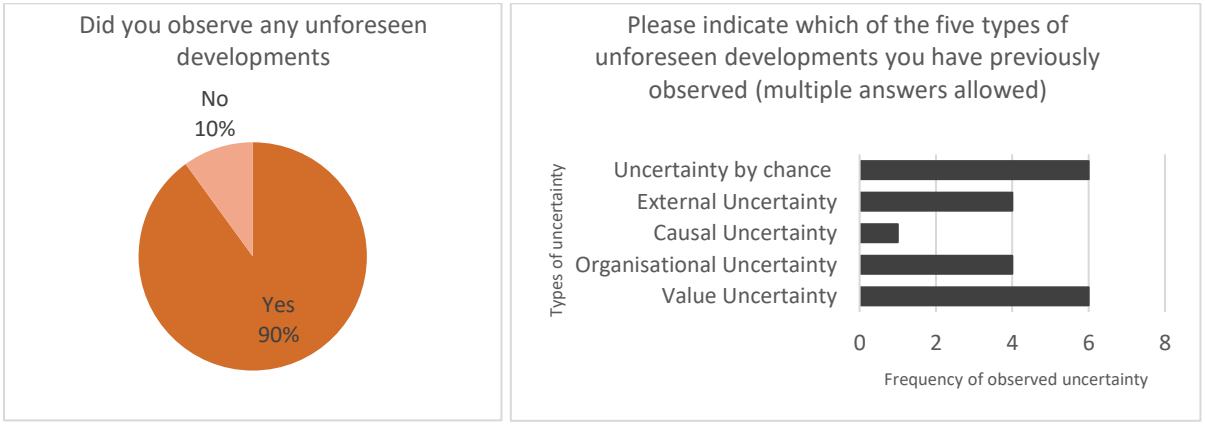


Figure 9 Graphs representing the first impression in the experience of local policymakers with uncertainties

4.2.2 Uncertainties in urban logistic practices

To assess if local policymakers in the field of urban logistics are aware of the uncertainties that surround urban logistics policy-making, respondents of the questionnaire were asked to indicate their consideration of future developments (Q7) and to describe an unforeseen development which they had faced in preparing and implementing policy (Q8). The results of question seven, which are presented in figure 10, show that every participant keeps an eye on future developments that might influence their policy plan. Furthermore, the majority of participants (n=10) gave brief examples of unforeseen developments that they have observed, which come across the operationalisation of uncertainty types as is presented in table 2 on page 26. These results in combination with the data

obtained in the workshop give a first indication that policymakers in the field of urban logistics are confronted with uncertainties.

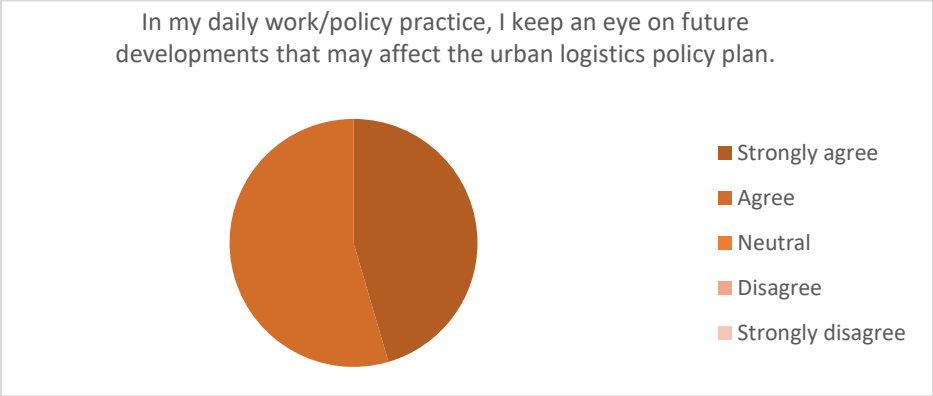


Figure 10 Graph representing the answers of Q7 in the survey

By analysing the frequency of the codes related to the uncertainty types (table 10), value uncertainty proved to be important in policy practise. This type of uncertainty is mostly mentioned during the interviews, and represents cases of uncertainties in relation to political opinions, priorities or changes as is indicated in the following quotes

> *"Yes, some uncertainties we have in mind, but mainly the political decisions that may change may in the future." (C293)*

> *"So yes, logistics is not such a popular topic and does not get the same ... not the same attention as the other topics" (C483)*

> *"But in our city there are changes like every day now but definitely after every elections. So the whole institutional system is just down rearrangement and it's another uncertainty and you can you can list." (C637)*

The uncertainty in political agendas proceeds from the unpopularity of the topic, the lack of a general urban logistical plan and the unawareness of decisionmakers on the topic of urban logistics. Other uncertainties that are mentioned during the interviews or in the questionnaire but to a lesser extent compared to value uncertainty are organizational uncertainty and causal uncertainty. The causal uncertainty examples represent side effects of attempted pilots or implemented policy measures, where organizational uncertainty refer to the reactions and actions of logistics stakeholders towards pilots and policy measures. The quote below presents an example of both an organizational as causal uncertainty as presented in one of the interviews:

> *"When implementing circulation plan & timeframes for delivery, we see more kilometres for deliveries. Logistics companies have to drive in & out each city zone to do deliveries in the entire city. If this means they cannot deliver in time (time frames), they add an extra vehicle with lower load factor." C851)*

Table 10 Overview of the uncertainties addressed during the interviews

Type of uncertainty	**Explanation**	**Code frequency**
Value uncertainty	Developments which arise by a change in community values and goals or as result of changing political values or priorities	20
Organisational uncertainty	Developments which are initiated by the actions and interactions of urban logistics stakeholders	15
Causal Uncertainty	Developments that are caused by policies	15

External Uncertainty	Developments in the contextual environment that are beyond the scope of influence of involved actors.	11
Uncertainty of chance	Developments in the form of one-off chance events	9

The frequency of value uncertainty mentioned in the interview matches the findings of gathered data from the workshop in which value uncertainty was also addressed as a type of uncertainty which local policymakers observed the most. In contrast to the workshop data, the frequency of examples of uncertainty by chance are the lowest in the interview data. These results could be explained with the data obtained in question eight- and nineteen of the questionnaire. In these questions, local policymakers were asked to point out the type of uncertainty that there are the most and the least concerned with, the results are shown in figure 11.

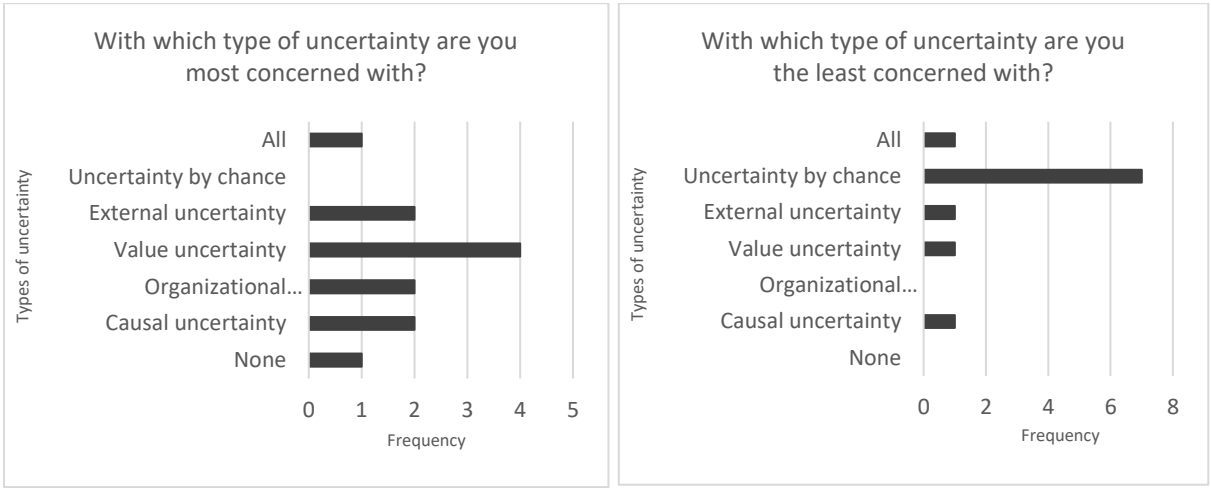


Figure 11 Graphs visualising the distribution of results from question 18 and 19 from de survey

Value uncertainty is cited by four cities as the type of uncertainty that local policymakers are most concerned about. Three of the cases have political underpinnings, but one city also cites public opinion as a factor since they believe it to be a strong driver of the creation of an urban logistics policy plan. The uncertainty type that cities are the least concerned with is uncertainty by chance, additionally this kind of uncertainty is the least frequently expressed in the interview results (table 10). In the interview, cities emphasised that the fundamental justification for this response was that this kind of uncertainty was beyond their control, which is also reflected in the quotes that follow.

> *"Like what's the real statistical likelihood of certain things happening. That's difficult because of climate change because of all of the things like, of course something's going to happen and you just don't know when." (C253)*
>
> *"Yes, that's outside the circle of influence" (C923)*

In addition, the inability to take proactive measures in the context of this kind of uncertainty was also cited as a factor in choosing this response. Hence, this kind of uncertainty is low on the priority list for cities to deal with proactively when there aren't many employees on urban logistics or when there aren't enough other resources.

The fact that many cities are currently working on the development of their urban logistics policy indicates that some cities do not yet have experience in putting the policy into practice. Due to this reality, local policymakers have also interpreted and answered question nine until thirteen of the questionnaire differently by using different frames of reference which implies that the data gathered cannot be compared to one another. Nevertheless, ten out of twelve cities could provide an elaborated answers to the questionnaire question if they have experienced any unforeseen development during

the development or the implementation of policy and described examples of the five categories of uncertainties. Furthermore, in every interview a minimum of one type of uncertainties was addressed or elaborated on, even the two cities who said they had not yet observed any uncertainty by filling in the questionnaire. The maximum of mentioned uncertainty types during the interviews was four.

These result indicate that local policymakers in the field of urban logistics have observed uncertainties during the development or implementation of urban logistics policy. The frequency of uncertainty codes and the elaborated examples obtained from the interview combined with the collected data of the questionnaire indicate that local policymakers are confronted with uncertainties to the extent of observing and experiencing foremostly value-, organizational- and causal uncertainty. Additionally, interviewers have shown that they are aware of uncertainties, however not all uncertainties are given priority due to their nature and position outside the scope of influence. Furthermore, the inability to proactively prepare for all uncertainty types is explained to be caused by a lack of resources, with more colleagues working on the topic or more time local policymakers could be provided with the opportunity to improve their understanding of uncertainties in SUL policy-making. In contrast to the initial developed conceptual model (figure 6), the distinguished conditions in chapter 2.6 also have an influence on the understanding of the typology of uncertainties. In figure 12, this finding has been applied to the adjusted conceptual model.

4.3 Exploring uncertainties in urban logistics practices

In chapter 2.5, a trilogy of strategies to explore uncertainties has been introduced (van der Steen, 2018). With the help of the questionnaire, examples of experienced uncertainties were identified in order to ask with which technique the local policymaker had explored the unforeseen development in order to make sense of its nature and influence. This chapter presents the collected results and answers sub-question four: 'Do local policymakers explore uncertainties of sustainable urban logistics and their potential consequences and in which ways?'

4.3.1 A young policy field in practice

As indicated by Termeer et al. (2015) and Kato & Ahern (2008), awareness of uncertainties should be the first step in dealing with uncertainty, and this understanding would also increase the use of potential instruments and strategies to construct a policy which can respond to uncertainties (Barg & Tyler, 2009; Woodruff, 2016). In support of the claims made by these academics, local policymakers acknowledged they operated in a complex sector of policy and have to communicate with a variety of stakeholders. The two quotations below also demonstrate that local policy makers are aware that the urban logistics sector is always changing, emphasising that their policy plan should take these developments into account and offer direction for the ongoing process.

> *"There's a lot happening on the political level, I guess, and there's lots of political actors. Especially in logistics, because there's so much, especially in a city area, there's so many interests, business interests that keep interfering" (C603)*

> *"Every five year you need to reach a goal and then when it's done. Yeah, but the city is never done. Process is never finished. The strategy is never over. You know, it's an ongoing process. So changing" (C637)*

The results from the last survey question also demonstrate how local policymakers are devoted to learning more about this policy domain and being able to put the numerous uncertainties on their radar. Participants were asked to answer the following question: 'According to you, how relevant is exploring uncertainties and their influence on policy plans for the performance of policies?" Respondent could choose a grade between 1 equalling 'not relevant at all' and 10 equalling 'very relevant'. The question received a general grade of a seven with the lowest grade being a four and the highest grade being a ten. The distribution of the grades in presented in figure 12.

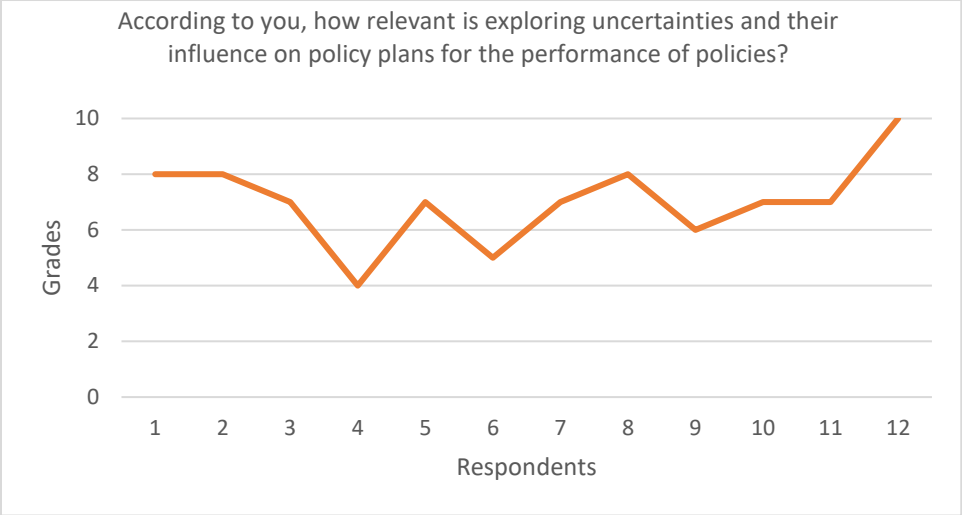


Figure 12 Distribution of the grades in relation to the relevance of exploring uncertainties

During the interviews, the interviewees were asked about their reasoning behind the given grade, which reveals that both participants do acknowledge the uncertainties that surround the policy field of urban logistics and their possible influence but prioritise the exploration of them differently. The interviewee who graded the question with a ten argues that is it very important because there are millions of uncertainties surrounding even the smallest decisions:

> *"We try to have a reasonable amount of analysis of market analysis of being aware of what's going in our urban sphere. They have to spend time learning and developing their competencies and things to be able to see what's happening on the market and then how to process the uncertainty that's related to that because when you go down to like micro decisions. How do we redefine this street? That's always millions of uncertainties". (C253)*

The interviewee who graded the question relatively low, with a five, also highlights the majority of changes but explains that the needed effort to proactively make sense of them is too much in comparison with the outcomes.

> *"As I mentioned in the beginning, the uncertainties are not in the focus for us. So, we try to keep flexible and to react. If we see that those situations will change. But not before, so that there are so many possibilities how the situation can change. And if we think about all these possibilities. I think it's too much input for the smaller output" (C293)*

Even though the respondent of the final quote (C293) gave the relevance of investigating uncertainties a five, the highlighted flexibility suggests they are aware of the changes and unexpected developments and established their policies in a way they are able to respond to these uncertainties. Indicating their awareness of the complex policy field and the need to respond to changes over time in order to deal with uncertainties. Nevertheless, the relevance of exploring the uncertainties is assessed on average with a seven, which raises the assumption that cities are trying to make sense of unforeseen developments in their daily practice. The way they accomplish this and if the trilogy of approaches is employed is demonstrated in the paragraphs that follow.

4.3.2 Forecasting: the use of models and projections

As explained in chapter 2.5, forecasting makes use of quantitative or numerical data to forecast scenarios with the help of programs or models (van der Steen, 2018). Therefore, by coding the

interviews, explicit attention has been paid to the use of quantitative data in exploring approaches to indicate if cities make use of the forecasting technique.

Ten cities have expressed their use of or the desire to use calculating methods to explore uncertainties and indicate unforeseen development in the field of urban logistics. The first function for which cities utilize this approach is to create a better understanding of their cities' urban logistics system. It is a technique in which information collected through monitoring systems - such as how many trucks enter the city centre or how many kilometres they travel for deliveries - can be used as a basis for making calculations (on future trends) in order to establish policy targets. Secondly, forecasting is used to make estimations or forecast for future scenarios, in relation to policy measures that contain costs, for example charging schemes or congestions fees. Cities can calculate the effects of a certain policy measure and indicate the magnitude of the consequences. In table 11, an overview is created of mentioned forecasting techniques that make use of quantitative data. Cities do state that they employ forecasting approaches to improve their policies or activities, however, they do not mention that this exploration method has a limitation since it only provides future scenarios within a restricted range as was stated by Van der Steen (2016) and Van der Steen & Twist (2020).

Table 11 Overview of nine forecasting techniques

	Forecasting techniques		
1	Models	7	Monitoring - City monitor - periodic
2	Projections		
3	Quantitative analyses		
4	Measurements	8	Surveys
5	Geofencing	9	Future scenarios
6	Calculations		

4.3.3 Foresight as main strategy to explore uncertainty

The strategy of foresight, defined as a technique which uses narratives or qualitative data to explore uncertainties in an organised setting like discussions or scenarios, is mentioned the most frequently in the interviews. The analysis of the data from the interviews illustrates that policymakers are aware of the various uncertainties that might exist and understand the value of involving stakeholders in the policy-making process to explore them. As a result, cities use a wide range of activities to explore the interests and reactions of private and public stakeholders during the development phase and implementation phase of their SUL policy.

When applying foresight techniques, a distinguishment can be made between the use of planned interactions with local government stakeholders and those with stakeholders outside the organisation, such as logistical operators or businesses. The interviewees indicate to use foresight techniques to either ask for insights or consult their colleagues for advice and/or feedback as is presented in the quotes.

> *"You must follow protocol by seeking counsel. And then, uh, you ask additional counsel from the appropriate colleagues."*
>
> *"So, um, we have this meeting where you present ideas towards each other and then discuss if it's a good idea or not, etc."*
>
> *"Uhm yes. I have already started a meeting that is a distribution overarching consultation that is, that is across the two departments"*

Organising a structural meeting in which representatives of multiple departments are present, pitching ideas of the policy plan to colleagues or discussing the topic of urban logistics within a 'core team' of

the municipalities that keeps an eye on every inner-city project are examples of how cities discuss urban logistics policies or explore uncertainties within their organisation. Inviting other experts within the local authority to give advice or feedback can be organised by the local policymaker or is a structural step within the planning process.

Involving external stakeholders in the process is also a frequently used strategy to explore uncertainties and to generate insight into the interest, actions and wishes of for example of logistical operators. Cities have explained to involve stakeholders in the development phase of the urban logistics policy by organizing workshops in which policy objectives or qualitative scenarios were discussed. Arranging public hearings in which stakeholders could address their opinions and thoughts is another example of how external stakeholder are incorporated in the policy-making process. During the development of a policy plan, or policy measure as well as during the implementation of a policy measure, stakeholders were continuously consulted during periodical roundtables, citizen participation processes and focus group(s).

In addition to consulting public and private stakeholders, many cities employ foresight strategies to stay up to date on new developments in technology, to disseminate and receive information, and to learn from other cities. Annual events, national and international networks or platforms, as well as European projects, are described as organised activities in which cities take part to expand their knowledge and keep an eye on novel and unexpected developments. Furthermore, foresight techniques are also used to monitor the development of a policy (measure) or as evaluation technique. Since, the method can be used to reflect the results of certain actions, it can be determined if the development in the field of urban logistics is heading in the right direction or whether it needs to be adjusted. Two cities indicate to make regularly use of this strategy in the form of stakeholder consultation or reporting. As an example of the latter, the reporting, one city explained that it uses three evaluation sessions over a year in which the progression of policy objectives is reported. These reports are made public, giving local authorities the opportunity to modify the strategy as necessary and to explain the adjustments made. A complete overview of the organised actions described in the interviews that fall under the category of foresight are presented in table 12. These strategies are either used during the development or within the implementation phase of urban logistics policy, to keep informed or to monitor the progress of urban logistics developments.

Table 12 Overview of seventeen foresight techniques

	Foresight techniques		
1	Discussions	10	SWOT analyses
2	Workshops	11	Collaborations
3	Roundtables	12	Public hearings
4	Information meetings (internally or externally)	13	Citizen participation projects
5	Focus groups	14	Interviews
6	Pitches	15	Brainstorm sessions
7	Evaluation reports	16	Future scenarios
8	Urban logistics Events and/ or congresses	17	Platforms (regional, national, international)
9	Surveys		

4.3.4 Exploring by testing, physical pilots and digital tests

In the interviews with nine of the twelve cities is exploring by testing mentioned as technique to explore the effects of policy measures. Within this strategy, cities foremostly use the concept of 'pilots' and describe how these tests are applied in the development phase of the policy. The interviewees explain that pilots are a fitting approach to test multiple solutions to foresee how the policy measure

will unfold and to map the reactions and perspectives of stakeholders within the urban environment. Other advantages of performing pilots that are described by cities highlight the possibility to explore negative or unforeseen consequences and the absence of obligations towards pilots which makes it easier to get approval increasing the possibility to show positive results or effectiveness to decisionmakers or politicians. The quotes below indicate the advantages of pilots.

> *"So already, of course, there was a question of uncertainty how to deal with uncertainty and. Also, one of the issues with this we tried to put it in the pilot and used the word pilot to make sure it's just temporary and there is no like major obligations that. It doesn't have to be like it won't be like this forever you just want to get more knowledge." (C463).*

> *"But if there's an overall sum, which should be in a way connected to everything. Yeah. So, we are a bit, you know, a pilot thing that I'm trying to show the CEO and some other colleagues that this is the way it should be" (C637)*

> *"We could do this test and then the tests had to be done in the craziest amount of time possible. Everything has to be done yesterday at this very short time window. But they made it. They got they got the tests done. They demonstrated that this would work" (C253)*

Most examples of the technique to explore uncertainties with the aid of testing described physical pilots which were performed at locations within the city. One example, however, described how the testing of new policy measure was performed with the help of a digital pilot in which the urban environment was replicated in an online tool, also referred to as a digital twin. This method helps to evaluate the effects of the policy during the realisation of the pilot in which information and data were used to recreate urban environment online, making it possible to analyse the data and explore – as is stated in the quote below - unforeseen developments.

> *"Because you can also check whether there is a negative effect, whether it is an unintended negative effect. So, I think that's the added value of those digital twins. That profit which can also be just a hollow word. But if you use that well and analyse the data, it shows you what you don't want. And yes, I can also share more with those people here."*

In other words, exploring through testing in the form of pilots gives cities the chance to improve their knowledge and test potential policy measures. This provides local policymakers with the to show the effective results to higher level of authority in order to raise awareness and highlight the importance of the urban logistics sector.

4.3.5 A fourth approach to explore uncertainties in SUL policy-making

During the interviews and the analyses of the collected data, extra activities of exploring uncertainties were indicated that would not fit within one of the three suggested categories. In order to understand the unforeseen development or ask advice, local policymakers tend to use more informal meetings like short conversations and calls. In addition, to keep an eye on possible uncertainties or future developments local policymakers make use of newsletters, LinkedIn posts or podcasts which all provide information on new developments or innovations.

The data used within this technique is corresponding with the qualitative data used in foresight strategies, however, the methods employed are neither structured nor organised compared to foresight activities. A city that recently adopted urban logistics as a policy topic provides an example of this informal approach to exploring uncertainty. This city indicates that maintaining contact with logistical actors and getting to know the various stakeholders is a key method for keeping tabs on one another's progress and comprehending one another's interests. The use of informal strategies to gather information is also mentioned in other cities to be of use to establish more effective

relationships for example with logistical players or with other cities. The quotes below indicate the informal character of the actions.

> *"On the other hand, we also have more contacts with all the cities around us. And, yes, that has been casually affirmed a number of times. Actually, we together could just look at that"*
>
> *"So, it's good to establish relationships. Some stakeholder had this objection he had that this morning. He just called me and then we can talk. Yeah"*
>
> *"Yeah. Um, I wish I could say that that's like that structures. But we do that every once in a while, in college. But I think we're not that far in a way. I, I would say that's pros of working in an open landscape for us to get close. But there's not like there is something arranged"*

Since local policymakers report that they also frequently use this strategy to monitor developments, stay in touch with stakeholders, or have data checked with the appropriate parties, we could presume that this fourth way of exploring uncertainties is primarily used for consolidation. In the study performed by Wilkinson (2011), informal strategies emerged as a success factor in relation to planners' response toward dealing with uncertainties. The use of these informal processes gives planners the space and time to improvise and to base their next step on their own experience and knowledge of this unforeseen development. This acquired knowledge in combination with the research results shows that a fourth way could be added to the available strategies to explore uncertainties. Table 13 from chapter 2.5 is therefore shown below and supplemented with the additional strategy, exploring uncertainty by consolidation

Table 13 Overview of four strategies to explore uncertainties in SUL policy-making

	Sort data	**Methods addressed in literature**	**Results**
Forecasting	Quantitative, numerical data	Model calculations	Numerous visualisations, future scenarios, unforeseen developments
Foresight	Qualitative, data in a narrative manner	Discussions, storytelling, debates, thinking out lout	Narrative visualisations of the future, network relationships.
Exploring by testing	Quantitative and Qualitative	Pilots, tests, experiments in physical or online environment.	Test of appliance of the policy measure, consequences and opportunities
Exploring by consolidation	Qualitative data	Informal conversations, calls, online platforms	Maintaining contact and relationships, knowledge inspiration, advice

The results presented in this paragraph demonstrate that local policymakers in the field of SUL policy-making are making use of the trilogy of approaches as presented by van der Steen (2018) to explore uncertainties, with most frequently, the foresight technique. The majority of the actions or techniques that practitioners use in this process are intended to increase their knowledge and understand the complex urban system better. In addition, an extra approach is added to the trilogy to represent the unorganised informal actions that local policymakers use to check their knowledge or ability to develop or implement a sustainable policy measure. This finding is visualized in the adjusted conceptual model, which can be seen in figure 15.

4.4 Opportunities and barriers in urban logistics practices

Chapter 2.6 provided insight in organizational and personal conditions that can become barriers or opportunities in dealing with uncertainties. As visualised in figure 6, the conditions could have an influence on the exploration of uncertainty types which allow local policymakers to make sense of the uncertainties that surround SUL policy-making. The results presented in the chapter below will indicate if the conditions - as indicated by academic literature - are also experienced in practice and formulate an answer to sub-question five: 'Which conditions can be observed to cause opportunities or barriers for local authorities in dealing with the uncertainties of sustainable urban logistics?'

4.4.1 Barriers and opportunities presented by organizational structures

Cities have expressed multiple organizational barriers and opportunities which hinder or enable them in understanding and exploring uncertainties. The experienced barriers by local policymakers in the field of SUL are presented in table 14.

Table 14 Overview of the experienced barriers by local policymakers

Barrier category	**Code frequency**	**Explanation**
Political culture & awareness	12	This barrier explains how the political agenda or priorities hamper the transition toward SUL.
Lack of strategic vision	12	This barrier implies that the lack of a local, regional or national vision on urban logistics hinders the work of local policymakers
Legal framework	5	Missing the right regulations prevents local policymakers to regulate SUL policy measures
Institutional procedures	9	The general procedure within institution hampers local policymakers in adapting their policy objective or policy plan
Urban logistics as an integral policy field	3	The topic of Urban logistics is belonging to multiple departments within local authorities, this can form challenges when various colleagues have to prioritise SUL policy measures.
Availability of Resources	14	A lack in essential resources like funding, time and data prevents local policymakers to deal with uncertainties

By analysing the experienced barrier in SUL policy-making practice, it becomes clear that the interviewees have mentioned three additional conditions to the barriers as explained in chapter 2.6.1. table 4, which can form a barrier in SUL policy-making. 'Political culture & awareness' and 'lack of a strategic vision' both belong to the three conditions that are newly introduced barriers by local policymakers and are also – alongside 'availability of resources' - mentioned to most frequent during the interviews.

The cities indicated that because the topic of urban logistics is not prioritised on the political agenda or considered as a responsibility of the local authority to act upon, the political culture and awareness creates barriers in developing SUL policy plans. Without political awareness, it is challenging for local policymakers to develop the city's vision for SUL or to win support for the implementation of policy measures. The absence of a legal framework to regulate pilots or govern policies once they are put into place is related to the unawareness of the politicians. Furthermore, the lack of a strategic vision for urban logistics is also mentioned as a self-contained barrier. Interviewees indicate that without a local, regional or national vision on SUL, local policymakers do not receive explicit orders or have no framework that guides their actions. The quote below resembles this finding.

"It's like swimming in there and just doing what you think is a nice project to perform that's there" (C463)

The availability of resources is another frequently mentioned barrier in the interviews, a lack in resources as for example: funding, time and data are indicated to hamper local policymakers in exploring uncertainties in SUL policy-making. This result is consistent with the assertions made in the theoretical framework, in which Akgün et al. (2019), Lindholm (2013) and Bjørgen & Ryghaug (2022) argued that lacking the necessary information and data makes it challenging for local policymakers to define the urban logistics network and its existing uncertainties.

Furthermore, without the existence of a political vision is difficult to receive funding and to implement new policy measures or perform other activities such as pilots. When the topic of urban logistics would receive more funding, bigger steps toward the sustainable transition of urban logistics could be made. In order to ensure that projects can still be undertaken, cities are putting a lot of effort into collecting funding and or knowledge by themselves by becoming part of an (European) consortium or collaborate with European projects. The following quote shows how European project can provide (sometimes the only) opportunity to take a step forward.

> *"And on the other hand, nothing will be realized if it was not for the European funding that we receive for that. And so where are we with that SUMP? Nowhere for now. That intention is there, but it will only be realized when we happen to be part of a consortium or where there is room to work on that SUMP, or that that is the deliverable or that we can take actions. And yes, it depends almost on chance rather than from a political decision what we need and what we need to work towards. And the whole logistics story is, also in that way and organized. It mainly goes bottom up. So yes, it depends on those European subsidies" (C483)*

Other barriers that are both introduced in academic literature and addressed by the interviewees are the 'institutional procedures' and 'Urban logistics as an integral policy field.' Institutional structures hinder local policymakers to adjust to and incorporate the lessons learned in urban logistics policy. In developing a project proposal, local officials are required to indicate the intended outcomes and how the project would benefit the city. As a result, a static structure is created in which the budget obtained would be solely granted to achieve the projected outcomes. In addition, policymakers are forced to produce the initial product because they fear having to return the budgeted funds, even in times they learn during the project's implementation or testing phase that the results are not likely to be as effective as initially proposed. The introduced barrier of the political / institutional structure as addressed by Bjørgen et al. (2019), Hull (2008) and Höllerman & Evers (2017), indeed prevent local policy makers to create adjustable urban logistics policy and are hindered to incorporate flexibility in the process to learn throughout time. The quotes below substantiate this finding.

> *"Yeah. Maybe just as a final comment, because I have to say a reflection on our political decision-making process makes it really complicated to adapt for unforeseen events just because we have to be really explicit. Like when I write my. Yeah. I have to write a report to the council where I say my plan for spending. It has to be really specific." (C603)*

> *"The sword of Damocles is always that you don't want to have to give back your funding. So you have to be able to prove that you did what was in the plan that you would do. "(C851)*

The condition of 'urban logistics as an integral policy field,' means that the topic has an integrated character and does not belong to one department in the cities administration. During the interview, the barrier that this condition can lead to as the opportunity it can provide were mentioned. Interviewees face difficulties when other departments are needed and experience ignorance from their colleagues when they have to explain the logistical policy measure or objective.

"Yes, it is always difficult to engage uh colleagues. Yes, for example with a new project. Because with new things there is always resistance. And this is separately from the politics, because our own colleagues are also often eh suspicious is perhaps a big word, but they then shrug their shoulders" (C483)

However, other cities also explain the opportunity this condition can have when urban logistics is not subdivided into one departments policy plan but inherent in an integral policy plan as demonstrated by the quote below.

"We have a climate campaign. So, I mean, we this is a this is something where we have companies that have showcased their logistical improvements and they've joined in through that. They have changed their logistics." (C293)

The overall finding of this chapter is that when you compare the organizational condition argued in literature as mentioned in SUL policy-making practise, there are six organizational conditions observed which can hamper or enable local policymakers in SUL policy-making.

4.4.2 Personal skills of local policymakers in SUL policy-making

In addition to organizational conditions, chapter 2.6.2 provides insight in personal conditions which can enhance the ability of local policymakers to deal with uncertainties. In the questionnaire, respondents were asked to indicate how they estimated their own abilities in relation to four elements, 'collecting information,' 'understanding uncertainties,' 'predicting uncertainties' and 'choosing a response for uncertainties.' The results are shown in figure 13 and explained in the paragraph below.

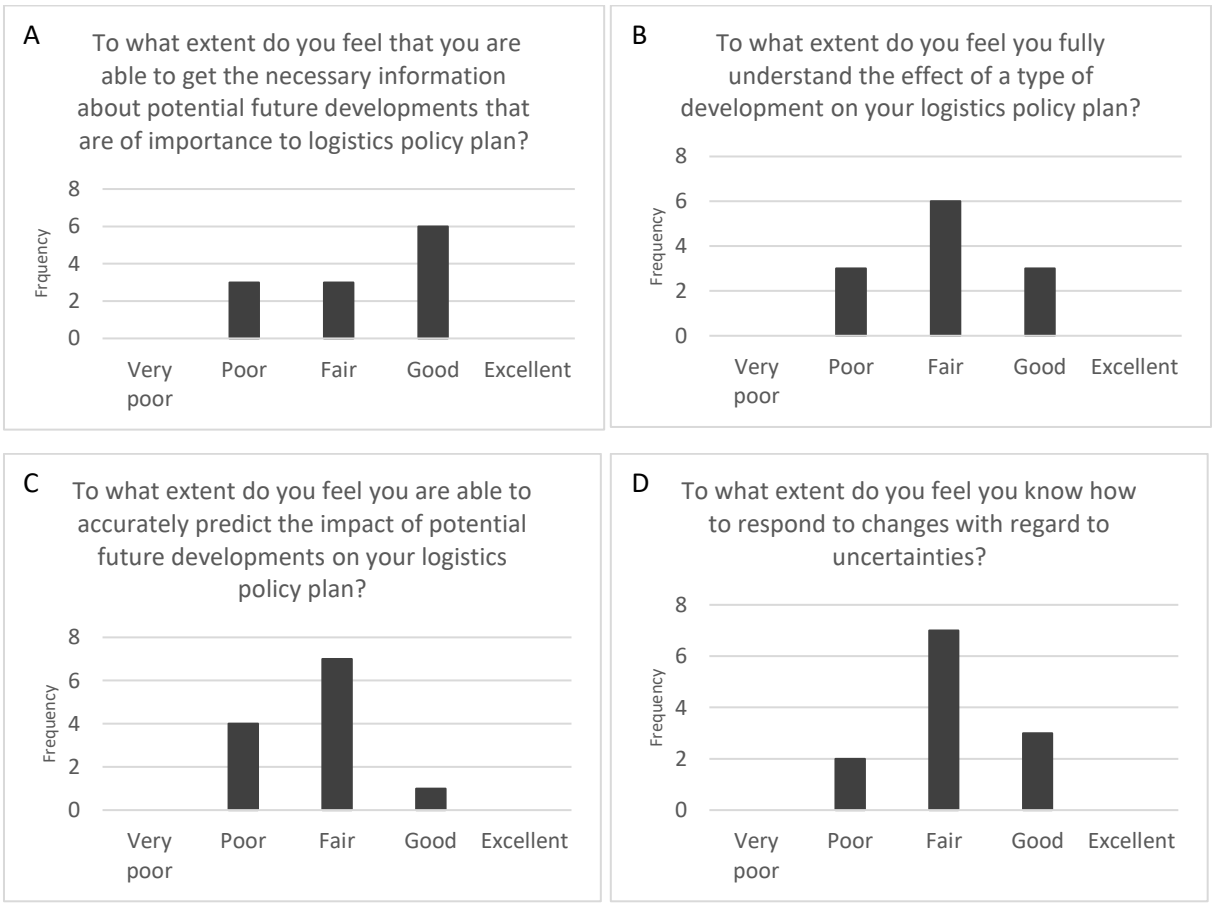


Figure 13 Graphs visualizing the results of question 14 to 17 from the survey

The respondents generally perceived their ability to respond to changes with regard to uncertainties (graph D in figure 13) and to fully understand the effect of an uncertainty on their policy plan (graph B

in figure 13) to be fair. Interviewees explained that their ability to explore uncertainties alongside collecting information to understand the unforeseen developments was perceived to be good. Substantially, the ability of acquiring the necessary information was scored to be the best perceived ability of the participating local policymakers (graph A in figure 13). During the interviews it was indicated that local policymakers foremostly act reactively to uncertainties, and that their ability to do so depends on the availability of resources.

The perceived ability to predict the impact of future developments (graph C in figure 13) is the respondents' lowest-scoring competence in relation to the data obtained in these four questions of the survey. In correspondence with Höllerman & Evers (2017), respondents mentioned that having more experience in the policy area of urban logistics can help them improve their skills. Time is therefore also mentioned as needed resource to learn more as time goes on and it is suggested that this will help them develop these talents. Currently most local policymakers have to divide their weekly hours over multiple projects or topics and have no time to invest in these skills. These results are in comparison with the data collected during the workshop, as can be seen in figure 14, time was also indicated to be a difficulty which further emphasizes that time is a barrier in exploring uncertainties.

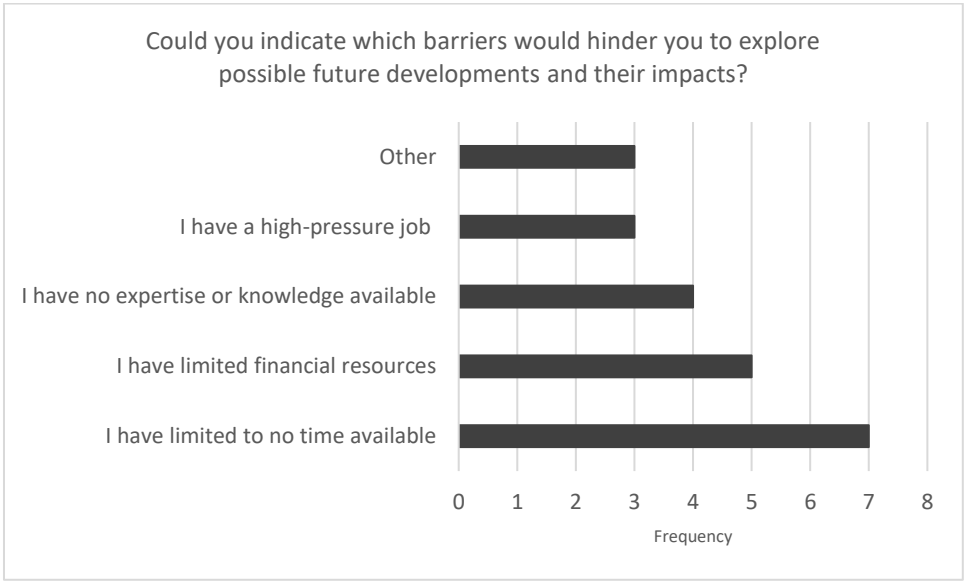


Figure 14 Graph visualising the data collected during the workshop, indicating possible barriers for exploring uncertainties

The relative higher score on the ability to gather necessary information is explained by the position that some policymakers were pushed into. Being the local policymaker working on the subject of urban logistics results in an information flow in which every piece of information is sent or forwarded to you. The quotes below reflect this position of some local policymakers.

> *"But yes, often the information comes to me. Electronics just saying. I went to that conference and someone talked about this and that since I am the only person, I got all the information." (C603)*

> *"We had nothing and no one working on city logistics at a strategic level. Mm hmm. And it's really weird to think that I was just thrust into it. I didn't either before. Mm hmm. And now I, am apparently the city logistics guy of the agency and, uh, many people I met in all the cities can say the same." (C463)*

Furthermore, acquiring the needed knowledge or information is a skill that you can develop easily as an individual by becoming part of a bigger network and using social skills to generate more relations in the field of urban logistics. Cities that indicated their perceived abilities to be higher in comparison to other cities addressed additional competencies or resources to have access to. For example, the availability of a collaboration with internal experts on the topics of for example legal frameworks, an

organisational culture that is willing to move in the direction of sustainable urban logistics and the and the presence of multiple staff members, more than 2, who are engaged in city logistics.

In conclusion, the data analysis of the semi-structured interviews and the surveys discussed and elaborated on several opportunities and barriers. Given that many challenges and opportunities have also been mentioned in the theoretical framework by multiple academic sources, an overview has been produced to contrast the characteristics suggested in science and practice. Table 15 provides a general overview in which similarities and differences between the suggested and experienced (dis)enablers can be observed. Furthermore, no additional personal conditions have come up during the analysis of the primary data collection, however, more experience in the field of urban logistics is indicated to be able to improve the personal conditions of local policymakers to deal with uncertainties.

Table 15 Overview of the barriers and opportunities in exploring uncertainties in SUL policy-making as addressed by academic literature and/or practice

Barrier or Opportunity in SUL policy-making	**Addressed in Theory**	**Addressed in Practice**
Barriers		
Political ignorance toward the topic of urban logistics	V	V
The integral character of urban logistics indicating the need for collaboration between multiple city administration departments	V	V
Lack in resources such as time, funding, workforce, information and or data	V	V
Static institutional procedures which hamper the flexibility or adaptivity of SUL plans to adapt over time	V	V
Absence of a national, regional or local vision on the topic of urban logistics	X	V
Opportunities		
The integral character of urban logistics indicating the need for collaboration between multiple city administration departments	V	V
Experience of local policymakers in the field of urban logistics	V	V
Use of different strategies to explore uncertainties	V	X*
Time for local policymakers to enhance the personal skill of exploring uncertainties in the field of SUL	X	V
Engage in multiple networks, National and European consortiums, networks or platforms, to improve the local policymakers' knowledge	X	V

*During the primary data collection multiple techniques of exploring uncertainties have been mentioned, however, the cities interviewed did not explicitly mentioned the use of a variety of action as an opportunity in exploring opportunities.

Combining the information presented in chapter 2.6 and this chapter 4.4 results in de existence of six organizational and three personal conditions which van be observed to cause opportunities or barriers for local authorities in dealing with the uncertainties of sustainable urban logistics. In addition to this finding, all conditions can become a barrier as well as present an opportunity in for local policymakers in dealing with uncertainties.

4.5 Enhancement of strategies to explore uncertainties in SUL policy-making

While conducting the interviews, a number of items came to light that could provide support in the exploration of uncertainties in SUL policy-making. This chapter provides insight in resources that were addressed by local policymakers to improve their practices and therefore generates an answer to sub question six: Which first steps can be identified to enhance the strategies of local policy makers to explore uncertainties in long-term planning for sustainable urban logistics?

4.5.1 The need for organisational support

The interviewees claimed that their employer's organisation could support them in better exploring and comprehending unforeseen developments. When we zoomed in on the approaches that local policymakers used to explore and deal with an unforeseen development, it became clear that providing time to fully understand the development and to consult the right stakeholders increased the ability and confidence of cities to respond to the uncertainty. Support in the form of financing, which refers to a separate account of money that may be used for logistics initiatives, was another strategy used to address and respond to uncertainties.

The awareness and acknowledgment of the opportunities that planning for SUL by the local authority provides, offers room for more flexible and adjustable plans, giving local policymakers the opportunity to gain experience and explore uncertainties that arise over time. As the quote below indicates, local policymakers request the use of adaptable policy plans. Nevertheless, the suggested steps to enhance the strategies for exploring uncertainties lie beyond the control of individual local policymakers.

> *"No. I mean, we need to come up with a roadmap in some way, but you never know what happens by 2030, so you can't expect to implement it step by step, 100%. There's always like. Yeah. You always have to go with the flow, I guess, except that things change and things can happen." (C603)*

In short, local policymakers indicate that the availability of the right resources can allow local policymakers to improve their own understanding of uncertainties. In addition, an improvement in political awareness would provide room to actually respond to the uncertainties explored and adjust their policy measures or objective to new gained knowledge.

4.5.2 A request for inspiration

In addition to a change in organisation or institutional culture, interviewees addressed more simple steps that can enhance their personal strategy for exploring uncertainty in the SUL policy field. With the existence of some uncertainty exploration in the form of risk analysis, local policymakers addressed how new examples of uncertainties and the categorization of uncertainties widened their perspective on which uncertainties might influence their urban logistic policy plan. In the quotes below it becomes clear how providing inspiration or examples of other uncertainties helped local policymakers to increase their awareness of the different uncertainty types and their consequences. Furthermore, a participant who both participated in the research as in the workshop indicated the positive contribution of the workshop exercise in exploring uncertainties in SUL policy-making and expressed interest in the design of the workshop so that their municipality could use it internally as well.

> *"I mean, this even this word uncertainty and some of your inputs in the questionnaire might just help us to rethink"*

> *"I think you have to think about it. All the different possible components of what? Like if you have a policy, you get an unintended outcome, an unexpected outcome. There's a tendency to think that it's causation or it's even a correlation where it might not, that you might see something else."*

> *"I remember thinking in Mechelen, gee. But we should actually do this a broader time, such a risk, so to speak. Really nice activity to do with uh with your own project team"*

In conclusion, all participated cities were very interested to receive the results of the research and indicated that tools which could broaden their perspective were explicitly valued as a first step in dealing with uncertainties in SUL policy-making.

CONCLUSION

Research results

The research of this master thesis has used five different data collection methods to gain insight into how European cities deal with uncertainties in long-term planning for sustainable urban logistics. From chapter 2.1 and 2.2 is becomes evident that urban logistics systems are complex and dynamic as well as consisting of a heterogeneous web of stakeholders and rapidly innovating technologies. In order to develop sustainable urban logistics policies – in which social, economic and environmental objectives are balanced and integrated – local policymakers of European cities try to get a grip on their complex urban logistics system (figure 15).

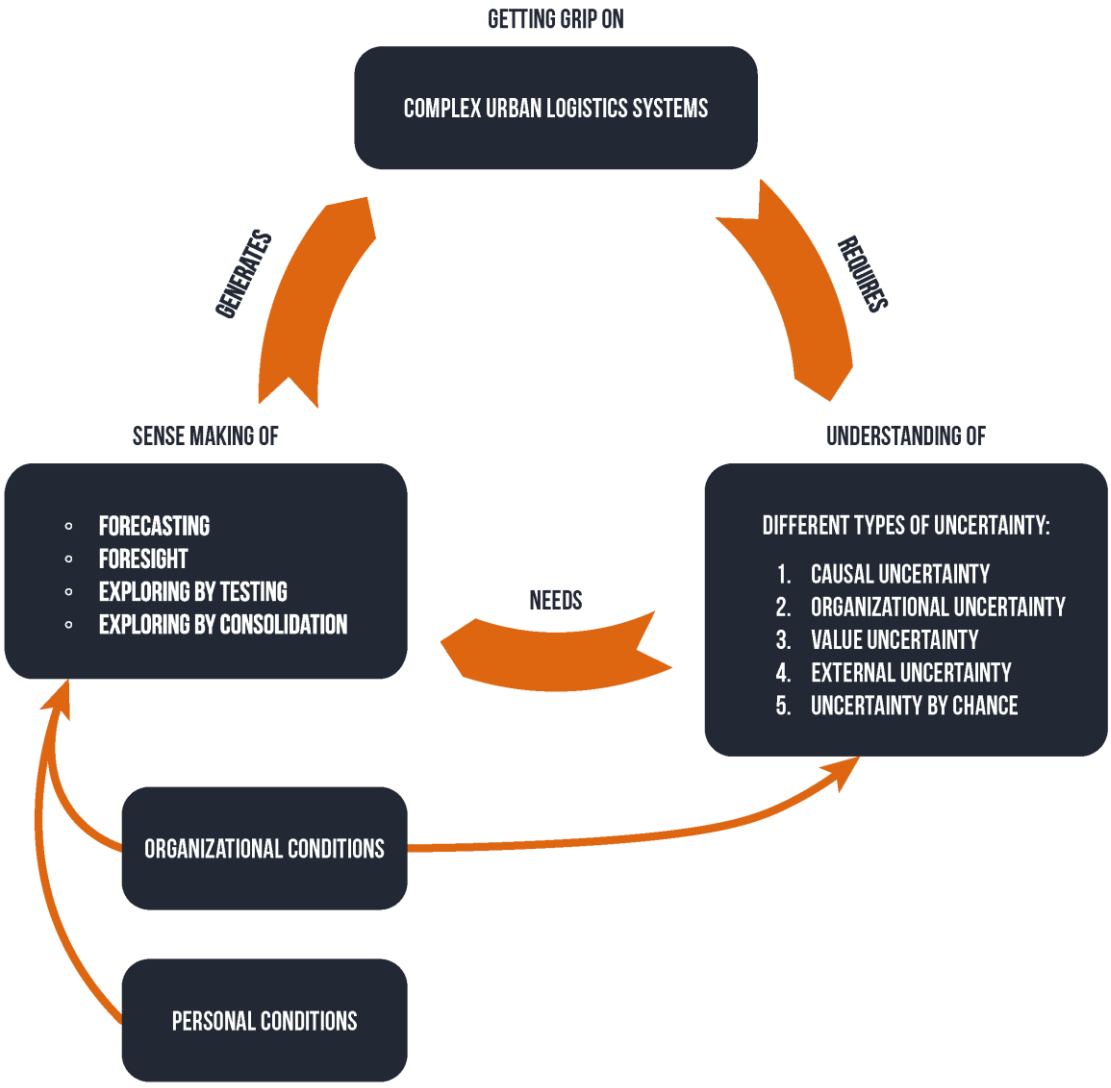


Figure 15 The adjusted conceptual model: showing how local policy makers can get a grip on complex urban logistic systems

In academic literature the first step in dealing with uncertainties is argued to be the acknowledgement and being aware of the uncertainties that surround the planning practise, in this study particularly SUL policy-making. In the overall data collection, all five types of uncertainty were encountered by the cities, however, the data analysis reveals that local policymakers are confronted with uncertainties in urban logistics policy-making to the extent that value-, organizational-, and causal uncertainty are most frequently mentioned by the practitioners. These results do not demonstrate the inexistence of external uncertainty and uncertainty by chance, though, these types of uncertainty are to a lesser

extent on the radar of local policymakers due to a lack of resources and their nature of lying beyond cities' their control. Furthermore, the data analysis explained that local policymakers are aware of differentiating quantity of uncertainties ranging from four to one uncertainty type indicating the possibility for improving the cities' understanding of all five uncertainty types that surround SUL policy-making.

Local policymakers make use of the three exploring techniques as introduced by van der Steen (2018) but also revealed to make use of an extra more informal strategy that is foremostly used for consolidation purposes. Hence this study concludes that local policymakers make use of four exploring techniques: forecasting, foresight, exploring by testing and exploring by consolidation, - of which the foresight approach is most frequently used by practitioners - to increase their knowledge and understanding of uncertainties. In addition to the first conceptual model (figure 6) the fourth method of exploring uncertainty by consolidation is added to the adjusted framework which can be seen in figure 15. Furthermore, practitioners indicate that the required understanding of the uncertainty types as well as the sensemaking by exploring uncertainties can be enhance by the organizational condition of available resources in the form of time, personnel and funding, this is also adjusted in figure 15. The research results show that complementary to three organizational conditions - as identified by literature - a total of six organizational conditions can be distinguished that can become barriers or form opportunities for local policymakers to deal with uncertainties. Additionally, three personal conditions can be established that have an influence on the ability of local policymakers to make sense of the observed uncertainties in order to deal with them. Overall, improved experience in the field of SUL policy-making is indicated to enhance these personal conditions for exploring uncertainties.

This conducted research has not resulted in strategies that can be explicitly named to get a better grip on the complex urban logistic systems, however, some first steps to enhance the strategies of local policy makers to deal with the uncertainties in SUL policymakers can be identified. Local policymakers have requested inspiration in the form of tools and examples to extend their viewpoints and increase their knowledge in understanding the different uncertainty types and exploring them. Furthermore, by improving the political awareness on the possible contribution SUL policies has on enhancing the liveability of urban centres and increasing organizational support in the form of providing resources, the ability of local policymaker to understand and make sense of uncertainties can be strengthened. In conclusion, European cities currently deal with uncertainties in long-term planning for sustainable urban logistics by creating an understanding of observed uncertainties trough exploring the unforeseen development and its effects. However, organizational and personal conditions can challenge or enable local policymakers in dealing with the uncertainties that surround the policy field.

Validation of the conducted research

This section of the master thesis will reflect on the used methodology and validity of the research conducted. Although the research has produced insightful results, it also reveals points that could be improved upon for a potential follow-up or comparable study.

Contribution to knowledge gap

The introduced knowledge gap by Höllerman & Evers (2017) implied that there is a difference in the approach of dealing with uncertainties used by scientists and practitioners and that this challenges the knowledge transfer between the two. This study partially covers this knowledge gap because, local policymakers prioritise the exploration of uncertainties that appear within their city or lay within their control over exploring uncertainties from a top-down perspective. Complementary to Maxim & van der Sluijs (2011) local policymakers explore uncertainties to get a better grip on the urban logistic systems and use exploring techniques to enhance their knowledge.

In addition, this master thesis has contributed to the research field of how policy-making can deal with uncertainties in the policy field of urban logistics. The conducted study connects theory with practise by exploring how local policymakers of European cities deal with uncertainties in their daily.

Methodology: points of improvement

Due to the abstract concept of uncertainty the researcher designed the interview guide in a way that would allow respondents to use a personal context—an experienced uncertainty—as a frame of reference. However, this led to limited time to ask the interviewee all the questions because it took longer than anticipated to discover an example or establish a personal context. Due to the fact that not all of the questions were asked in each interview, the data analysis of some topics is inadequate which influences the validity of the research.

The policy document analysis revealed that the development of urban logistics policy plans varied among the cities surveyed; some had only begun, whereas other cities had finalised the plan and were putting it into practise. This variation affected the respondents' capacity to complete the online survey entirely, resulting in an incomplete dataset and the inability to analyse some questions (Q9 – Q13).

The collection of data and thus the conduct of the interviews took place in the summer period and coincided with the holiday period in Europe, this made scheduling interviews more difficult due to the absence of local policy makers. By extending the data collection window it was possible to schedule twelve interviews with European cities, nevertheless, including a higher number of participants will increase the validity of the research.

Recommendations for future research

During the workshop, it was possible to evaluate the research's topic with the local policy makers to see how it was received and what people's general knowledge of the notion was. This was the first time that the researchers had the chance to speak with the practitioners which revealed that the conception of uncertainties was rather unknown and abstract to local policymakers in the field of urban logistics. This conclusion led to the combination of data collection methods that included a survey and interviews, in order to explain the topic clearly and address any misunderstandings. Furthermore, the introductory survey provided the opportunity to ask more in-depth questions during the semi-structured interviews.

The twelve interviews with corresponding questionnaire data on which the results of this study are based form a small sample size, therefore the opportunity presents itself to conduct additional research and to collect more insightful data to strengthen the results and generate more reliable conclusions. In addition, the introduction of a fourth method for local policymakers to explore uncertainties suggests potential directions for further study, for instance investigating the use or efficacy.

The master thesis can be used as a foundation in order to further study the applicability of the different types of exploring strategies. Future research can investigate the use of specific exploring strategies in relation to uncertainty types, which findings could enhance the knowledge and ability of European policy makers in exploring unforeseen developments.

Personal reflection

This master thesis will end with a personal reflection in which I can evaluate upon the improved skill and gained experience in performing a qualitative research of this extent. The explorative character of the research has proved to be challenging because there is no theory you are evaluating which makes defining the research design and the presentation of the results more difficult. Furthermore, I also struggle to find the correct balance between naming academic knowledge and outlining my own view

of a topic, in order to support the claims of my study. This has been improved by finalizing the master thesis but remains a skills I would like to improve. Last but not least, I've gained a lot of knowledge in the area of time management. As a result of various developments during the writing of the master thesis, I've improved at creating time schedules and gained experience finding a good balance between working and leisure activities. This has helped me to deal with the bypassing stress moments and has provided me with the opportunity to produce quality results.

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APPENDIX 1 DATA COLLECTION METHODS

	Sub question	Elements:	Type of source	Data collection
1	Which developments cause uncertainties related to sustainable urban logistics policies and which types of uncertainties can be distinguished in theory?	- Developments that cause uncertainties in UFT - Typology of Uncertainty - Operationalisation of typology uncertainties in SUL policy-making	Academic literature ULaaDS Deliverable	Literature review
2	Which policy strategies are suggested in urban policy literature to explore uncertainties?	- Strategies to deal with uncertainty in city policies - Strategies to deal uncertainties in SUL policies	Academic literature	Literature review
3	To what extent are local policymakers of European cities confronted with uncertainties in developing and implementing Sustainable Urban Logistics Plans?	- Do local policymakers know of uncertainties of SUL policy-making? - Do local policymakers experience the types of uncertainties that surround SUL policy-making?	Local policymakers in European Cities	Policy document analysis, Workshop, Questionnaire and interviews
4	Do local policymakers explore uncertainties that may affect policies for sustainable urban logistics and in which ways?	- Do local policymakers explore uncertainties that might influence their policy plan? - Which approaches do they use to explore uncertainties?	Local policymakers in European Cities	Policy document analysis, Workshop, Questionnaire and interviews
5	Which conditions can be observed to cause opportunities or barriers for local authorities in dealing with the uncertainties of sustainable urban logistics?	- Which factors would hinder or enable local policymakers to explore uncertainties?	Local policymakers in European Cities	Policy document analysis, Workshop, Questionnaire and interviews
6	Which first steps can be identified to enhance the strategies of local policy makers to deal with uncertainties in long-term planning for sustainable urban logistics?	- How can the approach of local policymakers to deal with uncertainties can be enhanced? - What assistance is needed for local policymakers to create a better understanding of the uncertainties and to improve their exploration of uncertainties.	Combination of Literature review, and data collection	All the above

APPENDIX 2 QUESTIONNAIRE DESIGN

	Elements/ Questions	Answer format	Information	Theoretical relation
T1	Dear sir/madam, Thank you for your participation! Your contribution is essential to our research. We are very grateful that you are taking the time to fill in this questionnaire. The goal of the study: This study explores how policymakers in the field of urban logistics are keeping an eye on future developments that could influence their policy plan. Procedure: The questionnaire is about your experiences as a policymaker. There are no right or wrong answers. Filling the questionnaire takes approximately *15 minutes.* Please do not hesitate to contact *m.a.buser@student.rug.nl (Maaike Buser)* if you have any questions about this study.			
T2	**Voluntary participation** Your participation is voluntary. You can decide to stop participating in the survey at any moment. You do not need to give a reason to do so. **Privacy** The data you provide in this research will be anonymized in the report and cannot be traced back			

	to you as an individual in the report. However, since the questionnaire as serves as input for possible follow-up interview, your personal information remains linked to the data during the data analysis. All data remains confidential and will not be shared. The data is only going to be analysed by the researchers involved in this project: Maaike Buser, dr Ward Rauws and dr Paul Plazier. **What's in it for you?** If you like, we will send you the analysis of other policymakers their experiences with future developments. It will surely be fun and interesting to see how other policymakers keep an eye on future developments. Enter your e-mail address at the <u>end</u> of the survey to receive the report.			
1	I have read and understood the information above. I agree to participate in this study, and I agree with the use of the data that is collected. • Yes • No			
H1	**Respondent information**			
2	Does your city have a logistical policy plan (for example: urban logistics plan, urban mobility plan with section of logistics)	Yes No	If answer is no, the respondent is excluded from the sample and the questionnaire will end.	Chapter 2.1

3	How much of your working time is dedicated to the topic of urban logistics (in FTE; Full Time Equivalent)?	1 FTE 0.8 0.6 0.4 0.2 Other: ….		Chapter 2.6 and chapter 2.1
4	Do you work together with colleagues of your city administration on the topic of urban logistics? If yes, please indicate how many colleagues work on the topic of urban logistics. Considering the team as a whole, how many FTEs is dedicated to the topic of urban logistics in total?	Yes No Number of colleagues: open Open: …. FTE		Chapter 2.6
5	Please indicate the number of months you are working on the topic of urban logistics at your city.	Open		Years of work experience (inspired by Höllermann & Evers, 2017)
6	What is your educational background?	Open		Educational background (inspired by Höllermann & Evers, 2017)
H2	**Uncertainty in policy-making**			
T3	Please read this first! Urban logistics is a highly dynamic and complex sector. The wide range of stakeholders implies that urban logistics includes different interests, ambitions and responsibilities. Citizens for example ask for good quality public space and clean air. In response, local authorities may implement new			

	measures to restrict last-mile logistics in inner city access. However, how stakeholders (for example:) logistics operators will react to the implemented policy measures and if the policy measures generate the desired outcome is uncertain. Future developments can disrupt the policy plan or have an unforeseen effect on the policy goals. This study investigates how policymakers deal with these future developments in preparing and implementing policies for urban logistics. The upcoming questions are about unforeseen developments that you as a policymaker might have experienced.			
7	*Please indicate to what extent you agree with this statement:* In my daily work/policy practice, I keep an eye on future developments that may affect the urban logistics policy plan.	- Strongly agree - Agree - Neutral - Disagree Strongly disagree	Testing if the policymakers had any experience with uncertainties	Chapter 2.4
8	Which unforeseen developments, if any, did you face in preparing and implementing policy? Could you describe the effect on urban logistics?	Open .... I did not face any unforeseen developments	Testing if the policymakers had any experience with uncertainties and if they can describe its influence	Chapter 2.4
H3	**Types of Uncertainty**			

T4	Please indicate if you have kept an eye on the following examples of uncertainties in preparing and/or implementing the policy on urban logistics in your city.				Chapter 2.4
9	**Organizational Uncertainty**	Did or do you keep an eye on this possible development			
9a	A disruption in the group of key collaborators (For example: a partner with whom you collaborate in a project or pilot goes bankrupt)	While developing/ preparing the policy Yes No	While implementing the policy Yes No	Testing if policymakers had any experience with different types of uncertainties. The examples will be displayed in the questionnaire in random order without an indication of the type.	Chapter 2.4
9b	(Some of) the proposed policy measures appear to be unfeasible (for example: a time windows or zero-emission zones is declared legally invalid in court)	While developing/ preparing the policy Yes No	While implementing the policy Yes No	"	Chapter 2.4
9c	The level of ambition of the private sector and those of public actors grow apart over time (for example: as the result of a changes in leadership at logistics providers or in the city hall)	While developing/ preparing the policy Yes No	While implementing the policy Yes No	"	Chapter 2.4
10	**Causal Uncertainty**				
10a	Policy measures generate unexpected side-effects (for example: in face of zero-emission zones being developed, retailers and other companies unexpectedly relocate their business ate the edge of the city)	While developing/ preparing the policy Yes No	While implementing the policy Yes No	"	Chapter 2.4

10b	Policy measures are hampered in unforeseen ways (for example: due to lack of overall cycling safety the full potential of delivery of goods with cargo bikes cannot realised)	While developing/ preparing the policy Yes No	While implementing the policy Yes No	"	Chapter 2.4
10c	Projected policy outcomes are not obtained (for example: the reduction of CO2 emission by implementing parcel lockers is not realized since many consumers collect their parcel by car, leading to a nullifying effect of CO2 emissions)	While developing/ preparing the policy Yes No	While implementing the policy Yes No	"	Chapter 2.4
11	**Value Uncertainty**				
11a	A priority shift at national level results in a higher ambition on the planned policy goals at local level. (For example: the deadline on zero-emission is pushed forward)	While developing/ preparing the policy Yes No	While implementing the policy Yes No	"	Chapter 2.4
11b	The political support for sustainable (logistical) policy is undermined. (For example: A political party that denies climate change comes into power).	While developing/ preparing the policy Yes No	While implementing the policy Yes No	"	Chapter 2.4
11c	A citizens movement leads to a change in consumer behavior (for example: public interest for locally produced goods increases) which changes city logistic flows and the type of goods.	While developing/ preparing the policy Yes No	While implementing the policy Yes No	"	Chapter 2.4
12	**External Uncertainty**				
12a	New technologies change the cities logistical flows. (For example: 3D-printing create the possibility of printing parts on the spot in the spare part sector, in turn decreasing the need for on-demand delivery while increases the supply flows of	While developing/ preparing the policy Yes No	While implementing the policy Yes No	"	Chapter 2.4

	polymers and raw materials)**.**				
12b	Disruption in other policy domains: (for example: The city's grid operator is unable to provide enough electric (re)charging points for electric transport vehicles.	While developing/ preparing the policy Yes No	While implementing the policy Yes No	"	Chapter 2.4
12c	New business models that flip around urban logistic flows (for example: Many retailers transform their stores into showrooms and home-delivery becomes the dominant mode, resulting in a stark increase of logistics in residential areas)	While developing/ preparing the policy Yes No	While implementing the policy Yes No	"	Chapter 2.4
13	**Uncertainty of Chance**				
13a	As a result of global constrains, updating the logistics transport fleet to zero-emission is not going as fast as hoped" (for example: due to a lack of nickel required for battery production, global trade war hindering the automotive industry, or congestion in the Suez Canal)	While developing/ preparing the policy Yes No	While implementing the policy Yes No	"	Chapter 2.4
13b	Social unrest triggering emergency measures (for example: A big strike in the waste collection sector results in local authorities forbidding packaging materials)	While developing/ preparing the policy Yes No	While implementing the policy Yes No	"	Chapter 2.4
13c	A natural disaster disrupting logistics systems (for example: the eruption of a volcano hinders solar energy production used for zero-emission delivery).	While developing/ preparing the policy Yes No	While implementing the policy Yes No	"	Chapter 2.4
	Personal barriers and Incentives				
14	To what extent do you feel that you are able to get the necessary information	- Very poor - Poor - Fair		Testing the perspective of local	Chapter 2.6

	about potential future developments that are of importance to logistics policy plan?	- Good - Excellent	policymakers on possible barriers that could hinder them in dealing with uncertainties	Ashill & Jobber, 2010
15	To what extent do you feel you are able to accurately predict the impact of potential future developments on your logistics policy plan?	- Very poor - Poor - Fair - Good - Excellent	Testing the perspective of local policymakers on possible barriers that could hinder them in dealing with uncertainties	Chapter 2.6 Ashill & Jobber, 2010.
16	To what extent do you feel you fully understand the effect of a type of development on your logistics policy plan?	- Very poor - Poor - Fair - Good - Excellent	Testing the perspective of local policymakers on possible barriers that could hinder them in dealing with uncertainties	Chapter 2.6 Ashill & Jobber, 2010.
17	To what extent do you feel you know how to respond to changes with regard to uncertainties?	- Very poor - Poor - Fair - Good - Excellent	Testing the perspective of local policymakers on possible barriers that could hinder them in dealing with uncertainties	Chapter 2.6. Ashill & Jobber, 2010
H4	**Closing questions**			
18	With which type of uncertainty are you most concerned with?	- All types - Value uncertainty; describe the changes in public values and political interest and priorities. A change in the perceived responsibility of stakeholders is also an example of a value uncertainty. - Organizational uncertainty: arise from	Testing which types of uncertainty policymakers would rate as important to be concerned about	Chapter 2.4

		the actions performed by players, people and organizations, who are involved in developments and implementation of a logistic policy. - Causal uncertainty: are uncertainties which arise from a cause-and-effect relationship. For example, the implementation of a policy measure can have an influence on the liveability of a city. - External uncertainty: can be describes as developments over which the city has no influence. They come from external environments like the development of new logistics technology. - Uncertainty by chance; are specific events which have an unannounced and single effect on the city. Natural disasters, epidemics or wars are examples. - None		
19	With which type of uncertainty are you the least concerned with?	- All types - Value uncertainty; describe the changes in public values and political interest and priorities. A change in the perceived responsibility of stakeholders is also an example of a value uncertainty. - Organizational uncertainty: arise from the actions performed by players, people and organizations, who are involved in developments and	Testing which types of uncertainty policymakers would rate as non-important to be concerned about	Chapter 2.4

		implementation of a logistic policy. - Causal uncertainty: are uncertainties which arise from a cause-and-effect relationship. For example, the implementation of a policy measure can have an influence on the liveability of a city. - External uncertainty: can be describes as developments over which the city has no influence. They come from external environments like the development of new logistics technology. - Uncertainty by chance; are specific events which have an unannounced and single effect on the city. Natural disasters, epidemics or wars are examples. - None		
20	According to you, how relevant is exploring uncertainties and their influence on policy plans for the performance of policies?	1 = not relevant at all 10 = very relevant	Testing if local policymakers find the analysis of uncertainty relevant for the performance of their policy plan.	Chapter 2.5
	Closing			
T5	Thank you for your participation. Is there anything you would like to add? Then please do not hesitate to add your suggestion or comment below.	Comments/additions:		
H5	**Contact**			
21a	I am interested in the results of this survey.	(Yes / No)		

21b	To follow-up on this questionnaire, we **very much need** policymakers who are **willing to participate** in an interview (of +/- 1 hour). Would you be interested to participate?	(Yes / No)		
21c	If you answered 'Yes,' please provide your address here.	Email address		
	End			
T6	Thank you very much for taking part in this survey!			

APPENDIX 3 INTERVIEW GUIDE

	Introduction of the interview	Information	Theoretical relation
	Thank you for taking part in this interview. With this interview we would like to explore how local policymakers respond to future developments (uncertainties) that could have an effect on your policy goals for sustainable urban logistics. We would like to emphasize that what you tell here will be anonymous in the research report, your name will not be mentioned. What you say cannot be traced back to you and the data is only going to be analysed by the researchers involved in this project: Maaike Buser, dr Ward Rauws and dr Paul Plazier. This interview is voluntary. If at any time you do not wish to continue, the interview will be stopped without reason, and if you do not want to answer a question tell the interviewer and the question will be skipped. This interview will take approximately 60 minutes unless you wish to stop earlier.		
	Permission		
1	To analyse the gathered data, we would like to record the audio of this interview. So, before we start the interview we wanted to ask if you give us permission to record the audio of this interview?		
	Policy goals information		
2	I read that these X, Y, Z goals are set for the logistics policy plan. How and when where these priorities established? And do you feel they still fit with the present time?	Can be used as a context to which other questions about uncertainties can be addressed.	Chapter 2.1
3	In what time frame are you planning on achieving these goals?	Informs if the city has a long-term policy plan (10 to 15 years)	Chapter 2.1
	Uncertainties & strategies		
4	What is the status of your policy plan or activities (to achieve the goals of Q2), is everything going as planned or do you experience disruptions or unexpected opportunities?	Asking if local policymakers do experience uncertainties and what kind.	Chapter 2.1; chapter 2.4

5	In the questionnaire, you have indicated to keep an eye on the [Q7 & uncertainty types from survey Q9 until 13]. Could you explain how these future developments (could) have influenced your policy plan?	How do policymakers understand the influence of uncertainties on their policy plan	Chapter 2.4
6	Possible strategy for dealing with uncertainties: Take one type of uncertainty as context for the following questions [example can be taken from Q8 from survey, or Q9 t/m Q13]. - How did you respond to [this opportunity or disruption]? - What actions did you undertake to understand or deal with [this opportunity or disruption]? *Example strategies:* - Did you experience any barriers as a local policymaker to deal with [this opportunity or disruption]?	Current strategy of local policymakers on how to deal with unforeseen developments.	Chapter 2.5
7	In the survey we asked you to indicate the relevance of exploring uncertainties and their influence on policy performance [Q20], could you explain the reason behind your given answer?		Chapter 2.5
	Possible barriers in practise	*The following question are yes/no question but are all intended to figure out what the interviewee thinks of the presented possible barriers.*	
8	Do you experience difficulty in communicating about uncertainties with decision-makers or the regional/national authority? -Why? -How? -Does this relate to personal skills/experience? [Q14-17]	Testing the perspective of local policymakers on possible barriers that could hinder them in dealing with uncertainties	Chapter 2.6
9	In your experience do you think it is feasible to integrate an uncertainty analysis into planning and decision-making practices? -Why? -How? -Does this relate to personal skills/experience? [Q14-17]	Testing the perspective of local policymakers on possible barriers that could hinder them in dealing with uncertainties	Chapter 2.6; chapter 2.5
10	Do you experience limited time and/or room for an uncertainty analysis in the	Testing the perspective of local policymakers on possible	Chapter 2.6; chapter 2.5

	current policy making practice in your city? Why (not)? -Why? -How? -Does this relate to personal skills/experience? [Q14-17]	barriers that could hinder them in dealing with uncertainties	
11	If the planning and decision-making practises would allow an uncertainty analysis, do do you then expect decision-makers will take up the findings in their decisions? -Why?	Testing the perspective of local policymakers on possible barriers that could hinder them in dealing with uncertainties	Chapter 2.6; chapter 2.5
	Closing questions		
12	To what extent do you consider your logistics policy(-ies) future-proof? Or able to deal with potential unforeseen developments?	Possibility to ask further about possible barriers or incentives for local policymakers to make their policy plan ready to deal with uncertainties	Chapter 2.2; chapter 2.3.
13	What would you like to see changed to make it possible for you to make an uncertainty analysis for your policy plan?	See above	Chapter 2.6; chapter 2.5
	Closing remarks		
14	Would you like to add anything that we didn't discuss, or you would like to share with us?		
15	Do you have some literature or document suggestions that we could read for more information? Do you know someone who might be interested in participating in the research?		
16	Thank you for your time and effort to be here with us. Would you be interested in receiving the result and/or final report of the study?		

APPENDIX 4 WORKSHOP – ANSWER FORM

European urban logistics policymakers gathered for a Study Visit, an event organized by the city of Mechelen and ULaaDS for the ULaaDS project, to share their expertise and experiences on the subject of SUL. The master's thesis author had the chance to develop and run a workshop together with dr. Paul Plazier and dr. Ward Rauws and gather the initial primary data in order to get a general sense of the SUL practise. The workshop aimed to explore the opportunities and challenges for local policy makers in fostering sustainable last mile logistics in two workshop rounds in which the participants had to collaborate in pairs. The data used in this master thesis was obtained in workshop round two, of which the activity is described below.

Activity: A Stress-Test: how ready is your policy to deal with unforeseen change
How: In pairs
Context: Scenario 'The new cool collective'
Step 1: Choose and write down the city that will function as context region for this activity
Step 2: Check your disruption card & answer the two questions (15 min)

Five disruption cards were used during the workshop, each describing another disruption that could influence the policy plan on urban logistics. In figure 16, two of the five cards are presented. The questions the participants were asked to fill in can be seen on the front side of the workshop form which is demonstrated in figure 17. Lastly, at the end of the workshop the participating local policymaker in each pair was asked to fill in the questions on the back of the form, these are shown in figure 18.

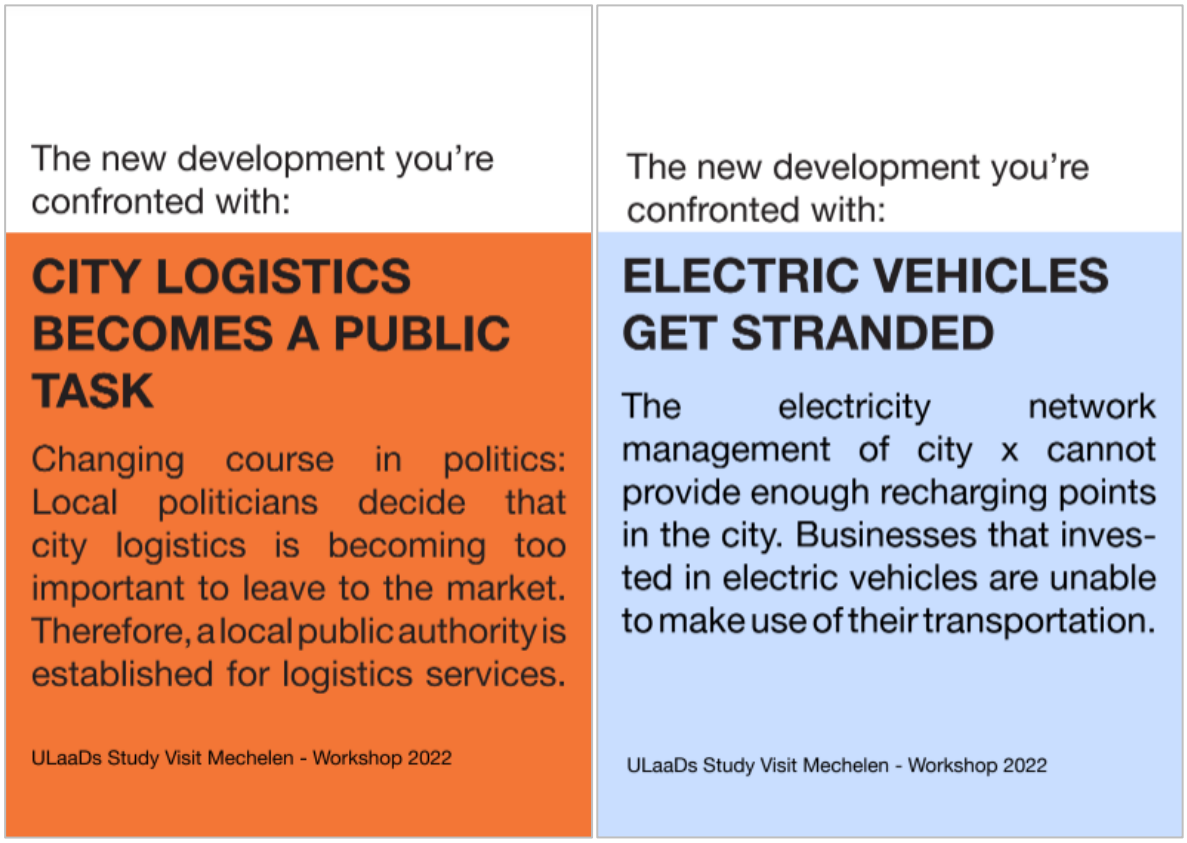
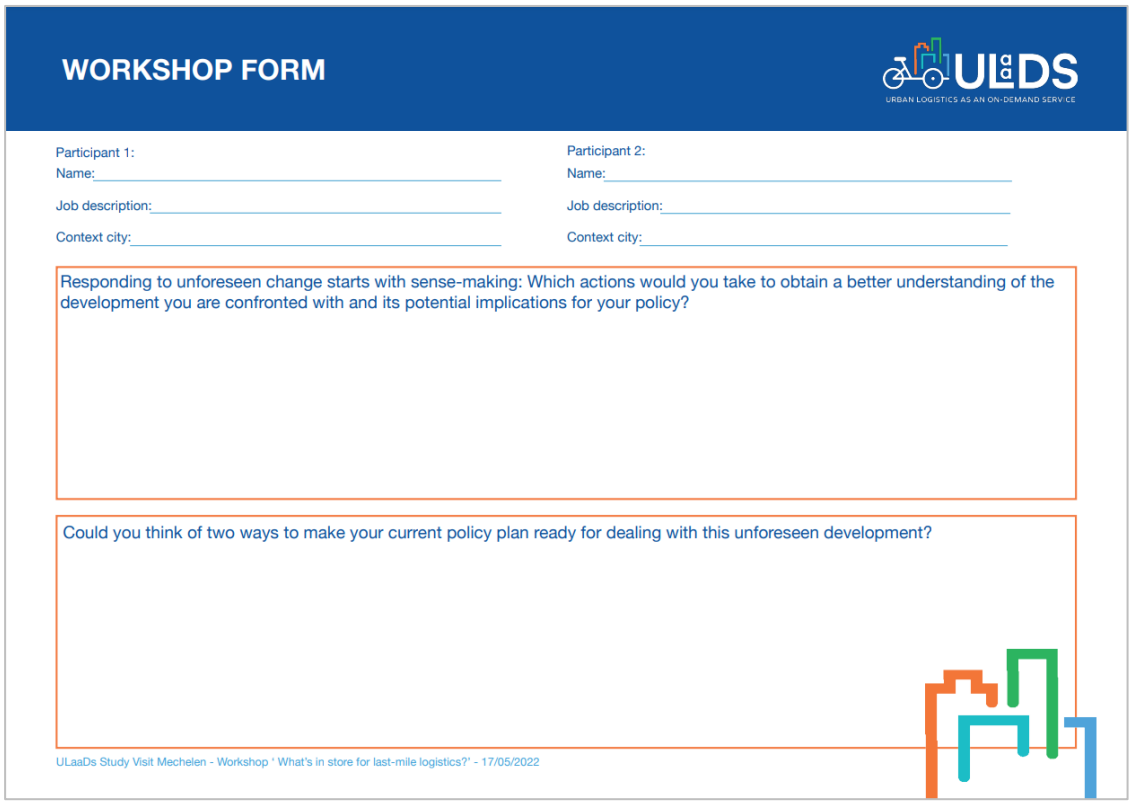


Figure 16 Two examples of the disruption card



WORKSHOP FORM

ULaDS
URBAN LOGISTICS AS AN ON-DEMAND SERVICE

Participant 1:
Name:
Job description:
Context city:

Participant 2:
Name:
Job description:
Context city:

Responding to unforeseen change starts with sense-making: Which actions would you take to obtain a better understanding of the development you are confronted with and its potential implications for your policy?

Could you think of two ways to make your current policy plan ready for dealing with this unforeseen development?

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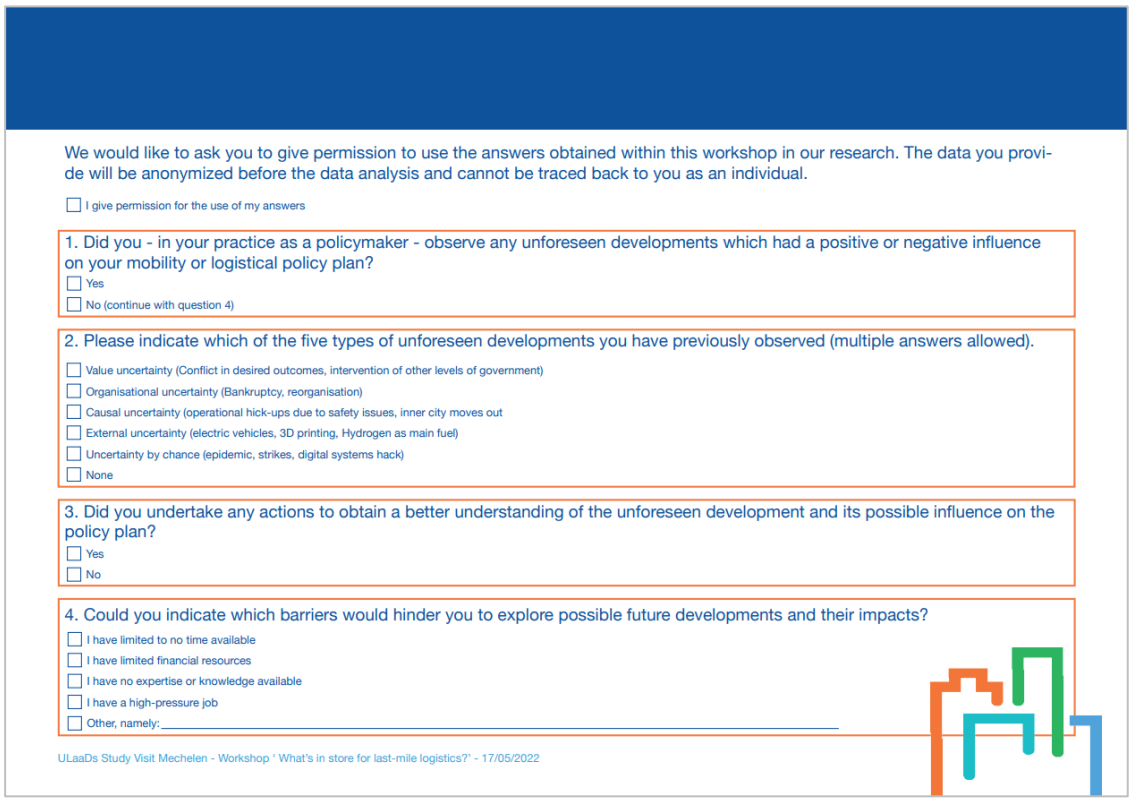
Figure 17 Front side of the workshop form



We would like to ask you to give permission to use the answers obtained within this workshop in our research. The data you provide will be anonymized before the data analysis and cannot be traced back to you as an individual.

☐ I give permission for the use of my answers

1. Did you - in your practice as a policymaker - observe any unforeseen developments which had a positive or negative influence on your mobility or logistical policy plan?
☐ Yes
☐ No (continue with question 4)

2. Please indicate which of the five types of unforeseen developments you have previously observed (multiple answers allowed).
☐ Value uncertainty (Conflict in desired outcomes, intervention of other levels of government)
☐ Organisational uncertainty (Bankruptcy, reorganisation)
☐ Causal uncertainty (operational hick-ups due to safety issues, inner city moves out
☐ External uncertainty (electric vehicles, 3D printing, Hydrogen as main fuel)
☐ Uncertainty by chance (epidemic, strikes, digital systems hack)
☐ None

3. Did you undertake any actions to obtain a better understanding of the unforeseen development and its possible influence on the policy plan?
☐ Yes
☐ No

4. Could you indicate which barriers would hinder you to explore possible future developments and their impacts?
☐ I have limited to no time available
☐ I have limited financial resources
☐ I have no expertise or knowledge available
☐ I have a high-pressure job
☐ Other, namely:

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Figure 18 Back side of the workshop form

APPENDIX 5 DEDUCTIVE CODE TREE & INDUCTIVE CODE BOOK

Deductive code tree created prior to analysing the interview data

Inductive code book Established after the data analysis

Code Group	Code Group	Description
Informal exploring uncertainties	Exploring uncertainties	Additional approach to exploring uncertainties in Sul policy-making
Awareness	Barriers & opportunities	Political awareness on the topic of SUL
Strategic vision	Barriers & opportunities	The lack of strategic vision on SUL policies
Information providing	Barriers & opportunities	Technique to share knowledge, information or experience from the local policy makers to other parties
Flexibility	Barriers & opportunities	Making policies more flexible enhances the strategy of local policymakers to be able to deal with uncertainties
Mindset	Other	The positive mindset of local policymakers to continue and work on positive results
Futureproof	Other	Characteristic to be given to SUL policy-making when they can adapt to uncertainties
	Other	