



**LUND INSTITUTE OF TECHNOLOGY**  
Lund University

# **PERFORMANCE EVALUATION OF SWEDISH URBAN FREIGHT TRANSPORT WITH AN ACTOR'S PERSPECTIVE**

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Johan Barkfors & Joakim Nguyen  
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# Abstract

<b>Title</b>	PERFORMANCE EVALUATION OF SWEDISH URBAN FREIGHT TRANSPORT WITH AN ACTOR'S PERSPECTIVE
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<b>Problem definition</b>	Freight transports are necessary to supply urban areas with goods. The complexity of urban freight transports is affected by growing cities that increases the demand for goods and the competition of city space, globalization which is altering the extent and complexity of supply chains, and technology innovations which have introduced new data collection methods. Policy makers of Swedish urban freight transport have to address the increased complexity, as well as account for increased demand for environmental sustainability.
<b>Purpose</b>	To analyse urban freight transport with the purpose to investigate how performance indicators can be used to attain long-lasting effects on policy measures that aligns with strategies for sustainable urban freight transport.
<b>Methodology</b>	This thesis aims to be descriptive and explanatory. First the thesis will investigate the context of urban freight transport, then the thesis will attempt to establish the linkages between the measures to satisfy the objectives of urban freight transport and performance measurement. The research approach of this thesis primarily is inductive, since the thesis aims to describe the context of data collection and performance measurement in urban freight transport. Additionally an abductive reasoning have been applied, with a set of observations from workshops, interviews and theoretical frameworks.
<b>Conclusion</b>	It was recognized that liveability, environmental sustainability, and mobility factors are emphasised by logistics experts in their visions for Swedish urban freight transport. The key stakeholders were identified to have distinctive success factors, the most important ones being reliability, accessibility, and environmental sustainability. Also, the most influential conflicts of Swedish urban freight transport are between: (1) Reliability and Environmental sustainability factors, and (2) Safety and Accessibility factors.
<b>Keywords</b>	<i>Sustainable logistics, Urban freight transport, Performance measurement, Scenario planning, Strategy map</i>

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# 1. Introduction

*This chapter outlines the subjects of this thesis. First – Its background. Second – Its purpose. Third – An introduction to the subject of urban freight transport and key issues in regards to the thesis. Forth – The research questions. Lastly, the disposition of the thesis is presented.*

## 1.1 Background

Logistics plays a significant role in societal development and during the last century it has increasingly attracted academic attention (McKinnon, 2012). In recent decades the focus of logistics has changed to include sustainability factors. Factors such as social sustainability and environmental sustainability have progressively become more important elements of supply chains (Allen and Browne, 2012).

During the last century there have been four ongoing megatrends that have altered the context of logistics and societies: (1) urbanization, (2) globalization, (3) technology innovations, and (4) customization. Urbanization have altered the environment in both urban and rural areas, resulting in the birth of megacities, and the rapid increase of minor urban areas (United Nations World Urbanization Prospects, 2011). Globalization have given societies the means, and furthered the purposes, of interacting over distances, by utilizing innovative ways to distribute knowledge and goods (The European Environment Agency, 2015). Technology advancements is increasing the technological capabilities of today, giving societies new ways to communicate and introducing environmentally friendly technology in many sectors (McKinnon, 2012). Customization of goods and services have provided consumers the possibility to access products that are increasingly aligned with their demands (Coletti and Aichner, 2011).

Cities are geographical areas with high population density, and as a consequence of urbanization an increasing portion of the population are living in cities (United Nations World Urbanization Prospects, 2011). 83 percent of the Swedish population lives in urban areas whereas 53 percent of the global population does (SCB, 2015; The European Environment Agency, 2014). Since populations is predominately concentrated to urban areas the consumption of goods and services is as well (Taniguchi et al, 2001). The concentration for the consumption of goods puts strict requirements on the supply chains that delivers these goods (Kawamura, 2014). The coordination of input and output of goods in urban areas requires strategic planning in the area of city logistics. According to Taniguchi et al (2001) city logistics can be defined as:

*“The process of optimizing the logistics and transport activities by private companies with support of advanced information systems in urban areas considering the traffic environment, the traffic congestion, the traffic safety and the energy savings within the framework of a market economy”*

## 1.2 Purpose

The purpose of this thesis was elicited iteratively by studying the subject of urban freight transport, and through dialogs with researchers and logistics professionals. Also, during a set of workshops, attended by logistics firms, logistics advisors, consultants and public authorities the purpose of the thesis could be framed.

The data that was collected during the course of the research work resulted in insights on the subject of urban freight transport, which finally resulted in four research questions and the overall purpose of this thesis. It was established that there are a couple of key issues on urban freight transport in Sweden. Firstly, administrators of urban freight transport in Sweden have identified that while there is a lot of data available on public transportation, there is little available of urban freight transport. Thus, there is a knowledge gap of the current situation. Second, there is no dominant design or standard, of how and why, data should be collected in Swedish urban freight transport. Third, a need to establish what kind of data that should be collected was identified.

The insights gained from the introductory investigation of Swedish urban freight transport resulted in the following purpose of the thesis.

*To analyse urban freight transport with the purpose to investigate how performance indicators can be used to attain long-lasting effects on policy measures that aligns with strategies for sustainable urban freight transport.*

### 1.3 Problem discussion

The importance of performance in urban freight transport is, as exemplified in the background, significant for the economical, social, and environmental performance in cities. However, it has been identified that urban freight transport as a research area is undeveloped and in practice problems are addressed with a trial-and-error approach (Anand et al, 2010). Various analytical models have been developed to investigate the demand and supply of goods in cities, the social impact of congestion, the environmental effect of increased traffic, etc. (Taniguchi et al, 2001; De Brucker et al, 2013). Still, in order to address the urban freight transport needs decision-makers have to account for the stakeholder perspectives (Taniguchi and Thompson, 2015).

City logistics has four key objectives: (1) mobility, (2) liveability, (3) resilience, and (4) sustainability (Taniguchi and Thompson, 2015).

Mobility is concerned with the maintenance of the flow of goods and to what degree urban freight contributes to this flow. A great amount of urban freight transport would either necessitate increased: (1) amount of freight trucks, (2) sizes of freight trucks, or (3) utilization of freight trucks, each alternative has implications on sustainability. Liveability is concerned with the safety of residents, accessibility of commodities, and the quality of life. An increased amount of freight trucks would increase the competition of city space, and thus increase congestion. Increased pollution and noise from large freight trucks is a health concern for residents. Resilience concerns the ability to secure commodities in case of disasters. Flows of goods should be accessible to the entire population, as well as being responsive in times of emergency. Sustainability concerns the objective of decreasing the impact on environmental pollution. The function of environmentally sustainable logistics is a factor of demand, fuel, vehicles, infrastructure, supply chain networks, environmental awareness and technology innovations. There are many contributing factors to why the system of logistics would become more sustainable, or not.

In order for public authorities to establish a decision-making process which accounts for different stakeholder perspectives, their preferences in regards to success factors, have to be addressed.

***RQ1***            *What are scope of the public transport authorities' objective-dimensions of urban freight transport, and what is their relative importance?*

As specified, each actor of urban freight transport has different motivations and objectives. Some of these influence factors are, from distinctive perspectives, more important than others. However, in order sufficiently investigate these motivations their linkages to the scope of urban freight transport should be established.

***RQ2***            *How can the objective dimensions be linked to the success factors for stakeholders of urban freight transport*

Stakeholder conflicts have the potential of influencing the performance of a project (Freeman, 2010). In order to assess potential conflicts of stakeholders the importance of stakeholders, as well as the relative importance of success factors have to be investigated (Hemingway and Cutts, 2013).

**RQ3**      *How can the importance of stakeholder conflicts of urban freight transport be assessed?*

In order to examine the performance of measures, performance measurements have to be developed (Parameter, 2007). Also, to investigate performance measures in regards to different stakeholder perspectives, the potential trade-offs of measures have to be assessed (King et al, 2015). A suitable approach should therefor account for the importance from a stakeholder perspective, and the influence of potential conflicts.

**RQ4**      *How can performance measurement be used to investigate suitable trade-offs between actors of urban freight transport*

## 1.4 Thesis outline

This thesis starts with an introduction of the thesis subject, followed by background, purpose of the thesis and then problem discussion which then generates the research questions. Thereafter a methodical framework that are used for this thesis. Followed by data collected for reaching the results which later are analysed and discussed. Finally, a description of several findings that are identified and presented for answering the research questions. The thesis is structured as follows.

<i>Chapter 1</i>	<i>This chapter outlines the subjects of this thesis. First – Its background. Second – Its purpose. Third – An introduction to the subject of urban freight transport and key issues in regards to the thesis. Forth – The research questions. Lastly, the disposition of the thesis is presented.</i>
<i>Chapter 2</i>	<i>This chapter provides the methodical framework for this thesis. Several aspects will be examined in this chapter: First, the research approach will be presented. Second, the methodology of the research questions. Lastly, the data collection and the research quality will be described.</i>
<i>Chapter 3</i>	<i>This chapter introduce the theoretical framework that will be examined. Starting with describing the principles of logistics, supply chain networks and city logistic. Thereafter description of sustainability, uncertainty and volatility. Followed by strategic and scenario planning and performance indicators. Followed by a description of four ongoing megatrends, starting with urbanization, globalization, technology innovations and customization.</i>
<i>Chapter 4</i>	<i>This chapter provides the data collected in interviews and from the questionnaire. Several aspects will be examined in this chapter: First, the results of workshop one will be presented. Second, the results of workshop two will be presented. Third, the results of the interview with the freight transport researcher Laetitia Dablanc will be presented. Forth, the results of the questionnaire will be presented. Lastly, the applied scenarios will be presented.</i>
<i>Chapter 5</i>	<i>This chapter provides the analysis for research questions based on the generated data collected. Starting with analysing research questions one and thereafter research question two.</i>
<i>Chapter 6</i>	<i>This chapter discuss the applied methodologies in this thesis and also the implications of these. Lastly establishing a model for performance measurement.</i>
<i>Chapter 7</i>	<i>This chapter addresses the purpose of the thesis and several findings are identified and presented for answering the research questions.</i>

## 2. Methodical framework

*This chapter provides the methodical framework for this thesis. Several aspects will be examined in this chapter: First, the research approach will be presented. Second, the methodology of the research questions. Lastly, the data collection and the research quality will be described.*

### 2.1 Research approach

The purpose of this thesis is to examine how policy efforts in urban freight transport can be measured and how it can be aligned with the strategic vision. In order to adequately satisfy the purpose a research approach and a suitable methodology approach have been selected.

According to Robson (2002) a thesis could have four different kinds of purposes: (1) Descriptive, (2) Exploratory, (3) Explanatory, and (4) Problem solving. Descriptive studies main purpose is to find out and describe how something works, or how it is performed. Exploratory studies aim to establish a deeper understanding of how something works, or how it is performed. Explanatory studies seek for casual connections and explanations for how something works, or how it is performed. Problem solving studies seeks to find a solution for a problem that have been recognized.

This thesis aims to be descriptive and explanatory. First the thesis will investigate the context of urban freight transport, then the thesis will attempt to establish the linkages between the measures to satisfy the objectives of urban freight transport and performance measurement.

Saunders et al (2012), describes that a research approach can be either: (1) inductive, (2) deductive, or (3) a combination of both. An inductive approach is described as a theory building approach and investigates the context of events, qualitative data is often critical in inductive research. A deductive approach develops and tests hypothesizes, and examines the outcomes of these tests, quantitative data is often critical in inductive research. The combination approach integrates both deductive and inductive research to offset the risk of missing important data. There is also one more research approach called abductive reasoning which indicates on a set of observations and theories and proceeds to find the most likely explanation of the observations and theories.

The research approach of this thesis primarily is inductive, since the thesis aims to describe the context of data collection and performance measurement in urban freight transport. Additionally an abductive reasoning have been applied, with a set of observations from workshops, interviews and theoretical frameworks.

According to Gammelgaard (2004) there are three methodology approaches that are applicable to logistics: (1) the analytical approach, (2) the system approach, and (3) the actors approach. The analytical approach investigates patterns with non-interactive research, the methodology works to decompose a systematic view to isolated elements in order to elicit causation effects amongst these elements. The system approach aims to investigate how isolated systems can be improved by identifying parts, linkages, goals and feedback mechanisms, this approach looks at specific cases and is not concerned with the development of comprehensive mapping of elements of causation. The actors approach argues that the environment is a result of social constructs. Predictions does

therefore have to account from the perspective of the actors' intentions though the work of qualitative studies.

The methodology approach of this thesis is from an actor's perspective because of its emphasis on strategic management from the perspective of public authorities. However, a systematic approach is also applied since the scope of the thesis is isolated and because systematic understanding of parts, linkages, goals and feedback mechanisms, are necessary to explain how policy measures in urban freight transport can be aligned with the goal of the system. In order to ensure that the underlying purpose of the thesis is achieved two research questions have been isolated and a set of appropriate methods to solve them have been elicited.

Research question one concerns: (1) the objective-dimensions of urban freight transport, and (2) their relative importance. The methodological approach to satisfy this is described in section 2.1.1.

Research question two concerns: (1) the critical success factors of urban freight transport, and (2) their linkages. The methodological approach to satisfy this is described in section 2.1.2.

Research question three concerns: (1) Stakeholder conflicts of urban freight transport, and (2) the assessment of their significance. The methodological approach to satisfy this is described in section 2.1.3.

Research question four concerns: (1) performance measurement in the perspective of stakeholders, and (2) the influence of trade-offs regarding their preferences. The methodological approach to satisfy this is described in section 2.1.4.

### **2.1.1 Methodology of research question one**

In order to adequately satisfy research question one a methodology have been established. This methodology describes the framework of the tools that have been selected to elicit a suitable solution. Research question one is divided in two segments: (1) the objective-dimensions of urban freight transport, and (2) their relative importance.

The ability to establish forecasts is important for the development of viable strategies with a long-term perspective. Factors such as technological innovations have had great implications on freight transport historically, and its implication on the future may also be significant. Therefore, in order to investigate the effects of influence factors of urban freight transport sustainability forecasting is important. Thus, the first step to address of research question one is to develop a framework for forecasting.

Transport analysis (2014) have developed four scenarios based on technology innovation and the amount of freight traffic, this thesis will adopt these scenarios and instead apply them the last two steps of the scenario planning process (Schwenker and Wulf, 2013): (1) strategy definition, and (2) monitoring. Strategy definition is a process to develop an action plan to address future outcomes. This process involves the establishment of a strategic corridor, to establish a guiding standard to accomplish the most positive outcome. The process of developing the strategic corridor have four steps: (1) the sensitivity assessment, (2) strategy testing, (3) selective scenario strategy

development, and (4) complete scenario strategy development. Whereas monitoring is the process of assessing the ongoing development.

In order to analyse the project data collection is crucial. The analysis of research question one will rely on semi-structured interviews and literature studies.

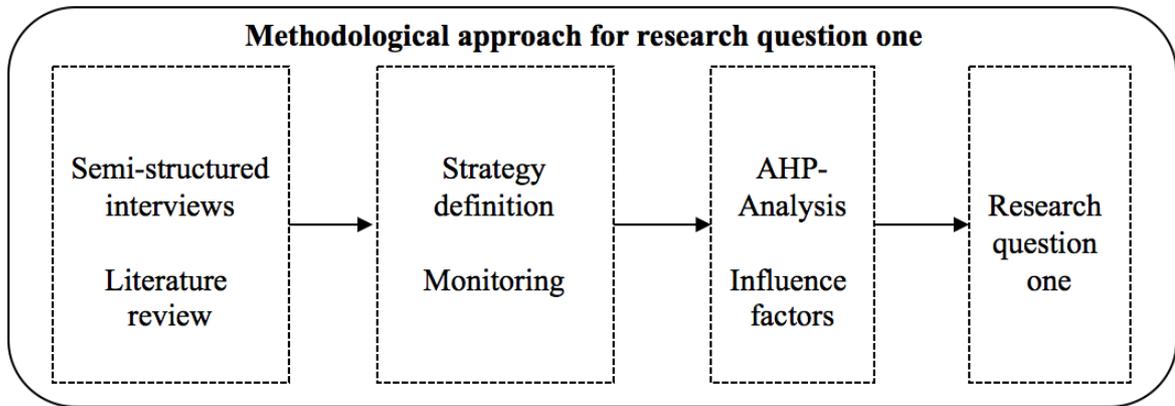


Figure 1 – Methodological approach for research question one

### 2.1.2 Methodology of research question two

The methodology to satisfy research question two have been developed in regards to the two segments inherent to it: (1) the critical success factors of urban freight transport, and (2) their linkages.

The critical success factors of stakeholders represent factors of key importance for performance, from their perspectives. In order to investigate what the success factors of urban freight transport are to different stakeholders their preferences have to be assessed. This assessment will be done by interacting with stakeholders. This interaction will be achieved by interviews with stakeholders of urban freight transport. Also, the success factors will be applied to the objective-dimensions of urban freight transport, established in research question one.

The analysis of research question two will rely on semi-structured interviews and literature studies.

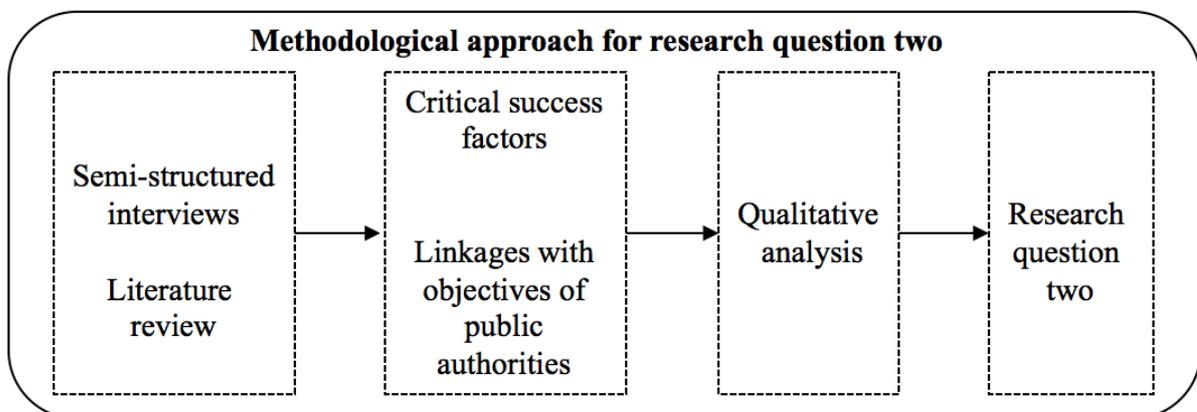


Figure 2 - Methodological approach for research question two

### 2.1.3 Methodology of research question three

Research question three concerns: (1) Stakeholder conflicts of urban freight transport, and (2) the assessment of their significance. In order to investigate the conflicts of different stakeholders their perspectives have to be investigated. Also, how these perspectives influence other stakeholder perspectives, and the significance of conflicts have to be addressed as well.

The conflicts of urban freight transport will be elicited by conducting literature studies and interviews with stakeholders. The significance of stakeholder perspectives will be investigated by determining the relative importance of success factors through interviews and questionnaires, and by assessing the results with the AHP method. The AHP-method is explained in more detail in section 2.2.5 AHP-analysis.

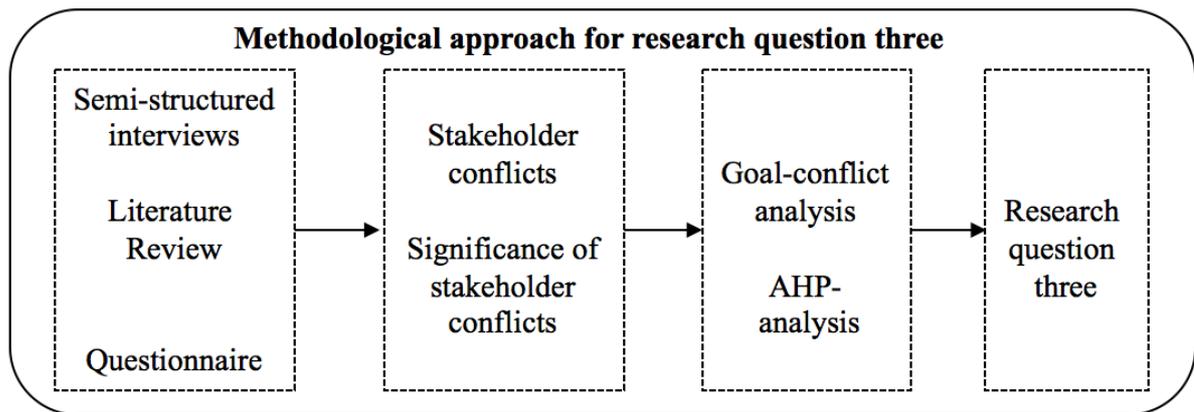


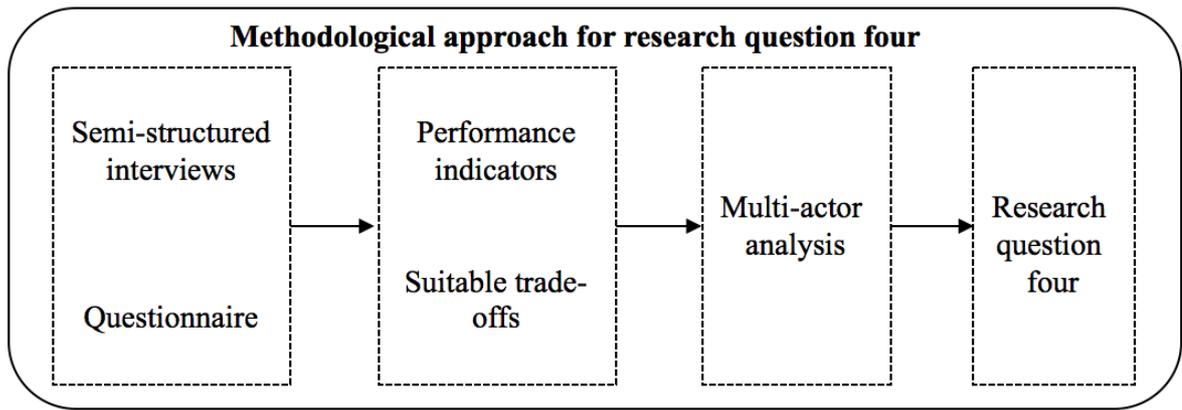
Figure 3 - Methodological approach for research question three

### 2.1.4 Methodology of research question four

Research question four concerns: (1) performance measurement in the perspective of stakeholders, and (2) the influence of trade-offs regarding their preferences.

Performance indicators are important tools in order to accomplish strategic objectives, and to align the business orientation with the strategic vision. Performance measurement of a firm should account for both tangible and intangible assets, to account for this a strategy map have been established. Also, in order to adequately address suitable trade-offs for decision-making in the perspective of public transport authorities, the most significant performance indicators will be established, using a multi-actor analysis.

The analysis of research question two will rely on semi-structured interviews and questionnaire.



*Figure 4 - Methodological approach for research question four*

## 2.2 Data collection

In order to properly analyse the current environment and elicit an explanation for the research questions data collection is a necessity. Data collection can be conducted by collecting either: (1) primary data, or (2) secondary data. Primary is collected for the purpose of the thesis objective. Primary data can be collected through various means, such as questionnaires, interviews, observations, etc. Secondary data was collected with a purpose other than that of the thesis. (Höst et al, 2006)

For this thesis, primary data have been collected through interviews, workshops and questionnaires. Secondary data have been collected from various academic sources with the purpose of validating theories.

Data samples can be collected in either a: (1) random, or (2) non-random manner. Random data samples provide a, within the target group, randomly dispersed selection process where the aim is that everyone have an equal chance of being selected. Whereas a non-random sample are based upon subjective selection. (Saunders et al, 2012)

The data collection in this thesis is non-random and data samples have been selected because of the perceived relevance to the thesis.

Data can be either: (1) quantitative, or (2) qualitative. Quantitative data is data that can be quantified in a way that is useful for the thesis and can be elicited from any methodological approach. The raw data itself is rarely explanatory and needs to be processed. Quantitative analyses use visual explanations, such as graphs, and statistical tools, to describe the trends and relationships of the dataset. (Höst et al, 2006)

Qualitative data have been collected to investigate the context of data collection and performance measurement in urban freight transport. Quantitative data have been collected to investigate performance indicators.

### 2.2.1 Literature study

According to Höst et al (2006) the purpose of a literature study to provide insights of the subject to be investigated. A literature study should be an iterative process and should initially provide basic understanding of the thesis subject, later when the scope of the thesis has been framed it should provide more depth in the area of study. Literature studies should also be used to validate the results.

In this thesis various sources of literature were used: (1) academic databases, such as ScienceDirect and Emerald, (2) Chalmers university library, and (3) governmental and intergovernmental organizations, such as Transportation Analysis and the European Commission. The literature study is presented in chapter three and investigates the context of urban freight transport, performance measurements and forecasting.

### 2.2.2 Interviews and workshops

Interviews are useful to elicit reliable data that is of relevance to the thesis and its objectives. First, interviews represent a way of establishing the scope of the research, and second, it is a way of procuring in-depth knowledge of specific subjects. Interviews can be structured in different ways, they could be: (1) Structured, (2) Semi-structured, and (3) unstructured interviews. Structured interviews are based on questions of a standardized nature and often have pre-defined answers, structured interviews are tools to collect quantitative data. Semi-structured interviews are based on a specific topic,

however the interviews are not standardized and specific questions can be omitted or appended during the interview. Unstructured interviews allow for the exploration of specific subjects and the interviewee can speak its mind without direction. The appropriateness of the structure of the interviews depends on the research approach. In an exploratory study semi-structured and unstructured interview are appropriate since they to a higher degree allows for the elicitation of new insights. Structured interviews are appropriate in a descriptive study since they can be used to elicit patterns. Semi-structured interviews are appropriate for explanatory to achieve an understanding in linkages between variables. (Saunders et al 2012)

For this thesis semi-structured interviews have been performed, because of its suitability to the explanatory research approach that have been selected.

Workshops often refers to a small group of participants interacting to solve a problem using existing tools. The result could lead to a particular product or outcome (Jeff and Susan, 1999).

For this thesis two workshops will be examined in order to get information within urban freight transport.

### **2.2.3 Questionnaire**

According to deVaus (2002), a questionnaire is a data collection technique that allows a respondent to answer questions that are prearranged and predetermined. Saunders et al (2012) states that a questionnaire can be: (1) self-administered, or (2) interviewer-administered. Whereas a self-administered questionnaire can be: (1) intranet mediated, (2) postal questionnaires, and (3) collection questionnaires. Interviewer-administered questionnaires are either: (1) telephone questionnaires, or (2) structured interviews.

For this thesis the questionnaire will be a self-administered collection questionnaire since closed questions will be used to assess the preference of critical success factors among residents.

### **2.2.4 AHP analysis**

According to Saaty (2008), the AHP-analysis a decision-making tool that can be used to weight different criteria through pairwise comparisons into a numerical matrix. The criteria's could for example be price, environment or development. According to Nydick and Hill (1992), the approach takes account of five steps. Additionally an example of evaluating and comparing suppliers is described in Table 1 below.

1	Specify the set of criteria for evaluating the suppliers proposals.			
2	Obtain the pairwise comparisons of the relative importance of the criteria in achieving the goal, and compute the priorities or weights of the criteria based on this information.			
3	Obtain measures that describe the extent to which each supplier achieves the criteria.			
4	Using the information in step 3, obtain the pairwise comparisons of the relative importance of the suppliers with respect of the criteria, and compute the corresponding priorities.  The pairwise comparisons are performed by issuing a numerical value (1-9) to signify their relative importance. “1” meaning equal importance, and “9” meaning extreme relative importance of one factor (Table 5).			
5	Using the results of steps 2 and 4, compute and normalize the relative importance of the factors for each supplier.			
<b>Step four</b>				
		<b>Factor 1</b>	<b>Factor 2</b>	
<b>Factor 1</b>		1	5	
<b>Factor 2</b>		1/5	1	
<b>Sum</b>		6/5	6	
<b>Step five</b>				
	<b>Factor 1</b>	<b>Factor 2</b>	<b>Sum</b>	<b>Weight</b>
<b>Factor 1</b>	$1/(6/5)$	$5/6$	$10/6$	$(10/6)/(12/6)$
<b>Factor 2</b>	$(1/5)/(6/5)$	$1/6$	$2/6$	$(2/6)/(12/6)$
<b>Sum</b>	1	1	$12/6$	1

Table 1. A five-step framework of AHP-analysis. Source: Adopted from Nydick and Hill (1992)

This thesis will use AHP-analysis to investigate the relative importance of specific influence factors, in order to establish a hierarchical ordering of these factors.

### 2.2.5 Research quality

According to Saunders et al (2012), scientific methodology should pay special attention to reliability and validity in order to reduce the possibility of receiving the wrong answer. Reliability concerns at what level the methodologies for data collection is consistent, transparent, and reproducible. Validity refers to the issue if the results are what they seem to be, internal validity concerns imperfections in the research and external validity refers to the applicability of the research with a different context.

Objectivity is a term that builds on a positivistic mind-set in regards to the description of the environment. In order to ensure that the research follows a rigorous scientific approach the researchers should be impartial and avoid selective selection criteria's and conscious bias in regards to the research. (Saunders et al, 2012)

The literature study was completed using sources with a high level of reliability, this refers to peer-reviewed articles, academic journals, academic textbooks, and

governmental organizations. The research of data collection in urban freight was identified as imperative to improve city logistics in Sweden and the methodology was elicited with logistics professionals.

The interviews were performed with actors of urban freight transport in order to establish an understanding of the current issues and challenges regarding the research topic. In regards to reliability was the results of the workshops interpreted by several actors, which also provided validation of the results.

The questionnaire was established in a fashion to be easily interpreted by the respondents in order to minimize the risk of the questions being interpreted incorrectly. The questions established to test the validity of hypothesizes elicited during the literature study and interviews with logistics specialists.

### 3. Theoretical framework

*This chapter introduce the theoretical framework that will be examined. Starting with describing the principles of logistics, supply chain networks and city logistic. There after description of sustainability, uncertainty and volatility. Followed by strategic and scenario planning and performance indicators. Followed by a description of four ongoing megatrends, starting with urbanization, globalization, technology innovations and customization.*

#### 3.1 The principles of logistics

Logistics is, according to the American Production and Inventory Control Society (2012), in an industrial context:

*“The art and science of obtaining, producing and, distributing materials and products in the proper place and in the proper quantities”.*

Logistics describes the system of shipping, storing and managing goods (Hrusovsky, 2014). This system includes the shipping of raw materials and the production, distribution, and disposal of commodities (Micklich and Lasch, 2014). While logistic activities have been an element for social and economical growth for thousands of years, it is during the last century that it has come to be regarded as a cornerstone for performance in industry (McKinnon, 2012). Since then, logistics studies have primary been driven by the objective of maximizing economical profitability. However, during the last couple of decades this unidirectional approach has been criticized for its incapability to account for alternative costs. This incompleteness has encouraged the development of more extensive models that integrates the indirect costs of logistics, such as the inclusion of environmental and social factors (McKinnon, 2012). Logistics is a prerequisite requirement, regardless of the industry, for the movement of components, commodities, people, information, and capital (Chakravarty, 2014). Likewise, logistics is not restricted to the movement of objects, the term comprises of activities such as storage, packaging, and forwarding services (Duin and Muñuzuri, 2015; Woodburn and Whiteing, 2012).

In order to adequately attend to increasingly complex systems with flows of goods actors of logistic activities need to have access to physical assets, such as warehouses, vehicles, information systems, and possess the organizational capability to collaborate with stakeholders with ambiguous objectives (Hamberg and Verriet, 2012; Brown et al, 2015). Different product types influence logistic services, such as hugely customized goods requiring a dynamic approach in order to satisfy the needs of niched market demands, (Chakravarty, 2014). The logistics of commodities are in relation to customized goods deterministic in nature, and consequently it does not require equally specialized delivery services (Riemann, 2013). Some product types require specialized transportation, such as the transportation of perishable goods which puts great emphasis on maintaining quality of the goods, these specialized requirements create a need for highly niched logistics services (Chakravarty, 2014).

According to Chakravarty (2014), transportation of goods is principally done through four transportation types: (1) Roadway transportation, (2) Railway transportation, (3) Seaway transportation, and (4) Airway transportation. The selection of transport type is dependent on the geographical setting, the product type, and its purpose. For the transportation of commodities with few and static customers, such as crude oil, railway

transportation is often appropriate because of the predictability and scalability of the operations. The shipments of customized goods are commonly characterized by scattered and dynamic customers, which motivates a transportation type that is capable of satisfying this demand, roadway transportation through freight trucks is normally linked to this kind of transportation. The transportation of hazardous materials merits specialized routing because of environmental concern in urban areas and in areas of special environmental concern, this is an example of how product types can be a determinant for logistics services, as well as for the transportation type.

Technology innovations, globalization, sustainability, infrastructure, and costs are factors that influence logistics services (Taniguchi, 2015). Advances in information technology have presented the possibility for real time analyses, for instance the possibility to utilize advanced and dynamic route planning algorithms (Moen, 2015). Meanwhile, the increasingly globalized business environment is motivating firms to internationalize and further their innovation activities, in order to maintain profitability (Archibugi and Michie, 1995; Chaminadea and Plechero, 2014)

During the past few decades there have been a growing concern regarding the environmental effect of logistic services, this concern has resulted in a revision of the requirements of these services. The shifting demands have augmented the significance of green logistics, and have fashioned a surge in demand for these services. Correspondingly, technology advancement has provided incentives for the implementation of more sustainable logistics. (Macharis and Van Mierlo, 2013)

Logistics are, on a global scale, accountable for global warming. Freight transports are, according to Ribeiro and Kobayashi (2007), responsible for 8 % of the energy-related CO<sub>2</sub> emissions. An according to the World Economic Form (2009) are logistics responsible for 5.5 % of the global greenhouse gas emissions. The significant environmental effect of logistics is encouraging governments and organization to develop new policies to drive change. Logistics is, on a local scale, responsible for effects on air quality and noise, congestions, and accidents (McKinnon, 2012).

According to Chakravarty (2014) does logistics necessitates capital intensive investments in physical assets. These investments include warehouses, distribution centres, equipment for material handling, information systems, and vehicles. Furthermore, the costs of logistics services are greatly influenced by operating costs associated with its activities, these operating costs includes prices of oil, interest rates, and currency rates. Since great efforts in logistics activities is subjected to cost minimization, the cost factors have great influence on the function of logistics activities. This means that capital investments in physical assets trails trends of expected expenditures. Recently the cost of roadway traffic has been decreasing, to which firms have adopted business models which to a greater extent relies on freight trucks.

According to Vrat (2014) does warehousing represent a function which emphasizes the supervision of physical goods from their acquisition until they are utilized. This function goes beyond storage of goods, and well-organized warehousing necessitates the custodian to ensure that: (1) the quality is tolerable, (2) quantity is tolerable, and (3) goods are located in a manner which generates efficient flows for inputs and outputs. Management of materials is coupled with costs that are visible or hidden. Visible costs are those who can be directly attributed to a specific activity, such as purchasing costs. Hidden costs are those that can not be directly attributed to a specific cost, these

includes: (1) carrying costs, (2) opportunity cost, and (3) the costs of material handling. The carrying cost of inventory represents the costs of storing goods. This cost constitutes the cost of capital from storage as a non-value adding activity, the cost of holding warehouses, the cost of obsolescence, etc. The opportunity costs represent the cost of minimizing the amount of stock that is not in demand. When the demand of a specific good surges this could cause cost of delays, brand recognition, and sales loss. Cost of material handling translates to the non-value handling activity that seldom can be attributed to specific goods.

According to Chakravarty (2014) does optimization of distribution centres enables the facilitator to improve packaging efficiency and distribution efficient, and thus, maintain a tolerable level of costs. The optimization function is determined by the location of suppliers, production facilities, and customers. In order for the facilitator to efficiently satisfy the need of customers it is essential to maintain an adaptable product-mix that fulfils the market prerequisites. Inventory management is critical to logistics since inventory itself is not a value-adding activity. Inventories provides the facilitator with the opportunity to dynamically match the needs of the customers. Packaging involves the fulfilment of several business objectives, it consists of protection, presentation, sustainability, and minimization of volume and weight.

### 3.2 Supply chain networks

An ongoing industrial trend is that manufacturers in reaction to increasingly globalized and competitive markets are establishing closer collaborations with other actors in the supply chain. This tendency has resulted in closely attached supply chain networks (Andersen and Christensen, 2005). Supply chains cover three central processes: (1) the supply of materials, (2) the manufacturing process, and (3) the distribution of goods. From these processes three distinctive types of flows can be observed: (1) Financial flows, (2) Material flows, and (3) Information flows (Hadaya and Cassiv, 2009).

Financial flows describe the allocation of payments, credits, and invoices. Material flows describes the movement of goods between buyers and sellers. Information flows describes the communication that conditions the the material- and financial flows (Akkermans et al. 2003). In order to manage complex supply chains with a well-organized approach, the management of financial, material and information flows is critical. The management of these flows requires detailed understanding of: (1) the business environment, (2) how to develop the necessary capabilities to collaborate with other actors, and (3) how to facilitate information technology in the entire network. (Hofmann and Belin, 2011; Hadaya and Cassiv, 2009).

Most supply chains stretch beyond the boundaries of the jurisdiction of a single planning entity. The reason for this is because large portions of the goods that are consumed in a specific area are generated elsewhere. However, certain transportation types, such as public transportation, is often concentrated locally, and is therefore under the jurisdiction of a single or few planning entities. (Taniguchi, 2015)

Supply chain networks are regularly transnational. First, raw materials are collected at one source, second, goods are produced at another, and third, goods are consumed at an additional destination. Furthermore, due to limitations of transportation types in respect to geographical, and demographical constraints most material flows necessitates intermediate shipments. (Kawamura, 2014)

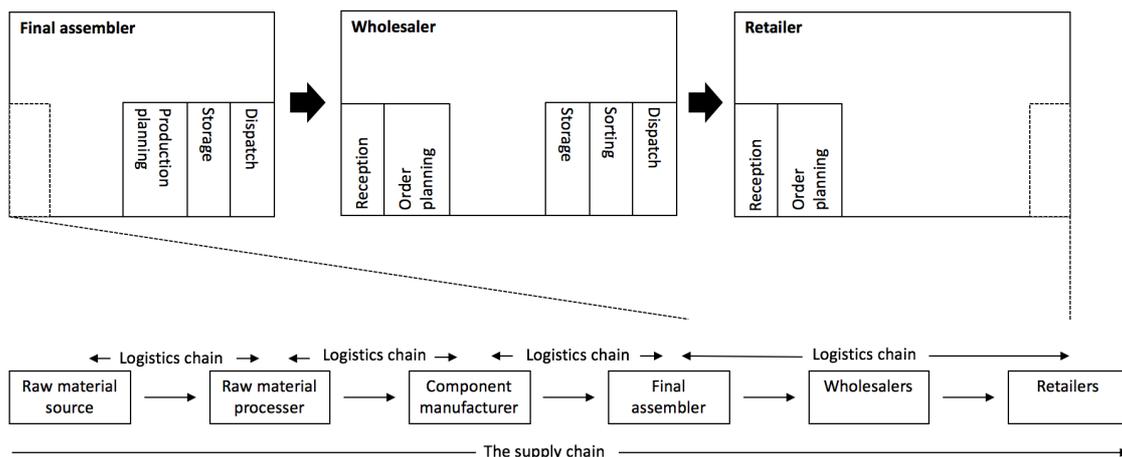


Figure 5 – Scope of the supply chain. Source: Adopted from Ramstedt and Woxenius (2006)

Customer demand and competition for reliable and speedy deliveries puts elevated requirements on modern supply chains and offers a low tolerance for errors or disruptions. Because of this, a system wide decision-making approach is essential for efficient planning. Also, because of the jurisdictional constraints between different planning entities, coordination between different entities are necessary, which motivates partnerships. (Kawamura, 2014)

Trends that have a considerable effect on supply chains are: (1) Shorter product life cycles, and (2) diminishing time-to-market for products. These trends are unilaterally causing growth of supply chain flows. These trends are driven by increasingly demanding consumers in regards to logistics services, and recent advancements in information technology that have accelerated internationalization and increased competition in numerous industries. (Chakravarty, 2014).

Supply chain networks involves firms who hold distinct organizational capabilities within the scope of logistics activities. The coupled structure that these networks maintain allows the entire network to be more responsive to changes within the system and this is a driver for increasingly aligning business models within specific networks (Petrick and Pogrebnyakov, 2009). Collaborations at the network level are driven by an increase in the implementation of strategic models which supports vertically integrated firms, such organization models are associated with high degree of knowledge sharing between collaborators. This aligns with the objective of collaboration strategies, which is to incite transparency to achieve a higher level of synchronization within the network (Skjoett-Larsen, Thernøe and Andresen 2003).

The supply chain networks can be structured in differently. The kind of industry, scope of the network, size of collaborators, and participation are determinants for these structures. According to Samaddar, Nargundkar and Daley (2006), there are three kinds of supply network structures: (1) Hierarchal structures, (2) Non-structural structures, and (3) Mixed structures.

Hierarchical networks have a top-down structure from the perspective of the OEM. The structure is tiered and there is little horizontal interaction between firms.

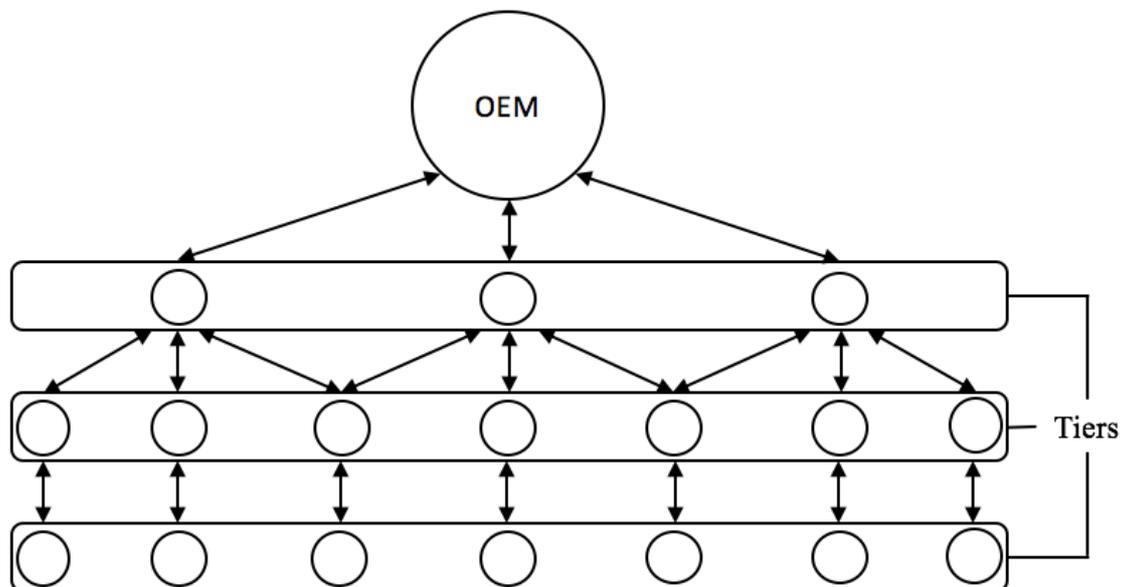


Figure 6 – A hierarchically structured supply chain network. Source: Adopted from Petrick and Pogrebnyakov (2009)

Non-structural networks have a governance that is diluted amongst the various firms. Different tiers are non-prevalent and there is less correlation between firm size and network influence.

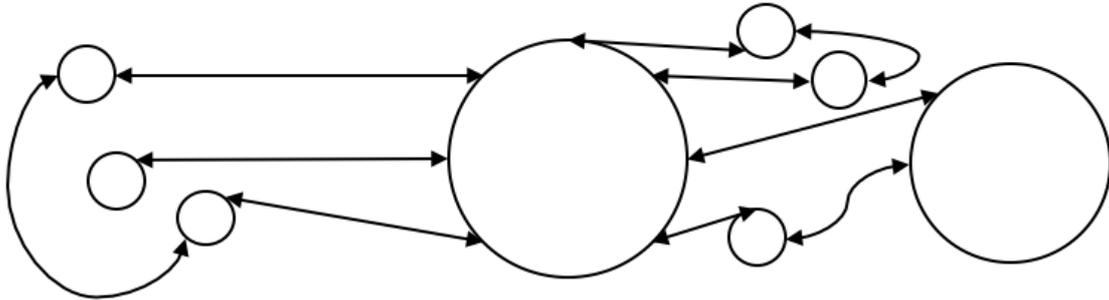


Figure 7 - A non-structural supply chain network. Source: Adopted from Petrick and Pogrebnikov (2009)

Mixed networks combines the previous structures with a loosely tiered structure where some firms interact across several tiers. The supply chain network structure is a determinant for network-level innovation, the more dynamic loosely tiered structure is more appropriate for adopting radical innovations, or to utilized technology push, whereas the top-down hierarchal structures are more appropriate for incremental innovation.

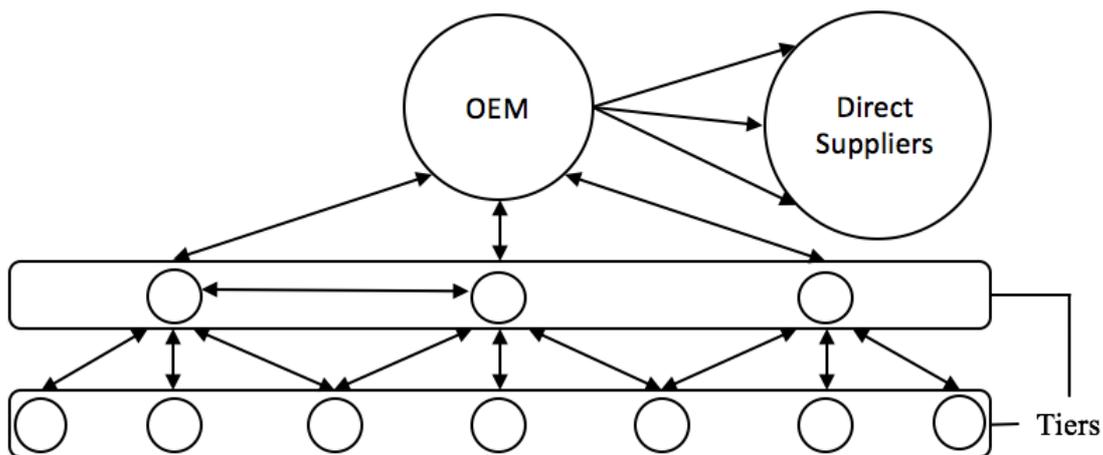


Figure 8 - A mixed structured supply chain network. Source: Adopted from Petrick and Pogrebnikov (2009)

Supply chain networks are adoptive systems and the decision-making within a single firm can have system-wide ramifications. Since it is the internal network behaviour that is separating the performance of one network compared to another, the linkages between the individual firm and the network is important for network performance. (Choi, Dooley and Rungtusanatham 2001).

According to Petrick and Pogrebnikov (2009) a firm's situational awareness is a term that describes its ability to apply its knowledge of the environment to investigate how actions may influence it. First, a firm must develop a basic understanding of its position and role within network, this will enable the firms to adopt to changes. Second, a firm should learn to incorporate its knowledge of the network in its decision-making, this will enable it to dynamically and systematically embrace changes. Third, the firm should use its knowledge to anticipate future market trends and align its strategy to the future potentials.

### 3.3 City logistics

City logistics is, according to Taniguchi et al (2001):

*“The process of optimizing the logistics and transport activities by private companies with support of advanced information systems in urban areas considering the traffic environment, the traffic congestion, the traffic safety and the energy savings within the framework of a market economy”.*

City logistics connects buyers and sellers in urban areas and enables the delivery of goods (Crainic et al, 2004). For urban living city logistics is required to ensure reliable flows of goods to ensure economic and social sustainability for residents and businesses (Behrends et al, 2008).

The objectives of city logistics are measures to address the: (1) mobility, (2) liveability, (3) resilience, and (4) sustainability of city logistics. Mobility concerns the objective of maintaining a flow of goods that with high levels of reliability in terms of travel times and connectivity. Liveability concerns the objective of maintaining high levels of safety, and maintaining accessibility of goods. Resilience concerns the objective of securing the availability of commodities in case of disasters. Sustainability concerns the objective reducing the environmental impact of of city logistics. (Taniguchi et al, 2015)

Urban freight transports are, in comparison to passenger transports, marginalized in city planning. Instead, city logistics are managed in regards to traffic and urban planning. Thus, in order to establish sustainable urban freight transport, the perspectives of the actors of urban freight transport has to be accounted for (Behrends et al, 2008). In city logistics there are mainly three actors: (1) Shippers and receivers, (2) Carriers, and (3) Public authorities (Behrends, 2011). According to Taniguchi et al (2001), there are four key stakeholders in city logistics: (1) shippers, (2) freight carriers, (3) administrators, and (4) residents. The objectives of each stakeholder is different and in order to balance the objectives of city logistics their interests have to be considered.

Shippers utilize freight carriers to send goods to their customers. The objectives of city logistics for the shippers is to minimize cost and maximize the level of service, which involves: (1) delivery time, (2) reliability, and (3) freight information (Taniguchi et al, 2001). According to Behrends (2011) is the main objective of urban freight transports to ensure accessibility of goods, and this aligns with shipper’s main objective, which is to offer high levels of accessibility at low cost to their customers.

Freight carriers are responsible of collecting and delivering goods. The objective of freight carriers is to maximize profits by minimizing the costs related to their responsibilities. Freight carriers are expected to, apart from offering low costs, provide a certain level of service. The service level function is determined by various factors, including reliability, time to collect, time to delivery, etc. A firms’ ability to maintain these service levels is not only a factor of its internal capabilities but also its external environment. In urban environments freight carriers have to manage traffic congestion, space constraints, and regional jurisdiction. In order to maintain sufficient service levels freight carriers are utilizing smaller freights and a larger number of transports. (Taniguchi et al, 2001)

Residents represents the local populace. While residents identify that freight transport is necessary for the delivery of commodities, and while they also prefer freight carriers

with high service levels, they also have an interest of minimizing traffic congestion, pollutions, and maintain a high degree of liveability in the city. (Taniguchi et al, 2001)

Public authorities represent the entities that attempts to push economic growth, while also providing the residents with an environment that is sufficiently liveable. They have linkages with all the other stakeholders and have the objective of resolving stakeholder conflicts. Because of their neutral nature administrators are responsible for facilitating city logistics through policy making (Taniguchi et al, 2001). The main objective of urban freight transport for authorities is, according to Behrends (2011): (1) enable accessibility in cities to ensure an attractive city with high levels of economic activity, and (2) reduce the environmental and social impact of freight transport to ensure a high quality of living.

According to Taniguchi et al (2015), there are three key elements for the advancement of city logistics: (1) Technological innovations, (2) the mind-set of actors regarding sustainable city logistics, and (3) the coordination of public and private initiatives. Firms are becoming increasingly engaged in sustainable urban freight transport. Some logistics firms have established themselves in niche markets that demands high emphasis on sustainability by utilizing electric vehicles or bicycles, also, as part of an increasing responsiveness to issues related to CSR, many firms are investing in sustainable options to establish a green image of the brand. Coordination amongst the private and public sector is important because their behaviour and decision-making influences the other, for instance as a consequence of authorities banning heavy freight trucks the freight carriers have adopted by utilizing a more numerous fleet with lighter freight trucks.

The term urban freight transport describes the input, output and internal movement of goods within the constraints of an urban area. Since goods often are produced externally the urban freight transport only represents a piece of the entire supply chain. The external input of goods does illustrate that the supply chain of these goods intersects several planning entities, or jurisdictions (Lindholm, 2012).

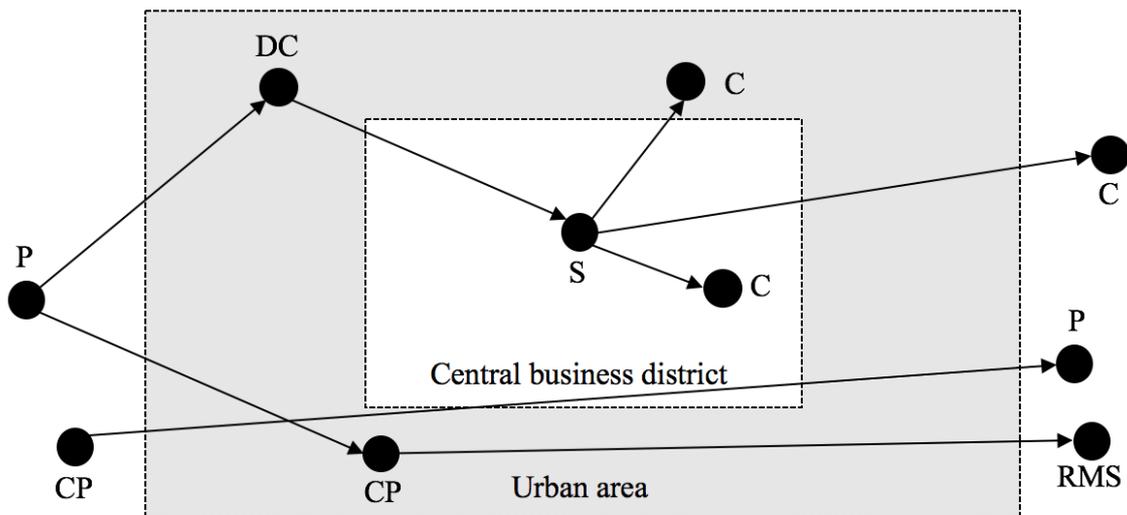


Figure 9 – Urban freight transport. C: Consumer, CP: Component producer, P: Producer, DC Distribution Centre, RMS: Raw material supplier. Source: Adopted from Lindholm (2012)

### 3.4 Sustainability

Sustainability is, according to Agustiady and Badiru (2012):

*“The human preservation of the environment, whether economically or socially through responsibility, management of resources, and maintenance utilizing support.”*

The objectives of logistics have, as mentioned in section 2.1, shifted from the predominant perspective of cost minimization to the inclusion of sustainability factors (McKinnon, 2012). While the preceding perspectives in some means did contribute to more sustainable logistics, such as route optimization, a sustainability perspective offers a systematic overview of the activities throughout the supply chain (Lindholm, 2012). Sustainability is consistently described as a function of: (1) economical, (2) social, and (3) environmental factors (Quak, 2008; Agustiady and Badiru, 2012). This function, or the triple bottom line, express the the value of objects and the linkages in the econosphere, sociosphere, and the ecosphere. In the econosphere objects have a value for exchange purposes, in the sociosphere objects are valued for their use, and in the ecosphere objects have an intrinsic value, the interface that the spheres illustrate the conflicts of each perspective (Figure 10; Shmelev and Shmeleva, 2012).

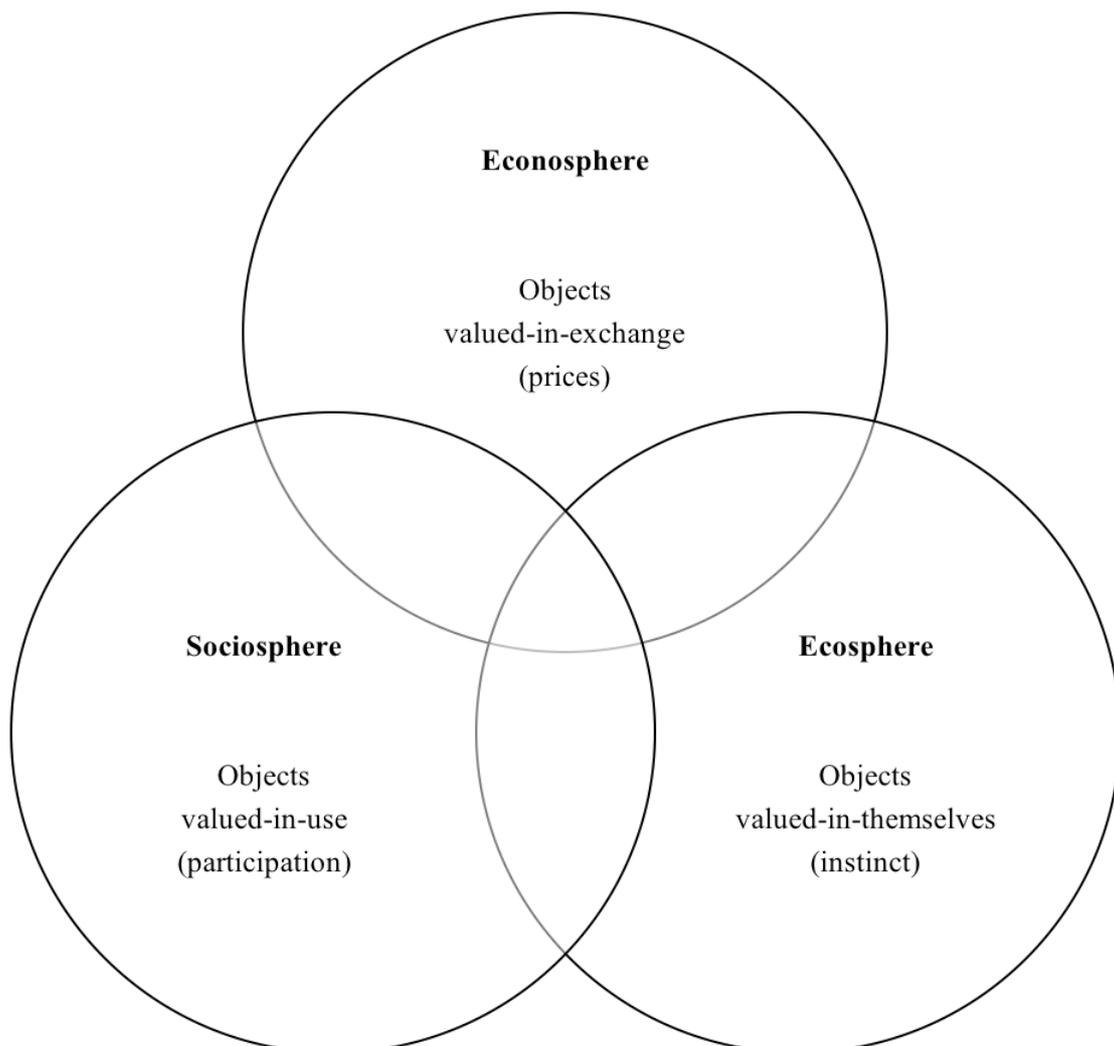


Figure 10 – Interactions and the value of objects in the econosphere, the sociosphere, and the ecosphere. Source: Adopted from Shmelev and Shmeleva (2012).

The environmental impact of unsustainable utilization of goods creates emissions, waste, and declining wildlife, causing a net outflow of environmental capital. The social impact of unsustainable logistics are public health concerns, accidents, conflicts, and social issues, illustrating the effect on human capital. The economical impact of unsustainable logistics is inefficiency, decreasing reliability, diminishing service levels, congestion, and low economic development, also described as economic capital. (Shmelev and Shmeleva, 2012; Quack, 2008)

By studying logistics through environmental performance, the emphasis is on the reduction of the environmental consequences that is caused by activities related to logistics (McKinnon, 2012). Environmental practices related to logistics emerged during the 1960s. However, it did not attract any significant attention until the last couple of decades (Fahimnia et al, 2015). According to the Global Corporate Sustainability Report by the United Nations Global Compact (2013), logistics are identified as one of four issues for increasing corporate environmental performance, the report remarks that “Supply chains are a roadblock to improved performance”. Sustainable logistics entails an approach that address local and global issues, this involves measures for air quality, noise levels, congestions, accidents, and greenhouse gas emissions (McKinnon, 2012).

The social aspects of sustainable logistics are generally marginalized, compared to environmental and business aspects, in the sense that they are rarely considered. In a framework proposed by Labuschagne et al (2005), it is proposed that social sustainability can be segmented in four different areas, (1) Internal human management, (2) External populations, (3) Stakeholder participation, and (4) Macro social performance. Internal human management issues are defined by factors relating to employment stability, employment practices, health, safety, and capacity development. Proposed indicators for internal human management issues are, number of jobs created, average working hours, gender ratio, health and safety incidents, etc. External population issues are defined by factors relating to human capital, productive capital, and capacity capital. Proposed indicators for external population issues are patient/doctor ratio, impact on housing prices, net migration rate, number of indirect jobs created, etc. Stakeholder participation issues are defined by factors relating to information provisioning, and stakeholder influence. Proposed indicators for stakeholder participation issues are number of stakeholder meetings, community forums, etc. Macro social performance issues are defined by factors relating to socio-economic performance, and socio-environmental performance.

According to Orsato (2000), firms are increasingly dedicated on measuring sustainability performance. A prolific motivation for measuring sustainability is the notion that eco-investments are coupled with the ‘win-win hypothesis’, which is the impression that eco-investments intrinsically are drivers for increasing efficiency, and thus diminishing costs. Yet, if eco-investments intrinsically were performance enhancers, business models would incite environmental sustainability. However, there are various instances of eco-investments that are performance enhancing, which incites the questions of, in which instances they are performance drivers. The scope of the win-win hypothesis offsets the public benefits and the firms’ profits with regards to eco-investments (Figure 11). A business model that only regards public benefit would align with the vertical axis, whereas a business model that only regards profitability would align with the horizontal axis. The greyed area represents the case of a business model

that is sustainable in regards to environment, as well as profitability, such business models supports the win-win hypothesis.

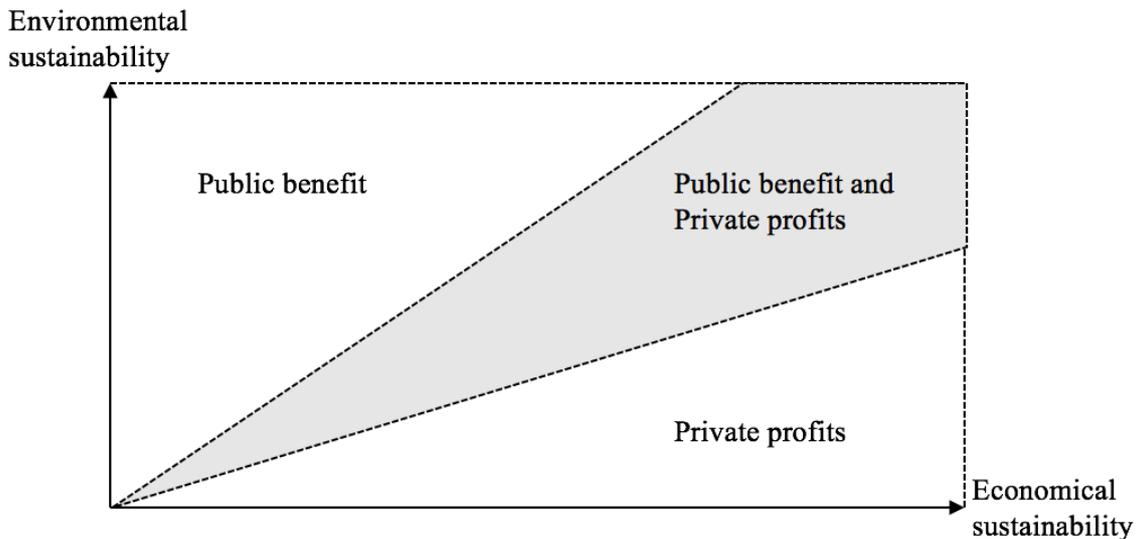


Figure 11 – Scope of corporate environmentalism. Adopted from Orsato (2000)

Sustainability in the sole perspective of urban areas is essentially pointless, because urban areas are dependent on the support from the rural ecosystems. Without sustainability in the supporting rural areas, there isn't sustainability in the urban areas (Newman and Jennings, 2008). For the measurement of sustainability within cities various tools have been developed, such as the city development index (Lindholm, 2012). Sustainable development is, according to Brundtland (1987):

*“Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”*

The key concepts of sustainable development are: (1) meeting the needs of this generation, and (2) ensuring the needs of future generations. In order to ensure sustainable development of urban transport several key objectives have been identified: (1) Ensuring accessibility for residents, businesses, and visitors, (2) ensuring low health and security concerns, (3) reduction of pollution, (4) increasing transportation efficiency, and (5) increasing the attractiveness of the urban environment. (Behrends et al, 2012)

Urban freight transport is critical to ensure the attractiveness of urban areas because it ensures the flow of consumption goods, however it is also a source that impacts sustainability (Taniguchi et al, 2015). Urban freight transport factors the safety, emissions, congestion and accessibility in urban areas (Richardson, 2005), and to ensure that the objectives of sustainable urban transport is met local authorities have collaborated with shippers, freight carriers and residents (Browne et al, 2010; Lindholm, 2012).

Sustainable development activities today mainly focus on passenger transport at the local authority level. Freight transport is considered a phenomenon exclusive to the private sector on both the supplier and user sides, and is driven by business economic parameters (Dablanc, 2011).

### 3.5 Uncertainty and volatility

Uncertainty can, according to Miliken (1987), be described as an entities failure to predict a future outcome a truthful way. Uncertainties are inherent to all decision-making and to offset its influence, strategies and technological aids have been developed. Nowadays, businesses are subjected an increasing level of uncertainty because of a progressively complex, volatile, and competitive business environment. In industry a trend of dwindling product lifecycles can be observed, which forces rapid decision-making. The globalization trend does not only open up the world for firms, but also increases the number of potential competitors. The complexity of fast-paced communication makes the threat of new entrants and the introduction of radical innovations increasingly more evident. (Morgan and Henrion, 1990; Schwenker and Boetzel, 2007)

Despite a complex world with growing uncertainty various prediction methodologies assumes that future outcome is predictable, however, by understanding that complexity and uncertainty effects predictability a firm can improve its insights of possible future outcomes (Boulton et al, 2015).

Complexity theory is, according to Boulton et al (2015), a theory that discusses (1) open, and (2) closed systems. Open systems interact with with its environment, while a closed system do not. Firms, organizations, markets, etc. are samples of open systems that exchange goods, knowledge, people, and capital. Several studies have, without prevailing, attempted to investigate what long-term factors separates firms with average returns and firms with over-average return.

According to Allen et al (2011) there are four different levels of uncertainty for a business unit: (1) efficiency, (2) extension, (3) fashion, and (4) emergence. Efficiency describes a business with a high degree of predictability, such as life insurance where the number of deaths of a large population is a deterministic system, except for abnormal events. Extension describes the act of extrapolating current knowledge to explain future outcomes. Fashion describes firms that have to account for unstable demand that is driven by trends, which requires adjustments of the product. Emergence describes emerging radical innovations that have the capability to challenge existing status quo. Sustainable firms can not rely on business strategies that rely on a permanent standstill, instead it is important to account for uncertainty.

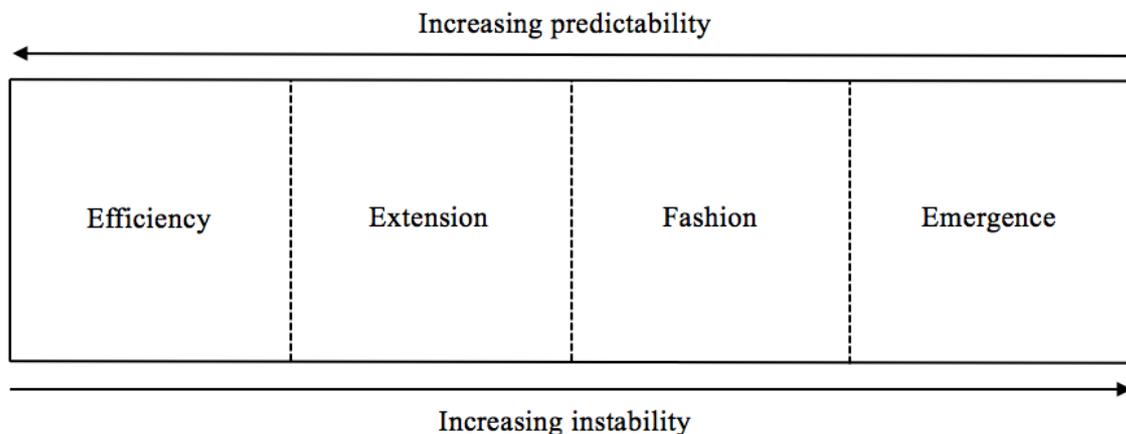


Figure 12 – Levels of uncertainty. Source: Adopted from Verity (2012)

Strategies often fail to be implemented as specified due to an increasingly complex business environment (Boulton et al, 2015). This complex and volatile environment is adding layers of uncertainty that decision-makers must face. Reliable forecasts of future outcomes are problematic to develop because of this as well, and also because of the uncertainties regarding trends, such as the length of product lifecycles. In order to build a strategic foundation for long-term and short-term decision-making a framework that accounts for volatility and uncertainty have to be applied (Schwenker and Wulf, 2013).

Complexity describes, according to Snowden and Boone (2007), the environment that globalization, technology, and more factors are making increasingly more convoluted. The studies of complexity have the purpose of helping decision-makers make sense of this intricate environment. Complexity generates a larger set of possible future scenarios and since many factors are correlated it becomes increasingly challenging to model system behaviour.

A complex system is characterized as, according to Snowden and Boone (2007): (1) Various interacting factors, (2) Non-linear interactions, (3) Circumstantial outcomes, (4) Present having little relevance to the future, and (5) Factors are constraining each other.

It is becoming increasingly important for firms to provide services that satisfy the needs of disparate stakeholders. Authorities, populaces, media, personnel, and collaborators represents a key stakeholder that frequently have interests regarding sustainability factors coupled with the firm's activities. The interests of different stakeholders are regularly in conflict and requires the firm to develop trade-off solutions, this makes the elicitation of efficient and encompassing strategies very difficult. (Schwenker and Wulf, 2013)

Information technology have resulted in the possibility to collect and process large quantities of data. However, the growing amount of data is generating an increasing redundancy and fragmentation, gradually it is becoming harder for decision-makers to filter out what data is relevant for decision-making (Schwenker and Wulf, 2013). According to Hemp (2009), the increasing amount of available data accessible to firms has an impact on the firm's ability to innovate and their decision-making.

### 3.6 Strategic planning

A strategy can be defined as the long-term direction that an organizational entity aims at, in order to pursue its objectives (Johnson et al, 2008). An alternative description is that a strategy is the synthesis of the plan that coordinates the organizational objectives and actions, in order to maintain competitive advantage (Ferreira and Proença, 2008). An overall description is that a strategy is a force that combines the organization and its environment (Junior and Vital, 2004).

Strategic planning is a systematic and methodical process which allows the organization to analyse externalities, in order to minimize the impact of uncertainties, and to leverage the organizational strengths and weaknesses with the purpose of improving the organizational effectiveness (Grünig and Kühn, 2011; Thibodeaux and Favilla 1996). Organizational effectiveness is the organizational capability to fulfil the needs of the target group (Balsler and McClusky 2005).

According to Johnson et al (2008), strategic management is the process of formulating and implementing the objectives of the organization, defining it as a process that ties planning and implementation. Strategic objectives should be relatable, consistent and, long-term. These factors are important because they should ensure that the objectives are in alignment to the possibilities, thus the objectives have to ensure a systematic understanding of the present, as well as future projections. (Bartušková et al, 2015).

According to Lindgren and Bandhold (2003), estimation of future events, or forecasting, are tools that are used to evaluate the effect that certain factors could have on the environment encompassing the organization. It is suggested that forecasting is a useful tool in strategic management, especially for strategic analysis, since it can give insights that could assist in the formulation of the strategic goals of the organization. Forecasting is used to motivate strategic decisions that have long-term effect on the organization (Green and Srinivasa, 1990).

In order to elicit a suitable strategic goal, different kinds of forecasting methods are regularly used. Their applicability varies depending factors such as time period, industry, and technology (Bartušková et al, 2015).

- The Delphi technique investigates the subject by communicating with specialists in the certain areas. After time the answers are expected to will converge as one or more solutions (Birdsall, 2004). When consensus have been achieved a strategic plan is developed to encompass the insights from the process (Brady, 2015).
- The analogy method is used to investigate analogies or similarities to the subject. The purpose of this method is to project determinants for trends by applying knowledge of a seemingly relatable subject (Azzeh and Nassif, 2015).
- Scenario planning is used to elicit to outcomes regarding the development of certain factors. Scenarios does not address what will happen, instead it investigates the possible developments that results from specific factors (Lindgren and Bandhold, 2003; Schwenker and Wulf, 2013).
- Conjoint analyses investigate the reaction of actor's preferences regarding alternative characteristics of products or services. It allows for the actors to

access hypothetical alternatives and allows them to respond according to their preferences. Conjoint analysis is primarily used for short-mid term forecasts. (Bartušková et al, 2015)

- Extrapolation uses historical data to elicit prognoses of future outcomes. While basic extrapolation models often are simple to develop, but the results can be deceptive without applying it to its proper context (Armstrong, 1984).
- Econometric forecasting models investigate market and industry trends with statistical and mathematical models. As with extrapolation models, observed data is used to investigate future outcomes (Baltagi, 2011).

It is necessary for effectual strategic planning, according to Schwenker and Wulf (2013), to understand how firms and organizations are affected and how they affect their environment, and because of this it is also important to forecast the different possible future outcomes. Strategic thinking is a creative process in the early stage of strategic planning and empathies on investigating different perspectives of possible outcomes, in order to establish actionable policies (Mintzberg, 2000). Three key stages regarding long-term plans is: (1) outlining of problems and objectives, (2) assessment of solutions, and (3) assessing uncertainties (Malekpoura et al, 2013). The inclusion of sustainability and liveability factors in the public sector have convoluted the task of identifying suitable objectives because their subjective nature (Kates and Parris, 2003).

It is essential for firms to investigate potential uncertainties to ensure that their possible impact will be diminished. This investigation requires forecasting and the selection of forecasting methodology. Nevertheless, in environments with high degrees of uncertainty it is critical to adopt a methodology with a wide spectrum to account for all possible outcomes (Schwenker and Wulf, 2013).

### 3.7 Scenario planning

A scenario is, a response to uncertainties related to questions such as, ‘What can happen?’ and ‘What happens if...’. Scenarios are, despite its similarities, different from other methods related to anticipation such as, forecasts, and visions (Lindgren & Bandhold, 2003). Scenario planning is used to elicit possible future outcomes, and thus it is not a tool that is used for prediction of the future, instead it is a tool that determines conceivable outcomes and is used to establish wide-ranging strategies and contingency-plans (van der Heijden, 2005). This approach allows firms to be more responsive to externalities (Grant, 2003). Scenarios are typically implemented with a long-term perspective of 15 to 20 years (van der Heijden, 2005).

The uncertainty regarding the development of trends is a pivotal point in the development of scenarios. Scenario planning emphasis to investigate trends were the direction of the development is uncertain and represents the outcomes between two extremes. These scenarios often depict outcomes that are more, or less appealing in the perspective of stakeholders but represents an unbiased and possible outcome, nonetheless. The scenario cross presents four scenarios regarding the development of two uncertainties, the scenarios represent different outcomes within the constraints that is limited by the extreme values of each uncertainty. These scenarios should represent four diverging outcomes in order to adequately investigate the spectrum of possibilities, and thus provide a context for contingencies (Lindgren and Bandhold, 2009).

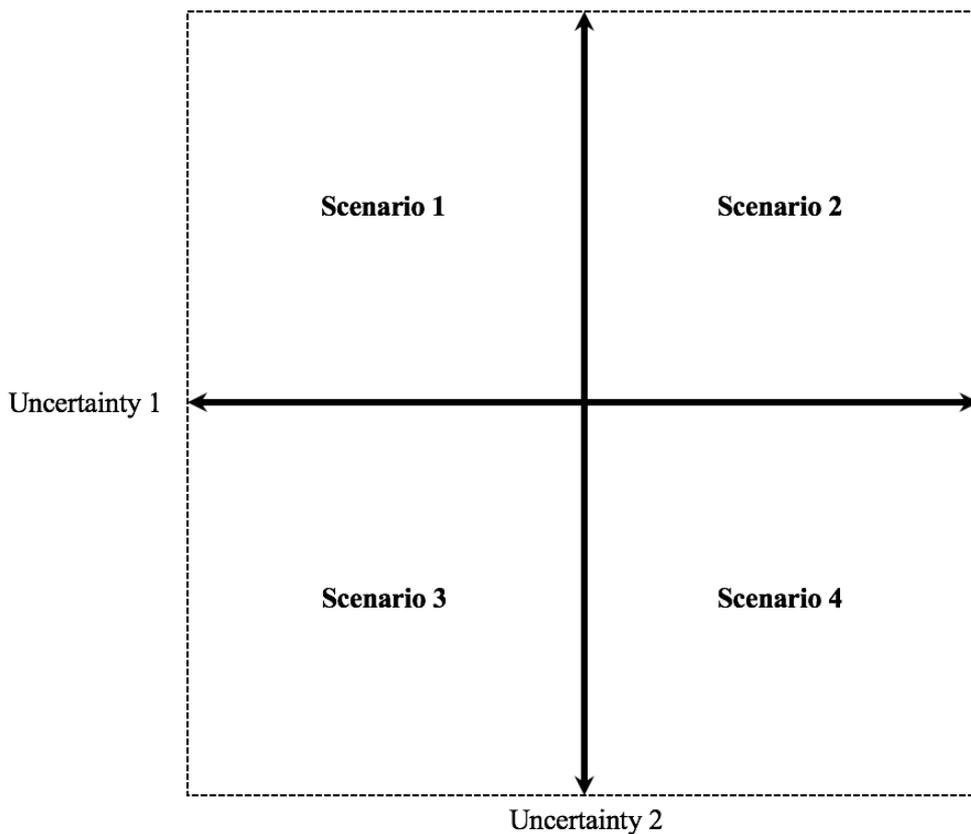


Figure 13 – A scenario cross. Source: Adopted from Lundgren and Bandhold (2009).

In a scenario planning framework presented by Schwenker and Wulf (2013) six steps have been established in scenario development. (1) Definition of scope, (2) Perception analysis, (3) Trend and uncertainty analysis, (4) Scenario building, (5) Strategy definition, and (6) Monitoring. Each step is executed with a number of tools and the purpose is to establish set of dynamic strategies based on the resulting scenarios. Definition of scope develops the mission scope, which includes constraints regarding time, resources, and collaborations. The definition of scope described in section 3.7.1. The perception analysis is identifying conceivable participants and stakeholders of the project and the analysis strives to investigate environmental threats. The perception analysis is described in section 3.7.2. The trend and uncertainty analysis investigates trends that could influence the development of the industry. These trends are categorized according to their potential their impact and the level of uncertainty. The trend and uncertainty analysis is described in section 3.7.3. The scenario building process involves the development of descriptive scenarios, based on the previously identified uncertainties. The scenario building process is described in section 3.7.4. The strategy definition process addresses the contingency plans that the firms develop according to each scenario. The strategy definition process is described in section 3.7.5. Monitoring is the process of continuously readdressing strategic decisions by measuring performance indicators. Monitoring is described in section 3.7.6.

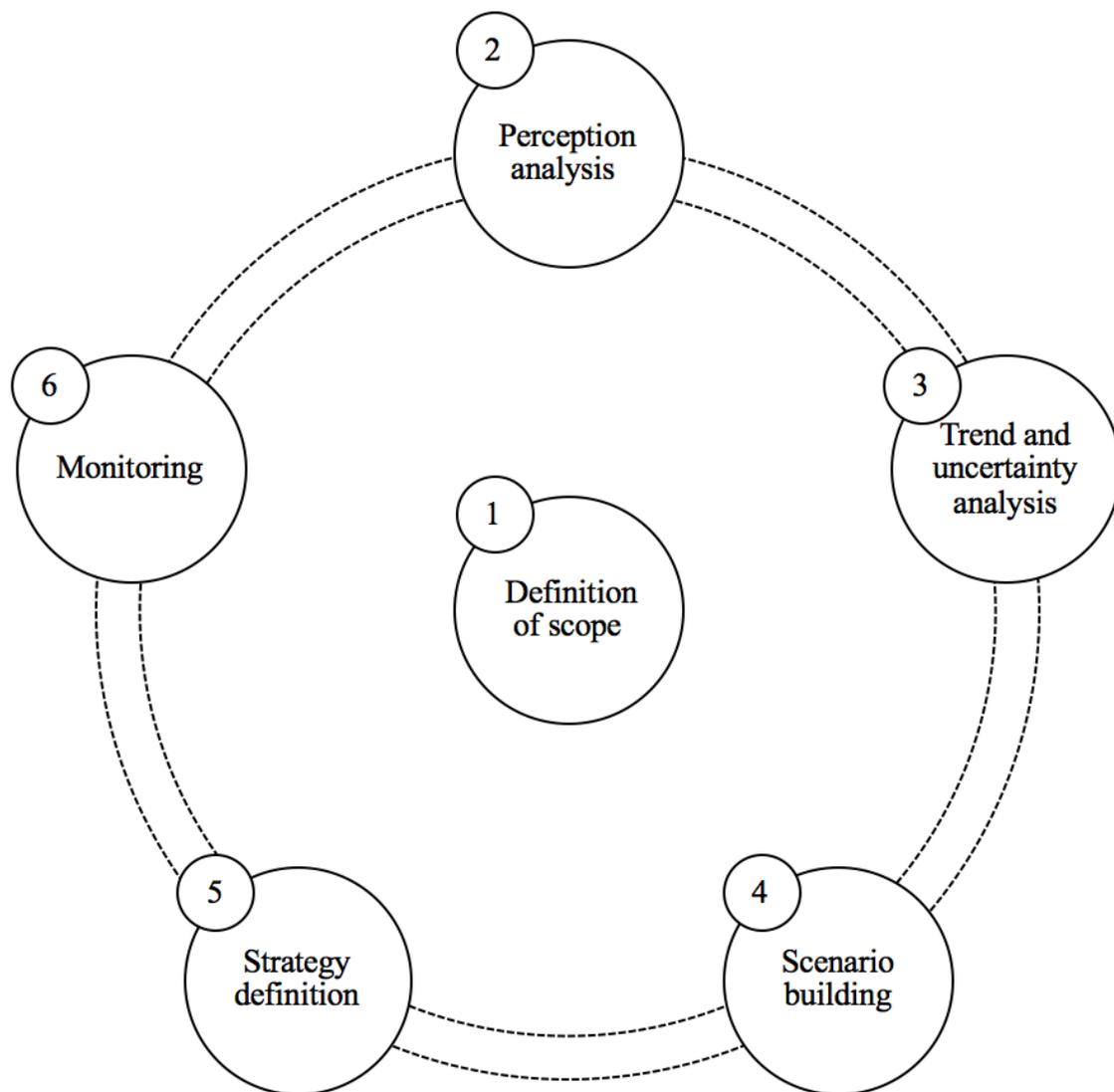


Figure 14 – The scenario planning process. Source: Adopted from Schwenker and Wulf (2013).

### 3.7.1 Definition of scope

Scenarios are, according to Wack (1985), suitable for investigations of strategic concerns, markets, or investments. However, the process should not be narrowly constrained by a heuristic approach since this could exclude key elements. Instead, the investigation should originate from a strategic vision, in order to establish scenarios comprehensive enough to ensure a systematic assessment. The vision is a desired outlook of what the firm aims to accomplish and the operational objectives and activities are elicited from it (Orhan et al, 2014).

The definition of scope aims to ensure that the mission is devised to satisfy the firms needs (Lindgren and Bandhold, 2009). During this phase the constraints of the mission is established in terms of time, resources, and collaborators (van der Heijden, 2005). During this process investigation regarding the strategic objectives is commenced, and this process is an important task to achieve organizational coherence regarding the mission, objectives, collaborators, and commitment (Schwenker and Wulf, 2013).

Defining the scope of a project could be specified by a framework called the framing checklist. The framing checklist includes (1) Goal of scenario project, (2) Strategic level of analysis, (3) Definition of stakeholders, (4) Participants and (5) Time horizon. The purpose with the checklist is that all the participants involved in the process understand the goals and purpose with the project (Schwenker and Wulf, 2013). A brief description of the framing checklist is described below.

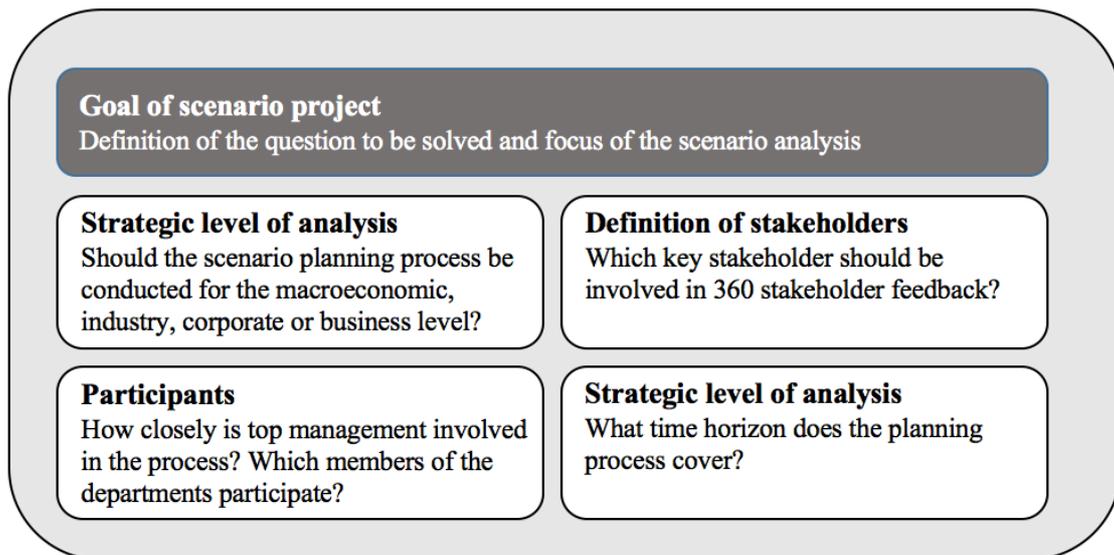


Figure 15 – Framing list. Source: Adopted from Schwenker and Wulf (2013)

Goal of the scenario project, is a central point of the framing list. The definition of the scenario analysis should be clear and defining the goal and the purpose. The involved participants should understand the aim with the goal of the scenario analysis and even those participants who are not involved, should understand the scope of the scenario analysis.

Strategic level of analysis, defines on which level the development of strategic scenario analysis should be on. Dependent on which type of business the company is, the outcome will vary.

Participants, indicates on defining all the involved in the scenario planning process from start to end. This means that defining everyone that is involved and those who is in charge for the project. It is crucial to define the project leader because of the outcome of the scenario analysis.

Definition of stakeholders that are involved in the process, so it simplifies finding blind sport and weak signals. The framework 360-degree stakeholder feedback process is a tool that manage these kind of aspects. The framework is described in detail in Step 2 Perception analysis. However, this step has a significant role since it can give input to the scenario development from externa stakeholders.

The last step in the framing checklist is deciding the time horizon of a scenario planning. The time horizon is dependent on the factors such as industry, geographic region and size of the project.

### **3.7.2 Perception analysis**

The perception analysis aims to investigate internal and external stakeholders of the project and their expectation and self-interests (Shoemaker, 1995). By establishing the decision-makers and their intentions it is possible to further explore elements that could be influence the development of internal and external factors. By applying a thorough investigation of each factor it is possible to identify certain risk-factors, which allows for a higher reliability for the establishment of contingency plans (Schwenker and Wulf, 2013).

Using the framework of 360-degree stakeholder feedback process can be used as a tool for identifying of key factors and performance uncertainty that have impact on the company. The framework somehow guides the managing team to find blind sport and weak signals. According to Schwenker and Wulf (2013), definition of blind spots indicates of areas that are consciously or unconsciously ignored and definition of weak signals indicate of future changes in the environment. How to point out and find these two factors is by survey participants, firstly, sending out open questions and secondly, closed questions. The open questions framework consists factors of shaping the industry now and in the future. The second questionnaire that covers closed question, are designed around the factors that was concluded from the first round questionnaire. The design of the second questionnaire should involve the company performance and its level of uncertainty. When all the key factors are gathered the company can distinguish changes in the macro environment as well as blinds spots and weak signals.

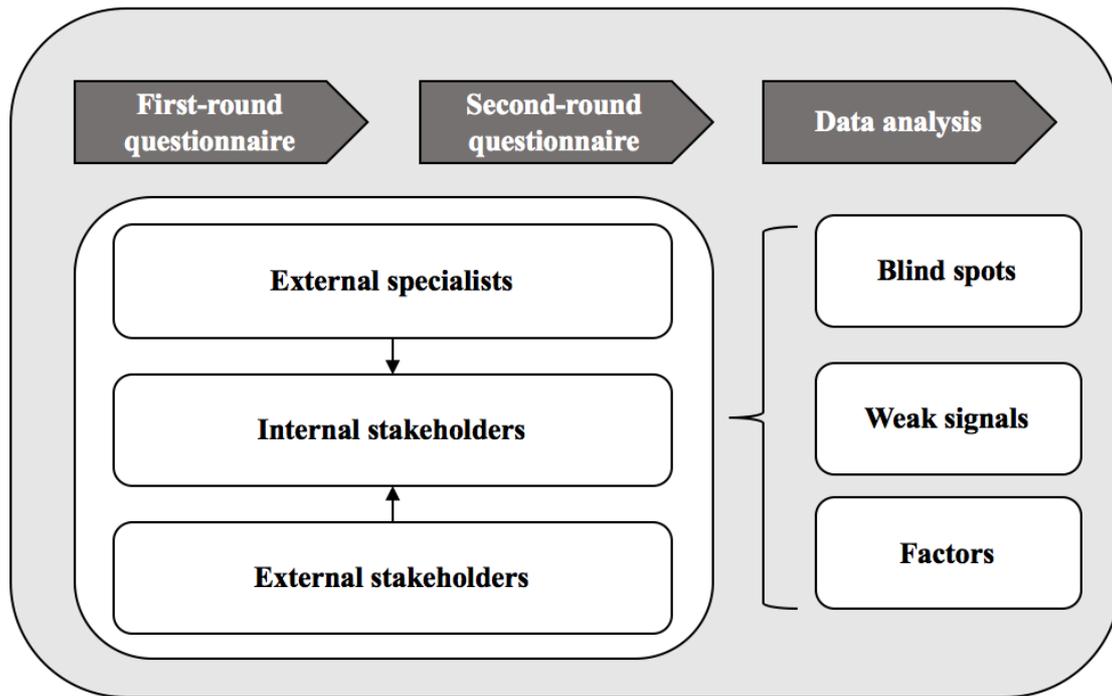


Figure 16 – Framework of 360-degree stakeholder feedback process. Source: Adopted from Schwenker and Wulf (2013)

### 3.7.3 Trend and uncertainty analysis

For scenarios to be applicable it is important that decision-makers are capable of grasping the underlying driving forces of development. Consequently, decision-makers have to comprehend what environmental factors are of biggest influence to the uncertainties with the potentially greatest impact on the mission (Wack, 1985). Trend analyses regularly results in the identification of trends in distinct industries, markets or areas. However, even if these trends shows distinct characteristics common denominators and patterns are often observable (Lindgren and Bandhold, 2009).

The trend and uncertainty analysis aims to investigate relevant trends and uncertainties, and their potential influence (Schoemaker, 1995). Trends and uncertainties that drives the development of the industry is investigated in order to establish the scope of possible development, these drivers are categorized according to their level of uncertainty and potential impact. Influential drivers are often guiding future outcomes, and should therefore be part of the analysis. Instead, trends with uncertain development are crucial for scenario planning (van der Heijden, 2005). The trend analysis aims to investigate, according to Lindgren and Bandhold (2009), the consequences and linkages of specific trends, knowledge of how trends effects the mission, the firm's environment, and how the environment effect the firm could provide valuable insights of the system and its development.

In the assessment of trends and uncertainties the impact-uncertainty grid is, according to Schwenker and Wulf (2013), a tool that provides insights of trends with a high level of uncertainty and potential impact, these kinds of uncertainties, are useful for scenario planning. Also, the impact-uncertainty grid provides decision-makers with the capability to exclude elements that correlates with either, or both, low levels of uncertainty and impact, since they have limited impact on results. There are three parts of the grid: (1) secondary elements, (2) predetermined elements/trends, and (3) critical uncertainties. The secondary elements represent the trends which are assessed to have

little impact on the mission, these elements are consequently disregarded in scenario planning. The predetermined elements/trends are coupled with a high level of predictability, consequently the effect of these trends should be accounted for. The critical uncertainties are instrumental to scenario planning because these trends frame the constraints of the scenario dimensions.

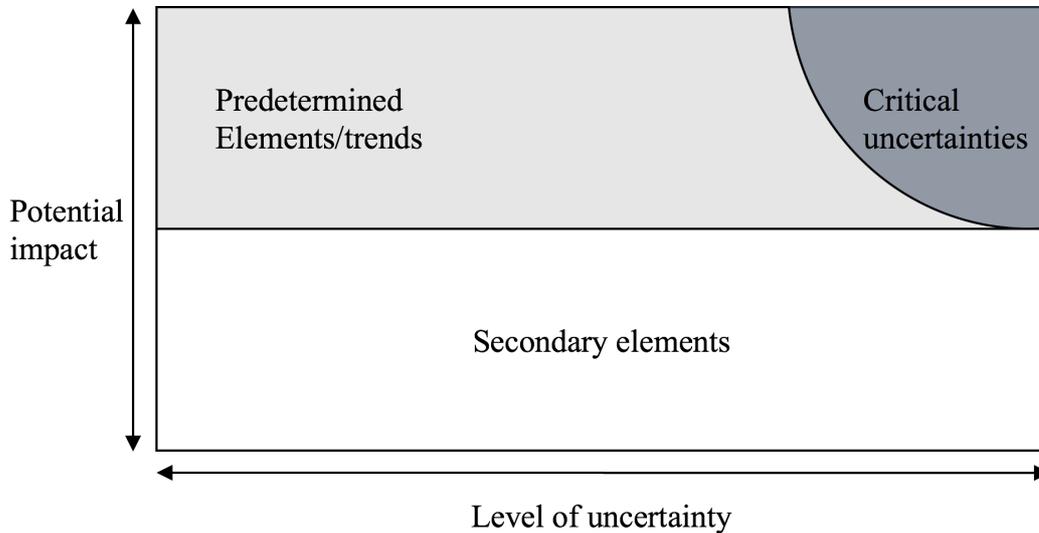


Figure 17 – The impact-uncertainty grid. Source: Adopted from Schwenker and Wulf (2013)

### 3.7.4 Scenario building

Scenario building is the process of eliciting vivid scenarios, these scenarios are a way of presenting in a so called scenario matrix (Schwenker and Wulf, 2013). Designing the scenario matrix is in general divided into four sub-steps and involves description with uncertain and volatile situations: (1) Identify the scenarios, (2) Create an influence diagram, (3) Describe the scenarios and (4) Create a fact sheet.

Identification of scenarios is based on previous step, trends and uncertainly analysis. Creating scenario matrix should rely on two scenario dimensions, projected on two different axes, (1) Positive development and (2) Negative development. Implementing these dimensions, will create four different quadrants that each scenario can be placed in.

Create an influence diagram, for mapping the two scenario dimensions. As shown in Figure 18, a few steps of how to create an influence diagram. The steps could for example align with trend and uncertainty for reaching the scenario dimensions. These step is described as causes and effects and illustrates the strategic path of the future behind each scenario will strive for.

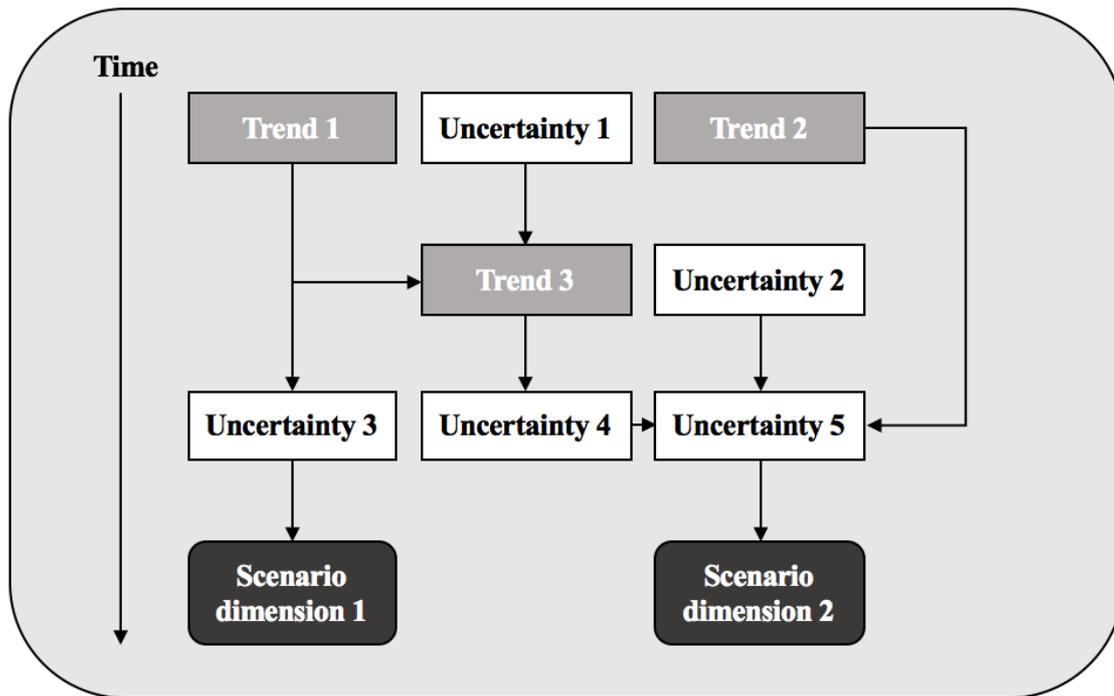


Figure 18 – Influence diagram. Source: Adopted from van der Heijden (2005)

Describe the scenarios based on the influence diagram. Each scenario should be described of how it could influence different developments.

Creation of a fact sheet implemented for each scenario in the matrix. The fact sheet should contain relevant information for each scenario. The fact sheet should be simple for the reader to understand the scenarios. A confirmation if the scenarios ensure that they fulfil the purpose.

### 3.7.5 Strategy definition

The fifth step is to define a strategy based on the scenarios in the scenario matrix. The purpose with strategy definition is to develop a distinct action plan for future obstacles. Working thru the strategy for generating best possible outcome associates with the strategy corridor. The purpose with the strategy corridor is to guideline towards the most positive scenario, which is comparable with the scenario matrix upper right quadrant. The involved participants should understand the benefit from a positive development and operate to prevent disadvantage development that can affect the scenarios. It is remarkable to define strategies to maximize the most wanted development and try to reduce negative development. This will in the end lead to the form of a strategy corridor.

### 3.7.6 Monitoring

The last step monitoring has the purpose of comparing the actual outcomes with the developed scenarios, in order to observe their relevance. This step is crucial since the observations made will provide an indication what strategy should be used, also if the scenario analysis does not adequately reflect the real outcome, the process of monitoring will provide the actor with the possibility to reiterate the process. How performance indicators are establishing is mentioned further in section 3.8.

### 3.8 Performance indicators

According to Parmenter (2007), performance indicators and key performance indicators represent measurements that aspire to show a firm's performance in activities that are identified as crucial for success. Many firms fail to identify their "true KPIs", because firms, or stakeholders fail to understand what a key performance indicator really is. Distinctions are made between: (1) Key results indicators, (2) Performance indicators, and (3) Key performance indicator. Key results indicators have the purpose of indicating how well some activity has been performed. Performance indicators have the purpose of indicating what needs to be done. Key performance indicators have the purpose of showing the most important things to be done. Also, key performance indicators should be easily understandable to all collaborators, and should be verifiable (Franceschini et al, 2007).

Parmenter (2007) has defined seven characteristics of KPIs: (1) Nonfinancial measures, (2) Measured frequently, (3) Acted on by senior management, (4) The entire staff should understand the measurement, (5) links responsibilities, (6) significant impact of business, (7) positive impact on business. Franceschini et al (2007) identifies that performance indicators should be defined on two levels: (1) The local, and (2) the global level. The local level represents the performance in regard to isolated performance, this to give an indication of the performance in a particular part of the system. The global level refers to the accumulated performance local levels.

According to Kaplan and Norton (1992), is one of the most prevalent problems for firms is the inability to utilize performance measures of non-financial measurements on a strategic level. Firms that are incapable of measuring non-financial performance are exposed to risk, since they do not measure the performance of factors that are drivers for financial performance. The balanced scorecard investigates the financial and the non-financial measurements of all tiers of a firm to ensure that each function's activities aligns with the strategic direction and to ensure tangible objectives. The balanced scorecard accounts for both internal and external environmental factors. The balanced scorecard involves four steps: (1) Clarify and translate vision and strategy, (2) Communicate and link strategic objectives and measures, (3) Plan, set targets, and align strategic initiatives, and (4) enhance strategic feedback and learning.

The first step, clarify and translate vision and strategy, refers to the elicitation of strategic objectives. The strategic objectives are drawn from the strategic vision of the firm. There are four objective perspectives: (1) financial, (2) customer, (3) internal, and (4) learning and growth.

The financial perspective represents the perspective of improving the financial performance of the company. In for-profit firms the financial objectives are a good indicator for its success, for a non-profit firm they are not as explanatory of the success. Depending on a firm's strategic direction the financial perspective will be different, firms with a growth strategy would most likely be interested in financial indicators of growth, such as revenue, market growth, etc. Whereas firms that pursue a productivity strategy are likely to be interested in financial indicators for productivity, such as cost savings, increases in productivity, etc. In order to adequately develop financial goals estimations are necessary, because without projections of future outcomes it is problematic to establish goals for revenue, costs, cash flow, etc.

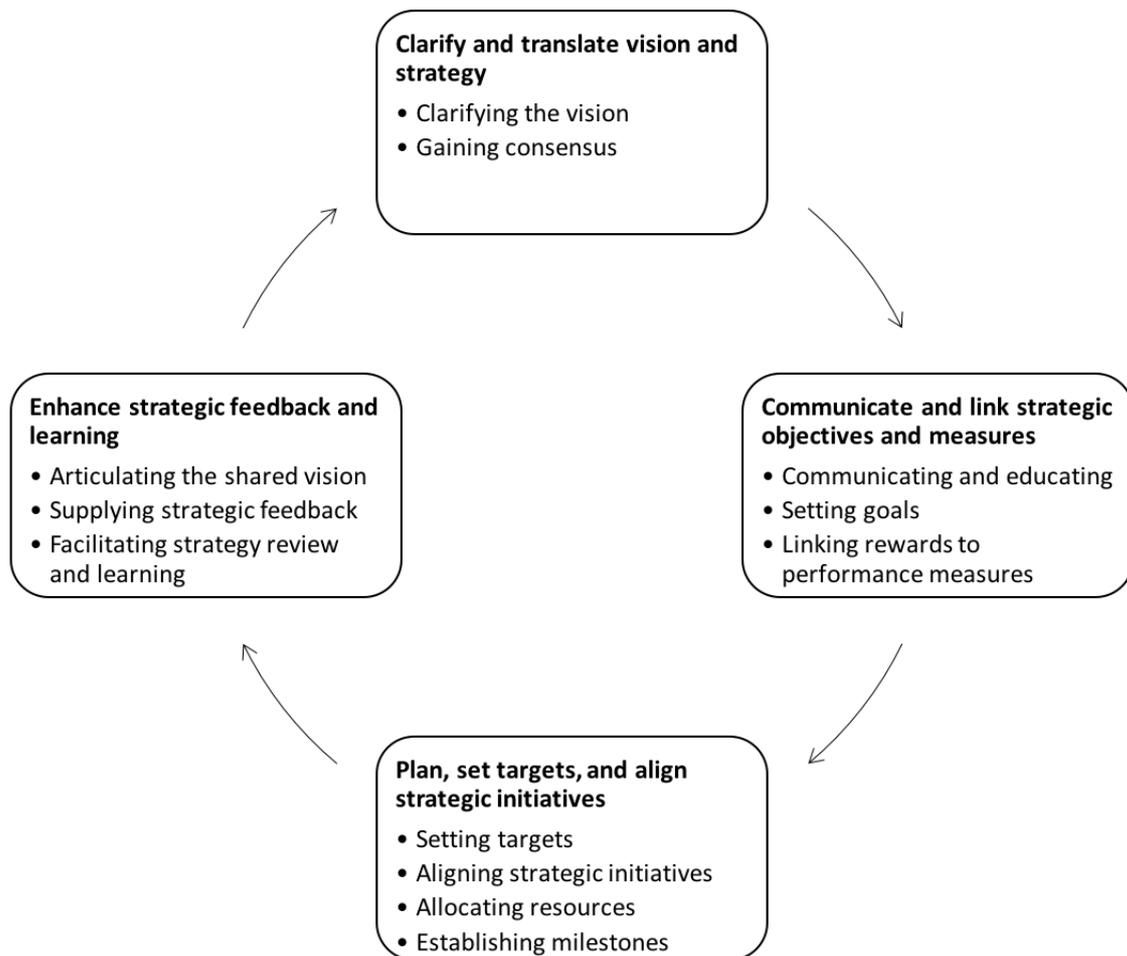


Figure 19 – The balanced scorecard. Source: Adopted from Kaplan and Norton (1996)

The customer perspective represents the value proposition that the firm offers to satisfy the need of their targeted market. Performance in the perspective of customer refers to the value delivered from the perspective of the customer. Indicators for performance in the perspective of a customers could include quality factors, time, service levels, total cost of ownership, and customer satisfaction. There are three different directions for the value proposition: (1) operational excellence, (2) customer intimacy, and (3) product leadership. Operational excellence refers to an emphasis on the constant improvement of a firm’s processes, such as improvement of reliability, pricing, etc. Customer intimacy refers to the customization of the offering to satisfy specific demands. Product leadership refers to the offering of products of services with improvements for the perspective of its applicability to the customer.

The internal perspective refers to the internal processes within the firm that are necessary to provide value to the customers. Performance in the perspective of internal processes emphasizes on performance on the firm’s operations in regards to development, supply chains, customer relationship management, innovation, etc. Innovation indicators are challenging to measure directly in terms of tangible goals

The learning and growth perspective refers to intangible assets of the firm and the process of aligning them with the core strategy, there are three types of learning and growth perspective: (1) Human capital, (2) organization capital, and (3) information capital. Human capital refers to the skills within the firm. Organization capital refers to

cultural and management aspects within the firm. Information capital refers to the ability to utilize information and technology to support the firm's activities.

The second step, communicate and link strategic objectives and measures, refers to the emphasis on the strategic direction that a firm assumes. Collaborators and key actors should understand the strategic direction of the firm to ensure that each actor understands in what way its responsibilities aligns with the long term goals of the firm.

The third step, plan, set targets, and align strategic initiatives, refers to the development of objectives for the firm, this could be in terms of market capitalization, return on investment, etc. In order to achieve these objectives, the firm has to evaluate how the customer perspective, internal perspective, and its learning and growth perspective have to perform. The objective-setting process requires three steps: (1) quantification of promising future outcomes, (2) identification of the resources needed to achieve this outcome, and (3) development of milestones.

The fourth step, enhance strategic feedback and learning, refers to the process of reaffirming the former steps in an iterative process that supports organizational learning. By investigating the entire process, a firm can dynamically reassess their vision, objectives and perspectives, as they implement the balanced scorecard. A directional change can be motivated not only if the firm fails to assess its environment adequately, it could also be a necessity if the environment itself changes.

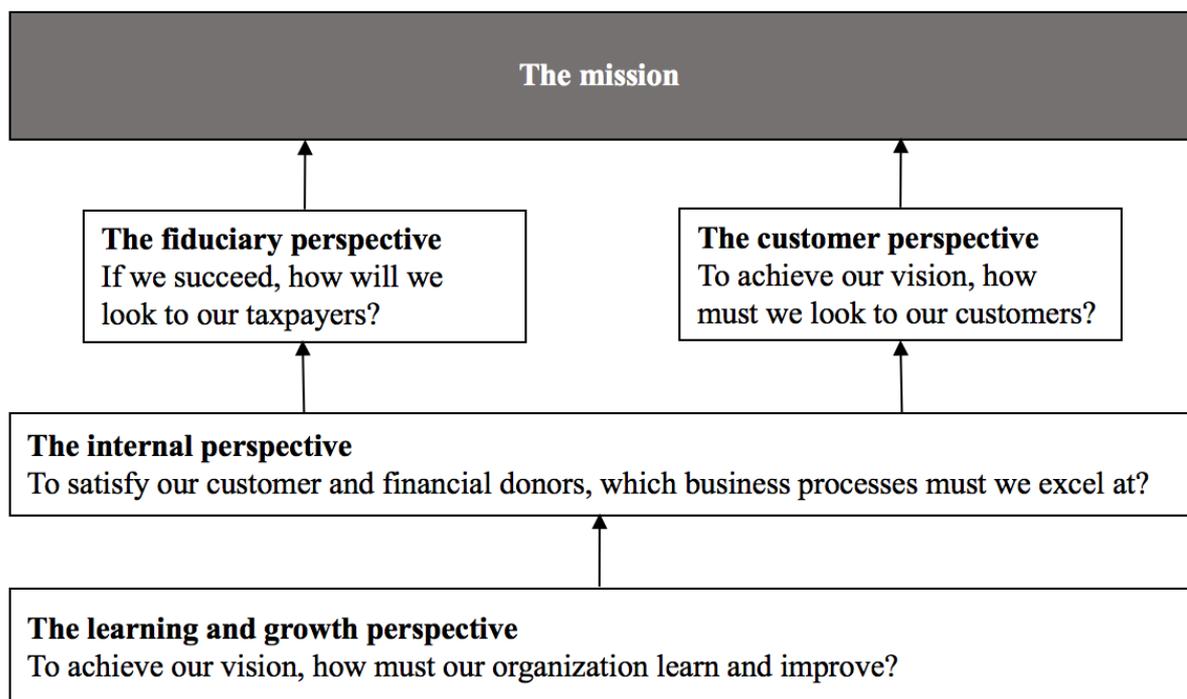


Figure 20 – Strategy map for Public-sector organizations. Source: Adopted from Kaplan and Norton (2004)

Strategy maps are, according to Kaplan and Norton (2004), a way of visually presenting a firm's strategy, objectives and the financial, customer, internal, and learning and growth perspective from the balanced scorecard. It provides the linkages between performance in the financial and customer perspectives with the internal processes, also it provides linkages between the firm's internal processes and intangible human, information, and organizational capital. The value of human capital, information capital,

and organizational capital, is not instinct, instead the value of these intangible assets is their ability to support the organization to implement the strategy. The value creation of intangible assets is indirect and depends on the context, potential, and their utilization.

In private-sector organizations and public-sector organization the implementation of strategy maps is different. In private-sector organizations the firms act from the financial, customer, internal, and learning and growth perspectives. For public-sector organizations the perspectives are different, because of pursuing a value-maximizing strategy their purpose is defined from the perspective of a mission. Instead of a financial perspective these organizations have a fiduciary perspective. The fiduciary perspective is the investigation of how the constituency will react if the goal is satisfied (Figure 20).

Different stakeholders of a project often have distinctive interests, and their motivation to participate in collaborations are also different. That stakeholders have different perspectives is not instinctually a threat to the project, when stakeholders have conflicting interests there is an inherent risk to the project and in order to accomplish coherence there is a need to compromise. Critical success factors represent elements of the project that, from a stakeholder perspective, are necessary in order for the stakeholder to be satisfied. The critical success factors represent the needs that is motivating a stakeholder to collaborate.

The concepts of sustainable development are defined, as mentioned in section 3.4, as (1) meeting the needs of this generation, and (2) ensuring the needs of future generations. The context of sustainable development contains the development of social, economical, and environmental goals and the interface of these factors, which underlines the necessity of compromising. In order to examine if there is a conflict of interests a firm can investigate conflicts by pair-wise comparisons in with a conflict matrix (Figure 21; Hemingway and Cutts, 2013).

	<b>Goal 1</b>	<b>Goal 2</b>	<b>Goal 3</b>
<b>Goal 1</b>			
<b>Goal 2</b>			
<b>Goal 3</b>			

Figure 21 - Conflict matrix. Green indicates little conflicts, red indicates probable conflict. Adopted from Hemingway and Cutts (2013)

Stakeholders can be defined as entities that have the capability and/or the willingness to affect project objectives (Freeman, 2010). In order to address stakeholders in respect tot their relative importance they are sometimes assessed based on their (Mitchell et al, 1997): (1) power, (2) urgency, and (3) legitimacy. Power refers to the stakeholder's

ability to influence the project. Urgency refers to the stakeholder's interest in the project. Legitimacy refers to the stakeholder's relationship with the project.

Multi-criteria analysis is an analytical tool that is used for decision-making when several perspectives have to be addressed. The analysis requires the examination of the different perspectives of the project, such as stakeholder perspectives. Criteria's are valued through a process that quantifies their relative importance. By allowing experts to assigning a criterion  $z_j(a)$  and allowing decision-makers to establish weights  $w_j$  an overall score of each criteria. The weight criterion presents the relative importance of the factor in the perspective of the stakeholder, whereas the expert criterion represents the relative importance in regards to the mission itself (De Brucker et al, 2013).

$$V(a) = \sum_{j=1}^J w_j [z_j(a)]$$

In order to account for hierarchies of objectives and their linkages criteria trees can be developed. Analytical hierarchy process (AHP) is one method that can be used to establish an aggregate depiction of the linkages and the weights. First, by linking the objectives of stakeholders with the overall vision the purpose of the collaboration can be established. Second, by linking each actor to performance indicators it becomes apparent what each stakeholder is interested in measuring. Third, by linking performance indicators with scenarios it becomes possible to establish their applicability in respect to different scenarios. The objective of criteria trees with scenarios is to establish those paths that adds the highest amount of value barring certain future outcomes (De Brucker et al, 2013).

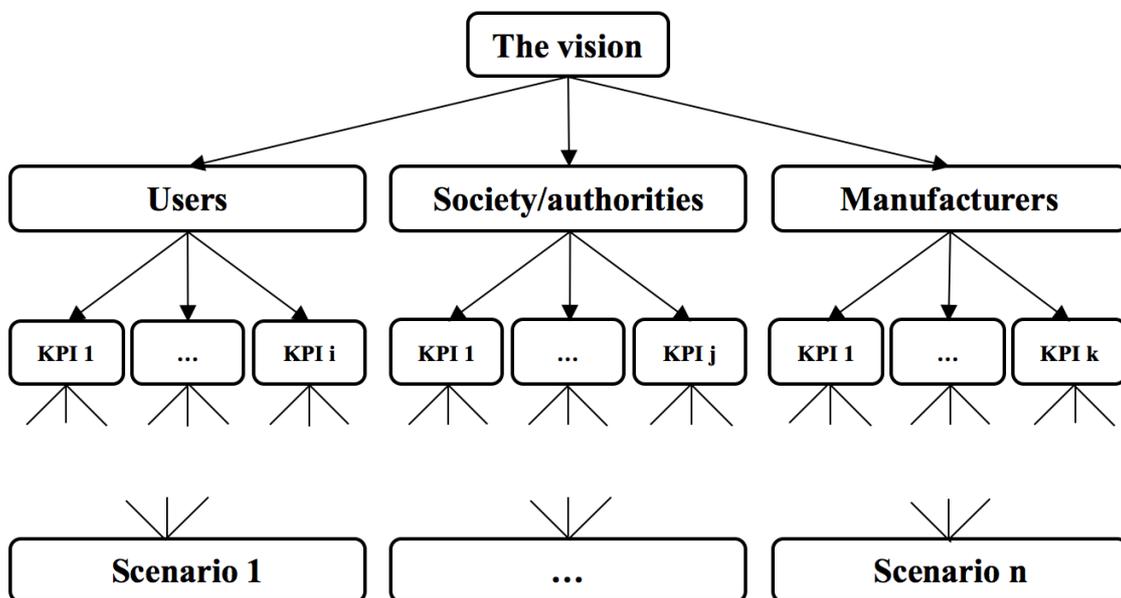


Figure 22 – Criteria tree with scenarios. Source: Adopted from De Brucker and Macharis (2011).

The AHP process is, according to Saaty (2008), a tool that can be used for weighting criteria's. The process uses pairwise comparison of the criteria to develop a normalized value of its relative importance.

## 3.9 Megatrends

During the last century there have been four ongoing megatrends that have changed the context of logistics and societies. This section describes the four ongoing megatrends: (1) urbanization, (2) globalization, (3) technology innovations and (4) customization.

### 3.9.1 Urbanization

The European Environment Agency (2015) have identified 11 megatrends of either social, economical, environmental, governmental, or technological nature, one of these megatrends are the change towards a more urban world. According to the United Nations' World Urbanization Prospects (2011) the amount of megacities, or cities with more than ten million inhabitants, will increase from 23 to 36 by 2025. However, despite the emergence of these megacities, their combined population accounts for a small fraction, or 5 percent, of the global population, whereas small cities, or cities with less than 500 000 inhabitants, accounts for 26 percent of the global population and over 50 percent of the global urban population (The European Environment Agency, 2014).

83 percent of the Swedish population lives in urban areas whereas 53 percent of the global population does (SCB, 2015; The European Environment Agency, 2014). Since populations is predominately concentrated to urban areas the consumption of goods and services is as well (Taniguchi et al, 2001). The concentration for the consumption of goods puts strict requirements on the supply chains that delivers these goods, the coordination of input and output of goods in urban areas requires strategic planning in the area of city logistics (Kawamura, 2014).

Urban freight transport is essential for the the development and the sustainability of social and economical factors in urban areas, because of the demand from the residents and local businesses for consumption goods (Taniguchi and Thompson, 2015). Pollutions are concentrated in urban areas, because the majority of the consumption is accomplished in these areas. Also, a majority of the anthropogenic green house gas emissions origins in urban environments (The European Environment Agency, 2014).

According to Taniguchi and Thompson (2015), the continued urbanization trend is enhancing the complexity of existing issues in urban logistics and raises three main issues concerning sustainable urban freight transport.

- If it is possible to balance efficiency, environmental friendliness, safety, and save energy associated with urban freight transport?
- If it is possible to establish sustainable urban freight transport systems in growing megacities?
- What features does sustainable urban freight transport systems have in an aging society?

### 3.9.2 Globalization

Globalization can, according to Bräuninger and Vöpel (2010), be linked to the ongoing trade and market liberalization between nations and markets. The incentive to trade within and across borders stems from transaction costs that are advantageous compared to local development. Since different firms and nations possess varied resources, in terms of human capital, natural resources and economical capital, the condition and capabilities for production of goods are different. Because of the intrinsic differences amongst administrative entities an exchange of goods or services can be favourable from both perspectives.

The Heckscher–Ohlin model examines the different factor endowments of nations and how nations choose to specialize in production which utilizes the resources that they possess in abundance. This extends to that nations with an abundance of economic capital will utilize economic capital to produce goods and services, whereas a nation that has an abundance of human capital will utilize human capital to produce goods and services (Milberg, 1996). The effects of the discrepancy of capital utilization is that capital-intensive nations will increase their capital, whereas labour-intensive nations will increase their labour. This contributes to an advantage for highly-skilled workers in capital-intensive, or industrialized nations, while workers in labour-intensive, or non-industrialized nations, are disadvantaged (Bräuninger and Vöpel, 2010).

The flow of goods between nations has increased drastically compared to a few decades ago. More firms tend to internationalize early or outsource tasks that formerly were performed internally. This development has contributed to progressively more complex supply chain networks with a global extent (Chakravarty, 2014).

Seaway transportation is the dominant transportation type and 90 percent of all goods are transported seaway. Since seaway transportation is leading logistics clusters have surfaced in coastal areas, such as Singapore and Rotterdam, or with a Swedish perspective in Gothenburg (Bräuninger and Vöpel, 2010; Transport Analysis, 2015)

Mobility was previously reserved for privileged people however, the economical and technological development have increased the amount of people in this privileged segment significantly. Recently, information technology has made instantaneous communication possible around the globe, this has furthered the capability to trade over great distances (Träm, 2010).

Globalization has contributed to increasingly complex city logistics, the increased economic activity across national borders requires vast supply networks and an anticipatory approach in regards to the capacity of existing infrastructure and the ability to cooperate with stakeholders (Müller, 2010; Bozzoa et al, 2014).

### **3.9.3 Technology innovations**

According to Boutellier and Heinzen (2014) Innovative technologies have the capacity to unbalance the current environmental stability of a market. By innovating firms have the opportunity to develop temporary monopolies, or Schumpeter Monopolies, due to the temporary exclusivity of being first to market. Disruptive technologies are characterized as technologies that introduce new, or radical, ways of performing a task that challenges the current status quo, whereas incremental innovations are iterative improvements of current technology (Wördenweber and Weissflog, 2005).

Technology is value adding to logistics services and many technology innovations in logistics and information technology aims to increase the efficiency of performing a task. Automation in warehouses, information systems, and in vehicles are examples of innovations with the purpose of increasing efficiency. Innovations in communication technology have significantly influenced logistics. Communication technology permits routing schemes that can adopt to traffic in real-time. Examples of technology with a wide usability in the perspective of logistics are GPS, EDI, and optical scanners. (Taniguchi and Thompson, 2015).

Advanced routing schemes is another example of technology innovations with high adoptability in logistics services. Routing technology have the ability to increase the load factor of freight trucks identifying the most suitable goods for a specific route, identify the most efficient route in regards to distribution points and load, increase the incentives of coordinated distribution by identifying the most suitable load (Moen, 2015).

According to Park et al (2015) there are two types of organizational knowledge: (1) Explicit, and (2) Tacit. Explicit knowledge refers to codified knowledge that easily can be accessed and transferred between individuals and organizations. Tacit knowledge refers to knowledge that is not codified and is difficult to transfer between individuals and organizations. Organizations that do not have the capability of adopting tacit knowledge risk losing competitive advantage inherent to specific knowledge. Companies that are successful in adopting new tacit knowledge are not exposed to the similar uncertainties and are more competitive on complex markets (Lindström et al, 2015). Firms that do not have the ability to adopt new technology and knowledge could miss profitable business models (Moen, 2015).

Data collection of vehicle routing and freight information can be used for improvements of urban freight modelling. By collecting real-time information on congestions, flows, emissions, transportation types, and travel times, future modelling efforts in urban freight transport can examine the actual traffic, rather than estimations (Taniguchi and Thompson, 2015).

### **3.9.4 Customization**

For production companies there are, according to Hvam et al (2010), three general levels of customization for companies: (1) mass production, (2) small series production, and (3) on-of-a-kind production. A general trend for mass production companies are the shift towards mass customization. Customization refers to adjustments of products in order to satisfy customer demands. Whereas, companies of either small series production or on-of-a-kind production have been offering these kinds of services past. Customization of goods and services allows consumers to access a product offering that is increasingly aligned with niched demands.

According to Coletti and Aichner (2011), what motivates customers to buy goods are their motivation to fulfil their needs. Needs can be tiered according to the hierarchy of needs where the motivation is strongest to fulfil the most basic needs first: (1) physiological needs, (2) safety, (3) belonging and love needs, (4) esteem, (5) cognitive needs, (6) aesthetic needs, (7) self-actualization, and (8) transcendence.

Companies that are offering customized goods and services will be more capable of satisfying specific customer demands, however, increased customization increases the complexity of ordering operations because orders have to account for additional factors, such as differentiated quantities, configuration speed, and aesthetics (Chakravarty, 2014).

According to Coletti and Aichner (2011), customization of distribution explains the involvement of customers in distribution. Their involvement involves customer participation in processes such as dispatch type, packaging, insurance, address, etc. The speed of delivery of is a highly important factor of customized goods for consumers. This relates to factors such as lead times, response time, reliability, life cycles, etc. (Chakravarty, 2014).

Price sensitivity among customers varies greatly. For industries related to hazardous waste materials or fragile goods, there is a higher tolerance for price, whereas commoditized products are coupled with a less price sensitivity (Coletti and Aichner, 2011).

## 4. Empirics

*This chapter provides the data collected in interviews and from the questionnaire. Several aspects will be examined in this chapter: First, the results of workshop one will be presented. Second, the results of workshop two will be presented. Third, the results of the interview with Laetitia Dablanc will be presented. Forth, a set of key performance indicators will be presented. Fifth, the results of the questionnaire will be presented. Lastly, the applied scenarios will be presented.*

### 4.1 Workshop one

The first workshop was held in Stockholm at the offices at Transport Analysis. The participants were predominantly city planners and traffic engineers employed at some of the most populous municipalities in Sweden (Table 2). The participants were divided in groups of 5-6 people and was tasked to discuss specific issues related to urban freight transport. The issues that were addressed was to establish: (1) the vision of urban freight, (2) the needs to satisfy this vision, and (3) a situational analysis of current measures. Lastly, the groups gathered and discussed their insights, which were synthesized.

The vision for urban freight is, according to the participants is:

*“A resource efficient freight system that provides a foundation for a city where all residents can have a high life quality and excellent employment opportunities.”*

The participants argued that urban areas should be accessible and attractive to everyone, including residents and businesses. Resident in the perspective that the urban environment should, in regards to urban freight, (1) have access to goods, (2) have high levels of safety, (3) be exposed to minimal amounts of pollutants, and (4) have access to the city centre.

The participants recognized several needs in order to satisfy the vision. (1) The approach to city logistics must transit from being project-based to a systematic-view, (2) city planners must establish standardized performance indicators for planning, (3) city planners must establish a standardized approach for data collection, (4) city planners needs to access at which level they should be involved, (5) authorities needs to be educated to increase the participation from a political standpoint, (6) Statistics is necessary for decision-making. The participants identified the need of data collection in order to assess policies influence on economical, social, and environmental factors. The following data was identified: (1) goods time deposit, (2) emissions, (3) vehicle types, and (4) land value. Also, it was discussed how the actors of urban freight transport could share data.

The participants identified the following methods that is currently used to collect data of urban freight transports: (1) hose measurements, (2) observations, (3) assessments of recipients, (4) assessments of shippers, (5) road tolls, (6) detectors on traffic lights, (7) assessment of garbage, (8) freight trip generation models.

As a conclusion, it was identified that authorities have a need for continuity and standardized methods, tools, and processes to establish a strategy to ensure that the vision is fulfilled.

Critical uncertainties that was identified during the workshops regarding the rate of technological innovations was: (1) Level of knowledge sharing, (2) Urban freight transport data quality, (3) Regulation, (4) Level of political interest, and (5) Degree of private-public cooperation.

Knowledge barriers represents the problems of sharing local initiatives on a national or international level. For instance, in Sweden over 60 municipalities have developed individual strategic plans for transportation, extensive collaboration is necessary to develop, adopt, and share transportation innovations. Scarcity of freight data refers to the issue that, while it is obvious that data of the current situation is necessary for decision-making and performance measurement the data that authorities have access to, such as toll, observations, household garbage, etc. does not provide an adequate picture of the current situation. Regulation like the personal data act (PUL) is restricting city planners from accessing more detailed data, such as analysing flows. There is little political interest in urban freight transport, compared to public transportation, this was attributed to how disconnected residents are to freight transport in comparison to public transportation. This disproportional interest has resulted in a shortage of political initiatives in the subject.

The relative preferences of critical success factors, was analysed in section 5.2-5.4 and was validated from each stakeholder perspective though email-correspondence.

<b>Participant</b>	<b>Affiliation</b>
Stefan Berg	Swedish Transport Administration
Erik Levander	Swedish Association of Local Authorities and Regions
Krister Sandberg	Transport Analysis
Petra Stelling	Transport Analysis
Lina Olsson	Closer
Maria Lindholm	Closer
Magnus Jacobsson	National Board of Housing, Building and Planning
Magnus Jäderberg	Traffic and Public Transport Authority Gothenburg
Karin Björklind	Traffic and Public Transport Authority Gothenburg
Staffan Bolminger	Urban innovation
Linda Bermin	The municipality of Helsingborg
Ludvig Elgström	The municipality of Stockholm
Elin Skogens	The municipality of Stockholm
Michael Åhlman	The municipality of Uppsala
Sara Andersson	The municipality of Uppsala
Ingrid von-Scheele	The municipality of Uppsala
Patrik Ståhl	The municipality of Örebro
Christopher Öhlund	The municipality of Örebro

*Table 2 - Participants in Workshop one*

## 4.2 Workshop two

The second workshop was held in Gothenburg in Lindholmen Science park. The topic of the workshop was innovation solutions regarding how to gather urban freight data. The participants were city planners and most populous municipalities in Sweden, also several participants from the private sector attended, conveying the perspective of shippers and freight carriers (Table 3). For the workshop the participants were divided in groups of 5-6 people.

The vision developed during workshop one was dissected in topics for discussion. The first topic was how decision-making regarding how to accomplish satisfactory levels of: (1) accessibility, (2) air quality, (3) noise, (4) safety, and (5) service levels. During the discussions it was identified that there was a need for increased data collection, in order to make rigorous planning. Several ways of collecting data was identified: (1) Travel times of freight, and (2) flow analyses. However, while it from the perspective of authorities seemed attractive to share transportation information amongst stakeholders, it did not do so amongst freight carriers. Freight carriers expressed that they identified limited benefit in sharing their information but also identified that they saw a benefit in obtaining traffic information from authorities.

Data collection itself was not identified as a problem. Instead, the problem relies upon understanding and knowing which data that should be collected. There is available data that still has not been enough investigated. For example, Örebro municipality have assembled different measurements related to urban freight on their homepage that not few are aware of.

There is other sources to collect and make data available from, such as (1) collecting on a system level, (2) pilot projects, (3) innovations competitions and (4) municipalities and stakeholders. From the system level perspective, it was identified that there was a problem in identifying how specific pilot projects be usable for others. Several pilot projects have been established, however they have not been implemented on a larger scale, such as on a municipality level.

Arrangement of innovations competitions with involved participants might reveal information that can be useful for continued development regarding urban freight transport. Further investigation on technical solutions that already exists.

Regarding municipalities, they have the ambitions to share information and coordinate within urban freight transport. The stakeholders must know what's in it for them and what do they gain for trading information. Municipalities must somehow guide and show that it is profitable with cooperation.

From the perspective of shippers, the most important factors are accessibility and the utilization of freight trucks. From the perspective of shipper's service levels, and then costs are most important. From the perspective of resident's safety issues, reliability of deliveries, environmental sustainability, and the attractiveness of the city, was identified as most important.

The relative preferences of critical success factors, was analysed in section 5.2-5-4 and was validated from each stakeholder perspective though email-correspondence.

<b>Participant</b>	<b>Affiliation</b>
Erik Levander	Swedish Association of Local Authorities and Regions
Lina Olsson	Closer
Maria Lindholm	Closer
Per Eriksson	Swedish Transport Administration
Thomas Ney	Ramböll
Sofia Löfstrand	Volvo
Stig Lundgren	The municipality of Umeå
Patrik Nilsson	Bäckebo's åkeri
Max Hanander	The municipality of Malmö
Sara Ranäng	Sweco
Elise Caspersen	Norwegian Centre for Transport Research
Staffan Bolminger	Urban innovation
Linda Bermin	The municipality of Helsingborg
Ludvig Elgström	The municipality of Stockholm
Elin Skogens	The municipality of Stockholm
Michael Åhlman	The municipality of Uppsala
Sara Andersson	The municipality of Uppsala
Ingrid von-Scheele	The municipality of Uppsala
Patrik Ståhl	The municipality of Örebro
Christopher Öhlund	The municipality of Örebro

*Table 3– Participants in Workshop two*

### 4.3 Interview with Laetitia Dablanc

Laetitia Dablanc is a researcher linked to the French Institute of Science and Technology for Transport. Laetitia has a PhD in transport planning and have researched urban freight and related subjects for years. A semi-structured or almost open interview was performed with Laetitia in order to elicit information of a transport model Freturb that she have employed in France, as well as other insights relating to urban freight transport.

The Laboratory of Transport Economics in France have designed a software tool called Freturb which simulates the goods transport in urban areas. The software is in the developing phase and have been tested on multiple French cities, from these tests the model have been continuously improved for over 20 years. Since its inception, new advanced technology have allowed for the implementation of additional features, such as behavioural statistics information gathering of traffic, also the weight of goods, vehicles, trip distances, and parking estimations can be modelled.

Further a limited literature study was performed to supplement the interview.

According to National Goods Movements Surveys, Freturb can take account to a variety of business and also be used in any city whatever size (Laetitia, 2013). In other words, Freturb is most likely understanding freight movements, estimate bottleneck link to freight transport and simulate transport and develop environmental solutions.

According to Dablanc (2016), the model is dependent on French culture. Which is problematic to translate it to the Swedish environment. The authors have also tried to contact the team working with the model, with the purpose to get more information about Freturb. The response and the result was not as expected. There are only a few reports that are publicly available and most of them in the language French. Therefore, there were no further investigation on this model due to limited information of the model.

The agenda for the interview are presented in appendix 1.

#### 4.4 Performance indicators related to urban freight transport

In order to adequately investigate performance indicators of urban freight transport a set of performance indicators were adopted (Swiftly Green, 2016; GRI, 2015; Victoria Transport Policy Institute, 2011; Central European Initiative, 2016; Taniguchi et al, 2013), performance indicators specified in ISO 37120, “indicators for city services and quality of life”, was applied (ISO, 2015).

<b>Perspective</b>	<b>Performance indicator</b>	<b>Unit of measurement</b>
Economical sustainability	Price/cost	SEK
	Total goods volume	Tonne
	Lead time	Hours
	Load factor	%
	On time delivery	%
	Undamaged goods	%
	Weight capacity	Kg
	Terminals	n
	Loading zones	n
	Average velocity	Km/h
Social sustainability	Fatalities	n
	Injured persons	n
	Accidents recorded	n
	Vehicles recorded	n
	License holders	n
	Response time of police department	Minutes
	City unemployment rate	%
	Population living in poverty	%
	Value of commercial and industrial properties of the total value of properties	%
	Average life expectancy	n
	Square meters of public indoor recreation per capita	m <sup>2</sup>
	Square meters of public outdoor recreation space per capita	m <sup>2</sup>
	Square meters of green areas per capita	m <sup>2</sup>
	Total collected municipal waste per capita	Kg
	Percentage of the city's solid waste that is recycled	%
	Annual number of public transportation trips per capita	n
	Number of automobiles per capita	n
Environmental sustainability	Total energy use	KWh
	Percentage reusable energy	%
	Noise	dB
	Emissions of PM 2.5	Tonne
	Emissions of PM 10	Tonne
	Emissions of CO <sub>2</sub>	Tonne
	Emissions of NOX	Tonne
	Emissions of SOX	Tonne
Emissions of O <sub>3</sub>	Tonne	

Table 4 - Key performance indicators related to city logistics

## 4.5 Questionnaire

In order to adequately reflect the relative importance of specific performance indicators a questionnaire was established. The scope of the questionnaire was to address weight of each critical success factor for residents identified during the workshops: (1) traffic safety, (2) reliability of deliveries, (3) low environmental impact from freight transport, and (4) an attractive city environment. Each respondent was given the opportunity to compare alternatives based on the scale proposed by Saaty (2008) in Table 5.

From the perspective of resident's safety issues, reliability of deliveries, environmental sustainability, and the attractiveness of the city, was identified as most important.

<b>Intensity of importance</b>	<b>Definition</b>	<b>Explanation</b>
1	Equal importance	Equal contribution to the objective
2	Weak or slight	
3	Moderate importance	Slight favour for one activity
4	Moderate plus	
5	Strong importance	Strong favour for one activity
6	Strong plus	
7	Very strong	Very strong favour for one activity
8	Very, very strong	
9	Extreme importance	Highest possible favour for one activity

*Table 5 - Scale of the analytical hierarchy process. Source: Adopted from Saaty (2008)*

12 respondents participated in the test which was conducted at Lindholmen, Gothenburg. The questionnaire is presented in appendix 2.

## 4.6 Scenario outcomes

The following scenarios provides a description of the scenarios adopted from Transport Analysis (2014).

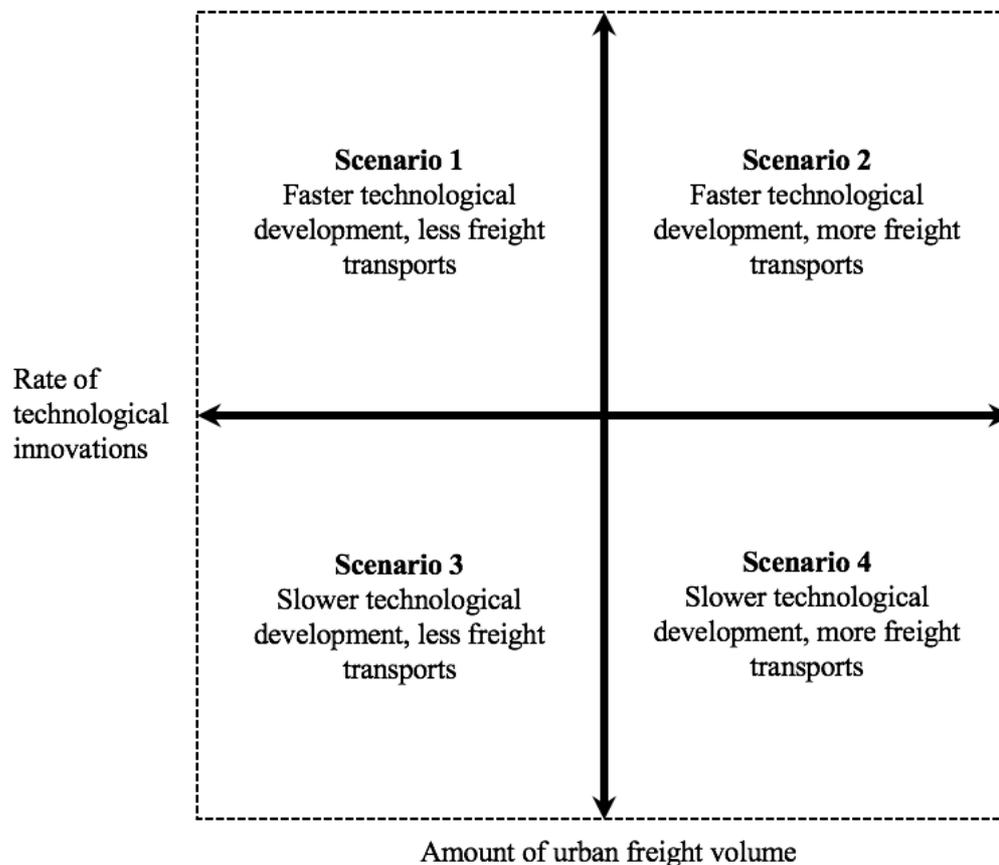


Figure 23 – Scenario cross for urban freight transport. Source: Adopted from Transport analysis (2014)

### 4.6.1 More urban freight transport and high rate of technological innovations

The year is 2050 and automation is increasingly more present in the city. Driverless cars are utilized to a high degree, electric vehicles have a large market penetration, and the noise contribution of traffic is low. Driverless cars have higher capacity since no passenger needs to be present. Traffic management have adopted to the automated systems and there is little tolerance for congestions caused by human fault or construction work. Pedestrians and cyclists can take up larger space of the roads and the competition in cities is large.

Traffic management is highly dynamical due to automation and real-time information on traffic can be uploaded. Due to this roads can be closed and traffic will automatically reroute. Engines are more efficient due to vehicle and driver (automated) efficiency.

Due to low contribution to noise freight transport is possible at night. Not only does this offset traffic congestion at the day, it is also efficient since the entire loading process and warehouse is automated. This automated distribution system is also integrated in homes, making distribution of commodities automated.

The service levels of logistic activities are excellent and the process is highly customizable, meaning that there are enhanced opportunities for niched goods and services. Employment in transportation is decreasing, however there is increased need for technical personnel to support the automated processes, this includes maintenance work. Outbound goods are transported by freight transports that have delivered to the city, this increases the potential utilization of trucks.

The cost of logistics services have decreased despite increased costs of energy and investments in technology. Also, the increasingly predictability of logistics due to increased accessibility leaves little motivation for congestion taxes.

#### **4.6.2 Less urban freight transport and high rate of technological innovations**

Technological innovations in manufacturing have contributed to increased miniaturization and utilization of 3D-printing, resulting in a decreased demand in freight transportation. Increased environmental concern amongst consumers have increased demand for organic food and transportation efficiency but the increased demand for perishable goods is increasing the cost of living.

There is a low level of automation in logistics because of diminishing demand of logistics services. Since transportation requires less space to operate within cities the competition of city space is reduced. The decreased amount of traffic have increased the accessibility in the perspective of residents, with increased room for housing units and recreational areas.

Traffic dispatching is utilizing real-time information of traffic, increasing the scope of decision-making in regards to flow control.

#### **4.6.3 Less urban freight transport and low rate of technological innovations**

The development of technology innovations related to logistics services have slowed down, as well as consumption of goods. Environmental regulation is strict and consumer requirements of labelling is high. Society have to a higher degree embraced sustainability by reducing consumption rather than efficiency.

Demand for goods have been substituted by demand for recreation, quality and services. Integrated solutions are popular, such as home delivery of groceries. This development have also surged the demand for eating out and services for cleaning and home services are increasing, this development is complemented by the fact that the population is aging.

#### **4.6.4 More urban freight transport and low rate of technological innovations**

Competition of the city is increasingly intense which have driven development of technology innovations for loading and unloading procedures. Increased demand for freight transport and little city space have created a need for larger freight trucks in cities. Vehicle efficiency have improved but is still highly dependent on fossil fuels. Noise is a lesser issue in cities because of new technology but not enough to eliminate restrictions for freight transport at night in urban areas.

Continued population growth necessitates housing projects, often with limited emphasis of transport efficiency. More neighbourhood stores are increasing their revenue by

cooperating with distributors by establishing distribution points, this increases the accessibility of goods for customers.

There is an increased emphasis on coordinated distribution in order to offset the increased volume of goods. Information is shared amongst urban freight actors to achieve the necessitated efficiency.

Congestion taxes have been normalized tool to offset increasing traffic in larger cities. The taxes have been increased and are required around the clock.

## 5. Analysis

*This chapter provide the analysis of the data collected in chapter three and four. The analysis is divided in four parts. Each part represents the analysis of each research question.*

### 5.1 Analysis of research question one

Urban freight transport and sustainability issues are interconnected (McKinnon, 2012). However, in order to investigate the effectiveness of urban freight transport policies in regards to sustainability its significance to Swedish urban freight transport have to be addressed. Likewise, since the strategic objectives of an organization should align with the strategic vision, sustainability in regards to the strategic vision of Swedish urban freight transport should be investigated. Furthermore, it is crucial to account for the environmental factors that influence the organization to ensure that the organizational efforts account for changes in the environment (Schwenker and Wulf, 2013). Thus, first the vision of urban freight transport has to be established. Second, the objectives to fulfil this vision have to be defined. Third, these objectives must account for the uncertainties of the environment.

The vision of Swedish urban freight transport was addressed during workshop one, as mentioned in chapter four. Likewise, the traffic political goal for Sweden represent the political vision for transportation. Since the approach of this thesis is in the perspective of public authorities, the vision should not only reflect the vision of specialists, but also the political vision. Therefore, a proxy vision has been developed, which partly accounts for the political vision of Swedish transportation and partly the vision of city logistics specialists.

The objectives of city logistics are, according to Taniguchi et al (2015), to ensure a city with high levels of: (1) mobility, (2) livability, (3) resilience, and (4) sustainability. Since the strategic objectives should reflect the strategic vision it is assumed that the strategic vision of Swedish urban freight transport should reflect these objectives. Consequently, the specialist vision of urban freight transport and the traffic political vision have been dissected in terms of mobility, livability, resilience, and sustainability. By using this methodology, the perspectives of politicians, specialists, and scientists have been triangulated to a proxy vision for Swedish urban freight transport. Each vision has been dissected in three parts.

The specialist vision, described in chapter four, specifies that Swedish urban freight transport should be: (1) resource efficient, (2) support a high quality of living, and (3) support the local industry. Each segment of the vision statement is to some degree related to mobility, livability, resilience, and sustainability. Resource efficiency refers to the ability to minimize the amount of resources needed to perform specific activities, this have evident implications on environmental sustainability, also, since effectiveness have economical implications there are effects to livability factors as well. The standard of living in a city is defined in terms of economical, social, and environmental factors, it is therefore assumed that this have implications on livability and sustainability factors as well. The local transportation industry, as mentioned in chapter four, is highly oriented towards mobility issues.

The traffic political vision, as specified in chapter one, specifies that Swedish traffic should be: (1) socioeconomic efficient, (2) be sustainable in the perspective of residents,

and (3) be sustainable in the perspective of the business sector. Socioeconomic efficiency refers to the endurance of economical factors for residents and industry, which are factors relate to livability and mobility.

The sustainability in the perspective of residents refers to the environmental, social and economical sustainability of residents, this is linked with livability and sustainability factors. The sustainability in the perspective of the business sector refers to the economical sustainability of businesses, this links to the mobility and livability factors.

By noting the emphasis of each objective in each vision, we can, in table 7, observe the following connections with the objectives of city logistics and each vision. It is noticeable that there is no obvious connection to resilience in either vision, this could be an indication that other concerns take precedence in the perspective of Swedish urban freight transport policies. In order to investigate the emphasis further a AHP-analysis of the workshop vision is presented in table 7-8, and of the traffic political vision in table 9-10.

	Relative frequency of factors regarding the objective dimensions of urban freight transport in the workshop vision	Relative frequency of factors regarding the objective dimensions of urban freight transport in the traffic political vision
Mobility	1	2
Livability	3	3
Resilience	0	0
Sustainability	2	1

*Table 6 – The emphasis of city logistics objectives in Swedish urban freight transport visions*

	Mobility	Livability	Sustainability
Mobility	1,00	0,33	0,50
Livability	3,00	1,00	1,50
Sustainability	2,00	0,67	1,00
Sum	6,00	2,00	3,00

*Table 7 – AHP-analysis of the workshop vision with emphasis on the emphasis of city logistics objectives in Swedish urban freight transport visions. Part one*

	Mobility	Livability	Sustainability	Sum	Weight
Mobility	0,17	0,17	0,17	0,50	0,167
Livability	0,50	0,50	0,50	1,50	0,50
Sustainability	0,33	0,33	0,33	1,00	0,33
	1,00	1,00	1,00	3,00	1,00

*Table 8 - AHP-analysis of the workshop vision with emphasis on the emphasis of city logistics objectives in Swedish urban freight transport visions. Part two*

	Mobility	Livability	Sustainability
Mobility	2,00	0,67	1,00
Livability	3,00	1,00	1,50
Sustainability	1,00	0,33	0,50
Sum	6,00	2,00	3,00

*Table 9 - AHP-analysis of the traffic political vision with emphasis on the emphasis of city logistics objectives in Swedish urban freight transport visions. Part one*

	Mobility	Livability	Sustainability	Sum	Weight
Mobility	0,33	0,33	0,33	1,00	0,33
Livability	0,50	0,50	0,50	1,50	0,50
Sustainability	0,17	0,17	0,17	0,50	0,167
	1,00	1,00	1,00	3,00	1,00

*Table 10 - AHP-analysis of the traffic political vision with emphasis on the emphasis of city logistics objectives in Swedish urban freight transport visions. Part two*

From this analysis it is observable that the emphasis of both visions is the livability factors. Whereas, sustainability and mobility factors are emphasized to a smaller degree. Table 12 presents a weighed average of both analyses.

Objective	Workshop one weights	Traffic political vision weight	Mean
Mobility	0,167	0,33	0,25
Livability	0,50	0,50	0,50
Sustainability	0,33	0,167	0,25

*Table 11 - Weighted average of the emphasis on city logistics factors in Swedish urban freight transport visions*

- The results of the AHP-analysis of the vision defined during the workshop. The weights presented in Table 12 indicates that the livability factor is most heavily emphasized. Also, the sustainability objective is emphasized stronger than mobility.
- The results of the AHP-analysis of the vision of the traffic political goal. The weights presented in Table 12 indicates that the livability factor is most heavily emphasized. Also, the mobility objective is emphasized stronger than sustainability.

The amalgamation of both AHP-analyzes lends the picture that livability factors have the highest merit in urban freight transport modelling, whereas mobility and sustainability factors have lesser merit. These results contribute to two insights. First, livability factors are heavily emphasized in visions of urban freight transport developed by Swedish professional city planners and city engineers. Second, as observed in the literature review and during workshop one, are the sustainability and mobility factors in conflict, the result in Table 8 may be an indication of the trade-offs that are necessary to fulfill the requirements of both mobility, and sustainability factors. Based on the results of the AHP-analysis the following proxy vision have been adopted.

*Urban freight transport activities in Sweden shall encourage high levels of livability, and should support sustainability and mobility factors in urban areas*

*Figure 24 - Proxy vision for urban freight transport in Sweden*

## 5.2 Analysis of research question two

Performance measurement of technology innovations and freight volume in regards to urban freight transport should support the strategic vision, and account for the uncertainties inherent to urban freight transport. In order to investigate performance measures the perspectives of each stakeholder have to be addressed, as well as their impact on the results. In order to account for the perspectives of each stakeholder the methodology will be to: (1) develop strategy map and balanced scorecard, and (2) examine performance indicators in a multi-criteria analysis.

The strategy map and the balanced scorecard is, as mentioned in chapter three, a methodology that examines tangible and intangible measurements. There are, as mentioned in chapter three, four key stakeholders of urban freight transport: (1) Shippers, (2) Freight carriers, (3) Administrators, and (4) Residents. Also, since this analysis investigates urban freight transport in the perspective of public authorities it is, as specified in chapter three, suitable to develop the strategy map and balanced scorecard from the perspective of a public-organization. The public-organization framework for strategy maps and balanced scorecards have five parts: (1) The mission, (2) the fiduciary perspective, (3) the customer perspective, (4) the internal perspective, and (5) the learning and growth perspective.

The mission is, as mentioned in chapter three, the existential motivation for an organizational entity. Thus, the mission of urban freight transport should provide a motivation for its existence. The mission of urban freight transport can be derived from its vision. From the proxy vision of Swedish urban freight transport, it is possible to derive the emphasis of livability, sustainability, and mobility factors. The mission present the purpose of urban freight transport, and describe how the management of how the purpose will be achieved through management of livability, mobility, and sustainability factors.

The fiduciary perspective refers to, as mentioned in chapter three, to the investigation of how success would be perceived from the perspective of the taxpayers. The role of public authorities in city logistics is, as mentioned in chapter three, to support the crucial success factors of the stakeholders to ensure a city environment that is attractive from an economical, social, and environmental perspective, this role is also supported by the proxy vision for urban freight transport (section 6.1). Thus, the fiduciary perspective of urban freight transport aligns with the description of sustainable development. Sustainable development is, according to chapter three, inherently a positive development. However, in the perspective of urban freight transport this homogeneous interpretation of sustainable development may be an unquestioning outlook because this outlook does not account for the goal-conflicts of urban freight transport, as specified in section 5.3 there are several goal-conflicts that have been identified amongst stakeholders. These conflicts make it impossible to achieve a fiduciary perspective that aligns with sustainable development, to the extent that all shareholders are satisfied since there is need to compromise. From the perspective of public authorities does this entail three alternatives: (1) one stakeholder must compromise, (2) several stakeholders must compromise, or (3) authorities must provide offset the costs by providing incentives.

The customer perspective refers to, as mentioned in chapter three, the activities that is necessary to ensure that the customers are satisfied. The customers, in the perspective of public authorities, refers to the: (1) residents, (2) shippers, and (3) freight carriers.

Residents of urban areas demands, as mentioned in chapter three and four, freight transport with high service levels, and that contributes to accessibility of goods, minimal impact on congestion, minimal contribution to pollutions and the number of accidents, and that freight transports support a high standard of living by contributing with employment and commerce. In order to achieve the vision of urban freight transport in the perspective of resident these factors must be addressed. Shippers stresses, as mentioned in chapter three and four, the importance of the ability to minimize costs and maximize reliability. Freight carriers are, as mentioned in chapter three and four, firstly interested in accessibility, and second in utilization.

The internal perspective of urban freight transports is, as mentioned in chapter three, the business processes that the organization must excel at to satisfy its customers. During workshop one it was identified that in order to improve decision-making in regards to urban freight it is essential to: (1) establish what kind of data is needed to be collected, and (2) apply these decisions with minimal negative consequences on each stakeholder’s critical success factors.

Critical success factors are, factors that in some perspective is regarded as essential. Different critical success factors for stakeholder of Swedish urban freight transport was identified by stakeholders during the workshop one and two (Section 4.1-4.2), from this their linkages in regards to their dependency have been established.

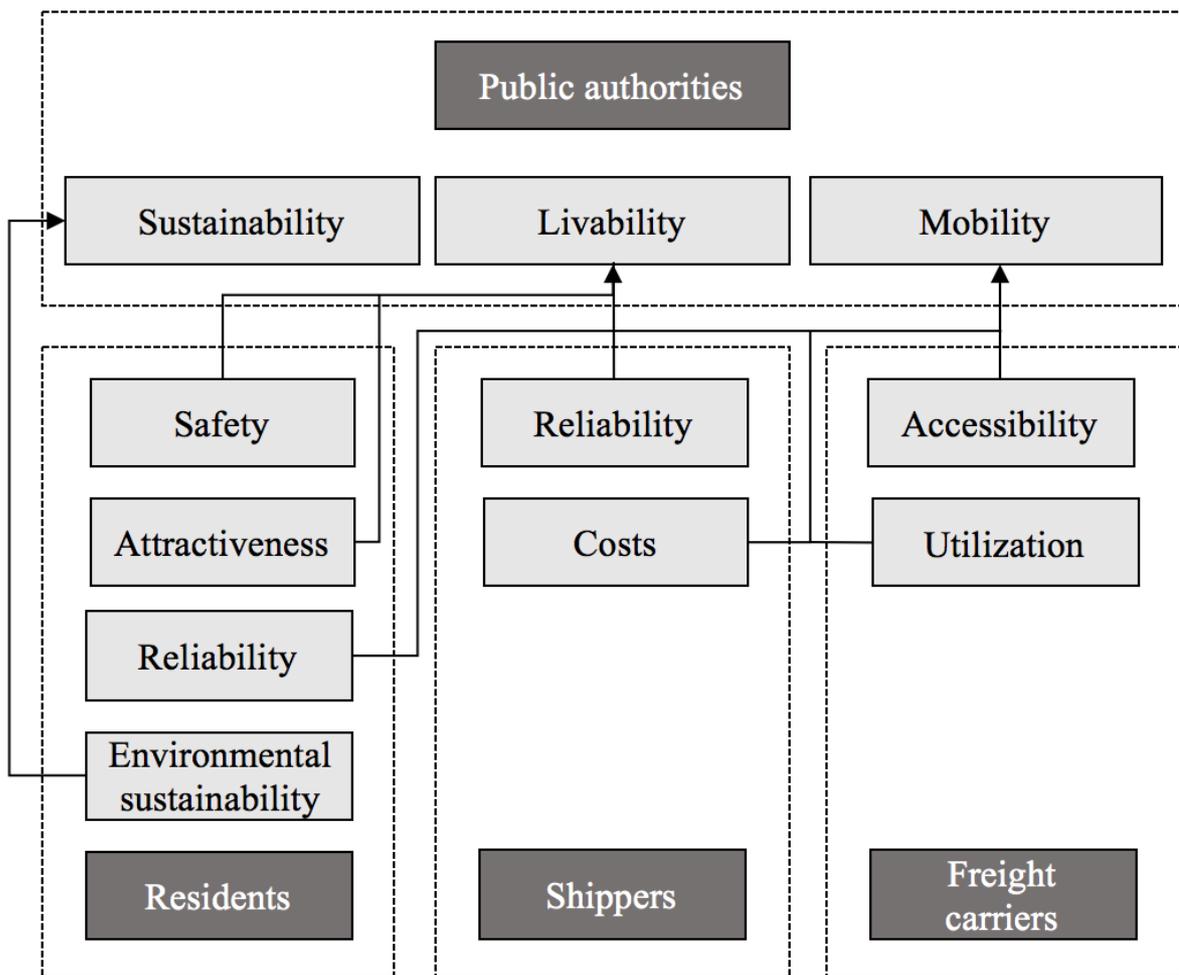


Figure 25 – Critical success factors and their linkages to the objective dimensions of Swedish urban freight transport

From the perspective of residents four critical success factors have been identified: (1) safety, (2) attractiveness, (3) reliability, and (4) environmental sustainability. Safety in regards to urban freight transport refers to factors such as number of accidents or the number of related deaths, this is a livability issue. Attractiveness refers to the relative attractiveness of urban living, in the perspective of residents this concerns livability factors such as the accessibility, stable housing market, employment opportunities, recreational areas, and access to infrastructure. Reliability refers to reliable transportation of goods; this refers to mobility issues such as congestions. Environmental sustainability primarily refers to pollution with local impact, such as noise.

From the perspective of shippers two critical success factors have been identified: (1) reliability, and (2) costs. Costs refers to the cost of logistics services, such as packaging.

From the perspective of freight carriers two critical success factors have been identified: (1) accessibility, and (2) utilization. The accessibility refers to the smoothness of city traffic. Utilization refers to the ability to maintain a high load factor in the trucks, and to minimize the amount of time that the trucks are empty.

The learning and growth perspective refers to, as mentioned in chapter three, how the organization must learn and improve to achieve the vision. This issue connects to the scenario planning analysis, and situational awareness in chapter three. By establishing how the organization can learn how to account for uncertainties and leverage performance indicators the firm should, according to theory, be better equipped to handle an uncertain environment.

### 5.3 Analysis of research question three

In order to investigate if there is any goal-conflicts regarding the critical success factors a goal-conflict matrix have been established. Three core goal-conflicts have been identified during workshop one and two (Section 4.1-4.2): (1) Safety-Accessibility, (2) Reliability-Environmental sustainability, and (3) Reliability-Utilization. The safety-accessibility conflict refers to the aspect that increased accessibility in cities is decreasing traffic security because it increases the pace of traffic, or since it opens up restricted areas for freight traffic. The reliability-environmental sustainability and the reliability-utilization conflicts was identified during workshop two, the conflicts stems from customers demanding shorter lead times and more reliable deliveries. Freight carriers have, in order to be more responsive to this, decreased their utilization rate of freight transports, this increase in traffic have implications on the environmental impact of logistics service.

	Safety	Attractiveness	Reliability	Env. sustainability	Costs	Accessibility	Utilization
Safety	Black	Light Green	Light Green	Light Green	Light Green	Red	Light Green
Attractiveness	Black	Black	Light Green	Light Green	Light Green	Light Green	Light Green
Reliability	Black	Black	Black	Red	Light Green	Light Green	Red
Env. sustainability	Black	Black	Black	Black	Light Green	Light Green	Light Green
Costs	Black	Black	Black	Black	Black	Light Green	Light Green
Accessibility	Black	Black	Black	Black	Black	Black	Light Green
Utilization	Black	Black	Black	Black	Black	Black	Black

Figure 26 - Goal-conflicts of urban freight transport. Red indicates a potential conflict

The goal-conflicts are, from the perspective of public authorities, an obstacle to fulfill the vision of urban freight transport. From the perspective of public authorities to goal-conflicts can be resolved either through regulation, or by providing incentives to offset the conflicts. In order for public authorities to establish how such conflicts can be resolved is by establishing their relative importance, thus understanding to what degree each stakeholder is invested in each sub-objective, this would make it possible to isolate large and minor conflicts.

Based on the internal ranks identified in workshops one and two and the questionnaire (Table 12-13). It is possible to identify that the safety-accessibility is a major conflict, so is the environmental sustainability-reliability conflict. In comparison, the utilization-reliability conflict is smaller.

	<b>Safety</b>	<b>Reliability</b>	<b>Environmental sustainability</b>	<b>Attractive city</b>
<b>Safety</b>	1	3,67	0,89	4,67
<b>Reliability</b>	0,27	1	0,21	2,04
<b>Environmental sustainability</b>	1,13	4,66	1	4,33
<b>Attractive city</b>	0,21	0,49	0,23	1
<b>Sum</b>	2,61	9,81	2,33	12,14

Table 12 – Respondent mean results of AHP test

	<b>Safety</b>	<b>Reliability</b>	<b>Environmental sustainability</b>	<b>Attractive city</b>	<b>Sum</b>	<b>Weight</b>
<b>Safety</b>	0,38	0,37	0,38	0,39	1,52	0,38
<b>Reliability</b>	0,10	0,10	0,09	0,17	0,47	0,12
<b>Environmental sustainability</b>	0,43	0,47	0,43	0,36	1,69	0,42
<b>Attractive city</b>	0,08	0,05	0,10	0,08	0,31	0,08
<b>Sum</b>	1,00	1,00	1,00	1,00	4	1

Table 13 – Normalized results of AHP test and weights from the perspective of residents

Stakeholder	Factor	Internal rank
Residents	Environmental sustainability	1
	Safety	2
	Reliability	3
	Attractiveness	4
Freight carriers	Accessibility	1
	Utilization	2
Shippers	Reliability	1
	Costs	2

Table 14- Internal rank of critical success factors from a stakeholder perspective

## 5.4 Analysis of research question four

In order to connect scenarios to the performance indicators and goals-conflicts a criteria tree have been established. The levels have been tiered in the order of: (1) vision, (2) stakeholders, (3) sub-objectives, and (4) KPIs. The linkages of certain KPIs and influence factors in the scenario model have also been established.

The weighting of tier one is trivial since it is the only entity in the first tier. Tier two is not as obvious, it represents the stakeholders of urban freight transport that are affected by the policy measures of public authorities, which are residents, freight carriers, and shippers. Since it has been identified in workshop one and two, and in literature that these stakeholders all are pivotal to achieve performance in the livability, mobility, and sustainability factors each stakeholder will be assigned equal weights (Figure 27).

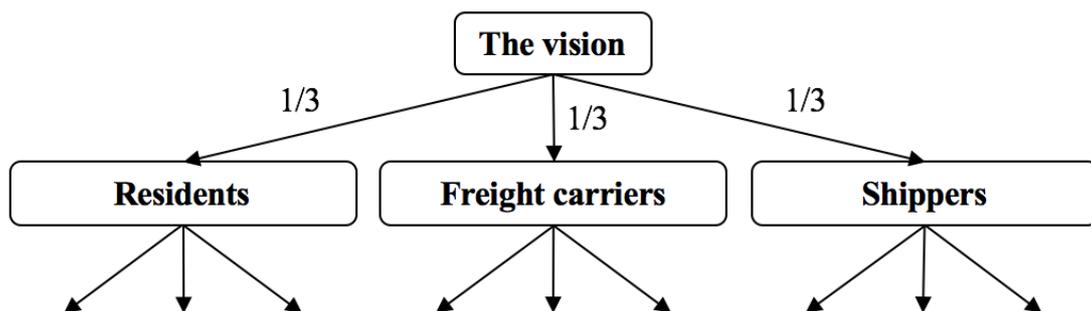


Figure 27 – Tier 1 and 2 of the model

In order for the policy measures to be successful, they have to be assessed from the critical success factors of each stakeholder.

From the perspective of residents their preferences regarding the critical success factors is presented in figure 25. These relative preferences have been established as weights for the critical success factors (Figure 28).

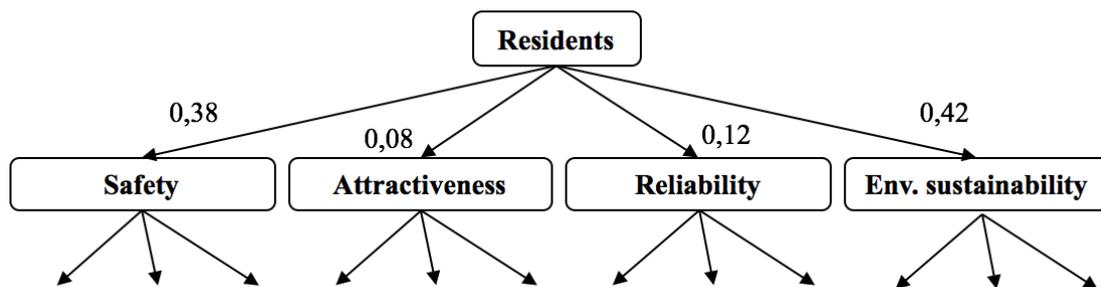


Figure 28 – Residents, weights and linkages

During the workshops it was established that the most critical success factor for shippers was strongly emphasized on reliability. Also, amongst freight carriers the emphasis was strongly directed towards accessibility. By Adopting the framework proposed by Saaty (2008), we have a numerical value for alternatives that strongly prefers one alternative to the other (Table 15-16).

	Reliability/Accessibility	Costs/Utilization
Reliability/Accessibility	1,00	2
Costs/Utilization	0,5	1,00
Sum	1,5	3

Table 15- Approximated weight of critical success factors using AHP analysis. Part one

	Reliability/Accessibility	Costs/Utilization	Sum	Weight
Reliability/Accessibility	0,67	0,67	1,33	0,67
Costs/Utilization	0,33	0,33	0,67	0,33
Sum	1	1	2	1

Table 16 - Approximated weight of critical success factors using AHP analysis. Part two

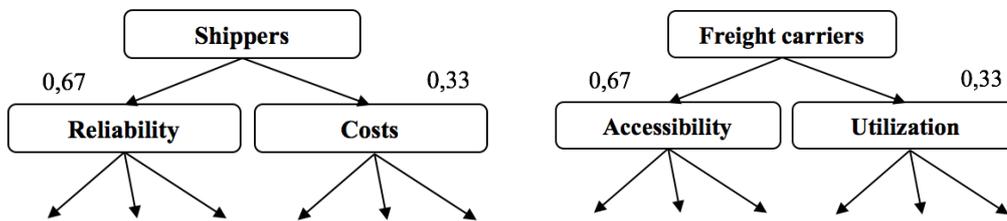


Figure 29 – Shippers, freight carriers, weights and linkages

Tier	Factor	Relative weight
1	The vision	1,00
2	Residents	0,33
	Freight carriers	0,33
	Shippers	0,33
3	Safety (Residents)	0,38
	Attractiveness (Residents)	0,08
	Reliability (Residents)	0,12
	Environmental sustainability (Residents)	0,42
	Reliability (Shipper)	0,67
	Costs (Shipper)	0,33
	Accessibility (Freight carrier)	0,67
	Utilization (Freight carrier)	0,33

Table 17 – Normalized weight distribution of performance indicators. The factors in tier three are coupled with the factors in tier two, the reliability factors are thus weighted from the perspective of residents and shippers

Path	Total weight
Reliability (Residents and Shippers)	0,26
Accessibility (Freight carriers)	0,22
Environmental sustainability (Residents)	0,14

Table 18 – Paths with the most significant weight

Table 17-18 provides an evaluation of the relative importance for sub-objectives of urban freight transport. The model indicates that issues regarding environmental sustainability, reliability of freight transport, and the accessibility in cities are most performance enhancing in the system.

This model provides an estimate of the relative importance of the critical success factors (section 5.2). However, as mentioned in section 3.8, key performance indicators should be tested after they have been developed. If it is discovered that they do not accurately describe the real weights, they should be redistributed. This framework provides a first iteration of such an iteration process.

In section 4.4 several performance indicators from an economic, social, and environmental perspective was recognized. Since environmental sustainability, reliability, and accessibility have been identified as the most influential influence factors for performance in the perspective of stakeholders, measurement of related performance indicators should be most influential for increased performance.

- In the perspective of environmental sustainability, noise and particle emissions are key performance indicators of significance.
- In the perspective of reliability, percentage of deliveries in time and percentage of undamaged goods are key performance indicators of significance.
- In the perspective of accessibility, freight time value are important such as lead time, goods volume, number of terminals, number of loading zones are key performance indicators of significance.

The scope of corporate environmentalism, presented in section 4.3, introduces the scope where policy efforts are beneficial from the perspective of different stakeholders. In the perspective of policy makers of Swedish urban freight transport, the identification of the scope, in regards to the critical success factors, could provide insights of how to manage stakeholder reactions to future policies. For instance, reliability was identified as a policy effort that is in the interest of both residents and shippers (section 5.4). However, reliability have also been identified as a conflicting goal to environmental sustainability, and to utilization of freight transports (section 5.3). Policy makers could, in order to account for these conflicts, establish procedures to estimate and measure the relative effects of reliability efforts in regards to environmental sustainability and utilization, to determine what data to collect and what incentives are suitable to offset the possible effect on environmental sustainability and utilization of freight transports.

## 6. Discussion

By applying the scenario planning process, it is possible to establish a framework for strategy alignment of activities, objectives, and influence factors. By applying the process on the scenarios presented in section 4.6, the first four steps of the process can be excluded, thus this discussion will apply the scenarios on steps five and six of the scenario planning process, namely: (1) Strategy definition, and (2) Monitoring.

The success factors in different scenarios can be fundamentally different, this means that a specific strategy can be disproportionately effective in regard to different future outcomes. In order to develop a strategy that aligns with the vision and drives for positive development of urban freight transport a strategic corridor should be developed.

By observing the scenarios, it is assumed that an administrator of Swedish urban freight transport desires to create a setting which increases the rate of technological innovations and the amount of urban freight volume. The creation of such a setting necessitates an investigation of how to incite each parameter.

The amount of urban freight transport volume, is intrinsically positive in the perspective of urban freight transport. Increased volume of goods correlates with an increased economic activity (Holmgren, 2012), increased volume of goods increases the customizability for customers (Lu and Storch, 2011), and the customized goods correlates with increased profitability for businesses (Abdelkafi et al, 2011; Duray, 2011). There are some indirect effects of an increased amount of urban freight transport. Increased volume of urban freight without an increased load factor of freight trucks would increase the number of freight trucks, and thus influence pollution, congestion, and other environmental and social factors. However, due to uncertainty regarding their impact, further involvement of these effects have been omitted in this discussion. Also, with increased adaption of information technology these effects could be offset with increased utilization of route optimization tools (Moen, 2015).

The second dimension, the rate of technological innovations, is assumed to be intrinsically positive in the perspective of urban freight transport. New technology provides the possibility to push the boundaries of existing practices, and such development is presumed to be positive. Behaviours that influence the uncertainty regarding the rate of technological innovations have been investigated. There are many factors that influence the rate of technology innovations. Innovation is a factor of internal and external factors, for instance, firms that internationalize are exposed to various competitive environments and are more adaptable than their local contemporaries. Also, since innovation activities generally are concentrated in a geographical area a method of systematically obtain this knowledge from the core innovative regions to the regional innovative regions is incremental for adoption. This provides motivation for the participation in national, regional, and sectorial innovation systems, that provides the infrastructure for such information sharing.

Since neither the trends nor the uncertainties are inherently quantifiable, the set of performance indicators recognized in section 4.4 have been coupled with the influence factors identified by Trafikanalys (2014) in Figure 30-31. In order to monitor the development of each scenario dimension these performance indicators should be monitored since they are assumed to reflect the development of the trends and the uncertainties.

Influence factors	Indicators
Amount of urban freight transport	Total goods volume
Customization	Lead time, On time delivery
Urbanization	Vehicles recorded, Licence holders, Response time of police department
Economical growth	Population living in poverty, Value of commercial and industrial properties of the total value of properties, City unemployment rate
Cost of transportation	Price/Cost, Total energy use, Percentage reusable energy
Demographic change	Unemployment rate, Average life expectancy

Figure 30 – Influence factors and performance indicators of the amount of urban freight transport volume and associated uncertainties. Greyed influence factor marks the scenario dimension. White influence factor marks uncertainties.

Influence factors	Indicators
Rate of technological innovations	Price/Cost, Lead time, Load factor, on time delivery, total energy use, percentage reusable energy, noise, emissions of PM/NO <sub>x</sub> /SO <sub>x</sub>
Level of political interest	Annual number of public transportation trips per capita, loading zones, terminals, weight capacity, response time of police department
Level of private-public cooperation	Loading zones, terminals, noise, Total collected municipal waste per capita, Percentage of the city's solid waste that is recycled

Figure 31 - Influence factors and performance indicators of the rate of technological innovations and associated uncertainties. Greyed influence factor marks the scenario dimension. White influence factor marks uncertainties.

The weights of the model (section 5.4) are dynamic and dependent on, internal and external factors of stakeholders. The assumption is consequently that strictly directing efforts on the influence factors that are identified as most influential (Section 5.4) is not the most performance enhancing strategy over time, since the relative importance of efforts of the influence factors will adjust. Also, the importance of resilience may increase due to a number of influence factors, for instance an increased uncertainty regarding the environment due to global warming is potentially such a factor. These issues would require decision-makers to reiterate the weighting process continuously, to ensure high performance efforts regarding urban freight transport.

## 7. Conclusions

This chapter describes the thesis conclusions based on the theoretical framework, results from data collection and scenario analyse. Lastly a description of contributions and further research areas is presented.

The purpose of this thesis was:

*To analyse urban freight transport with the purpose to investigate how performance indicators can be used to attain long-lasting effects on policy measures that aligns with strategies for sustainable urban freight transport.*

The thesis work concerned two issues: (1) the realization of long-term objectives in the perspective of policy measures, and (2) the measurement of policy measures in regards to sustainability.

Concerning the realization of long-term objectives, it was established that in order for policy efforts to be effective policy efforts must align with the vision of urban freight transport, as well as accounting for uncertainties. The vision of Swedish urban freight transport puts large emphasis on liveability factors, and little emphasis on resilience. This was interpreted that liveability issues are most important in a Swedish perspective. In order to establish an improved performance of urban freight transport it is important to measure and address trends and influence factors of this development.

- In the scenarios that was implied that in order to measure the performance of the amount of freight transport, influence factors such as customization, urbanization, economical growth, cost of transportation, demographical change, are of influence.
- In order to establish an improved performance of technology innovations, or the adoption of technology innovations it was implied that knowledge sharing, data quality, level of political interest and level of private-public cooperation, are of influence.

In order to measure these influence factors data, have to be collected, in order to establish data collection with a quality level that is enough to fulfil the objectives of urban freight transport discrete models, such as surveys, are most likely not enough, since they do not provide information of traffic flows and reliability. In order to fulfil the objectives, it is suggested that real-time data collection in collaboration between stakeholders is necessary. This would provide decision-makers with the prospect of eliciting the measurements that are of most significance to performance, in the perspective of all stakeholders. From the perspective of urban freight transport performance, it was suggested from the applied model that environmental performance was most critical in the perspective of residents, reliability performance was most critical in the perspective of shippers, and accessibility was most important in the perspective of freight carriers.

In order for collaboration for information sharing between public authorities, freight carriers, and shippers to be feasible, it was identified that it is important for each stakeholder to fulfil their most critical factors. If freight carriers do not gain access to accessibility data, they will be less inclined to share their freight data, and if reliability data is not accessible to shippers, they will be less inclined to share theirs.

By investigating research question one, it was established that liveability, environmental sustainability, and mobility factors are emphasised by logistics experts in their visions for Swedish urban freight transport. It was also established that resilience, in relation to the other objective-dimensions, is emphasised less (Section 5.1).

By investigating research question two, the critical success factors for residents, freight carriers, and shippers was established and their linkages to the objective-dimensions of Swedish urban freight transport was framed (Section 5.2).

By investigating research question three, three main stakeholder conflicts was identified: (1) Safety-Accessibility, (2) Reliability-Environmental sustainability, and (3) Reliability-Utilization, as well as their relative importance (Section 5.3).

By investigating the relative importance of the success factors of Swedish urban freight transport the three most critical success factors was identified: (1) Reliability, (2) Accessibility, and (3) Environmental sustainability (Section 5.4).

### **7.1.1 Contributions**

This study have concentrated on the performance of urban freight transport measures from the perspective of public transport authorities. The focus of the thesis have been on the establishment of influence factors of urban freight transport and the elicitation of stakeholder interests and conflicts. By adopting theory in strategic management, scenario processes and city logistics, and by collecting data from logistics specialists and residents the thesis have established a conceptual framework for determining the effectual efforts in Swedish urban freight transport.

In addition, by establishing the relative importance of influence factors decision-makers of urban freight transport can use the results to investigate the most suitable ways for policy efforts in regards to data collection, investments, and collaborations.

### **7.1.2 Criticism**

This thesis relies on data that was extracted during workshops, interviews, a questionnaire, and literature. Although the results from the workshops and interviews were validated by participants, it is conceivable that another approach or another set of logistics experts would have elicited different results. The questionnaire was limited in regards to size and geographical spread, it is also conceivable a different approach would have resulted in different results.

Several assumptions were made during the analysis, for instance it was assumed that each stakeholder is of equal importance in the perspective of freight performance. However, it is possible that each stakeholder carries different importance. Also, it was assumed that increased urban freight volume and an increased adoption of technological innovations is a inherently good development, however, it is possible to argue that increased consumption of goods have implications, such as increased waste, and that many technological innovations have environmental implications, such as increased energy consumption.

### **7.1.3 Further research areas**

As the thesis subject is rather broad aim than less, there is interesting research areas within the urban freight transport to further investigate. The results from the workshops indicated that there is less information sharing between the stakeholders and freight

carriers. There is need for more case studies and workshops at the local level to allow further assessment of local dimensions of urban freight transport. From a freight carrier perspective, they must know what is it in for them trading information. Remarkable is that they saw benefits in obtaining traffic information from authorities. Therefore, further study on freight carrier's perspective and their benefits of trading information could be in interests for the municipalities and public authority. The municipalities and the public authority must somehow guide and show that it is profitable with exchanging information. In association with data collection, it somehow showed from the workshops that there is sources with available urban freight data that are not really full investigated. This could attribute for further research, with the scope to understand what it could be used to.

In addition, increased trends such as economic growth, cost of transportation and e-commerce are factors that influence amount of urban freight transport. The urban freight transport relies much on how to handle information and using some sort of transport modelling. The authors investigated in a French transport model called Freturb which was rejected due to limited information. As mentioned in the interview with Laetitia Dablanc the model is mostly dependent on the French culture. As it seemed that the model is working well in French, further study on this transport model could be in interest, perhaps inspiring transport models on the Swedish environment.

As this thesis did not have any focus on e-commerce, the negative effects on the environment could be in interests for further investigation for finding improvements for a better environmental solution. Innovations of e-commerce solutions for route optimizing can help providers to increase their delivery efficiency. Development of sustainable solutions requires that stakeholders are involved. It could for example be politician regulations and system innovations (Fitcher, 2003).

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## 9. Appendix

### 9.1 Appendix 2 - Questionnaire with Laetitia Dablanc

Could you describe who Laetitia Dablanc and what you are working with?

Could you briefly explain what your research involves?

The authors have been investigated in a transport model called Freturb, what do you know about the model?

Is it possible to use the model Freturb in Sweden?

Do you have any source where we can get more information about the Freturb-model?

## 9.2 Appendix 2 – Questionnaire

Please rate what is most important for you in regards to urban living. Using the definitions described in the table on the bottom half of the page.

Safety concerns how important it is for you to feel safe in the city in regards to traffic.

Reliability concerns how important it is for you that deliveries in the city are reliable.

Environmental sustainability concerns how important it is for you that traffic have minimal impact on noise levels and the amount of emissions.

Attractive city concerns how important is it for you that there are recreational activities, green areas, and housing available in the city.

	<b>Safety</b>	<b>Reliability</b>	<b>Environmental sustainability</b>	<b>Attractive city</b>
<b>Safety over...</b>				
<b>Reliability over...</b>				
<b>Environmental Sustainability over...</b>				
<b>Attractive city over..</b>				

<b>Intensity of importance</b>	<b>Definition</b>	<b>Explanation</b>
1	Equal importance	Equal contribution to the objective
2	Weak or slight	
3	Moderate importance	Slight favour for one activity
4	Moderate plus	
5	Strong importance	Strong favour for one activity
6	Strong plus	
7	Very strong	Very strong favour for one activity
8	Very, very strong	
9	Extreme importance	Highest possible favour for one activity