Move! Bringing Urban Public Transportation towards Sustainability

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Abstract:
Today’s societal development is not sustainable. The transportation sector has the potential role to be a tremendous lever for sustainability due to its central position in the societal structure as well as for the current unsustainable trends that occur in this system.

Recommendations to public transportation providers were made by highlighting the main existing gaps between the current transportation system and an envisioned future transportation system that could exist in a sustainable society.

To highlight these gaps, multiple perspectives were considered. These perspectives were enabled by e.g. User Journey Maps at the individual level and a holistic perspective over the broader urban transport system.

The premise is that in order to increase use rates of public transportation, there is a need to better assess and address urban travellers' needs when commuting.

For providers to have a strategic, stepwise approach and to be able to bring the public transportation system towards sustainability, the authors recommended that public transportation providers prioritize and implement future actions aligned with the three prioritization questions presented at the strategic level of the Framework for Strategic Sustainable Development and by defining a criterion that would emphasize that the users’ needs of importance highlighted in the study are fulfilled.

Keywords: Public transportation, Sustainability, User needs, Product-Service System, Strategic Sustainable Development, User Journey Map.
Statement of Contribution

Consensus would be an excellent one-word description to how this thesis was carried on and build upon. The common agreement on general and specific details was key to develop our work, supported by many other key ingredients such as positive energy, commitment and strong will to achieve something that has potential to contribute to significant improvements regarding the shift of the public transportation sector to a more sustainable path.

The majority of the overall work was conducted with all members present and participating in several long and interesting debates which served as steering strategy regarding the work developed.

During this process, responsibilities were equally distributed bearing in mind each of the team members higher skills to make the best out of this group work. Whenever tasks were performed separately, the other team members reviewed each other's parts to reinforce the continuity of the earlier referred consensus.

Thibaut contributed with his knowledgeable analysis skills, his constant ideas and contributions to the topic, which were crucial to the overall structure of our work. In addition, his great sense of humour brought a joyful but committed will to work as a group.

Oscar contributed with his creativity, overarching perspective and graphic facilitation abilities, which were fundamental to our work. Furthermore, he brought the recent experience of having done a thesis on a similar topic the previous year, which helped build on our work as it progressed. He also brought a sense of group equilibrium and practicality in many different group situations.

Luís contributed with his defying nature, challenging several aspects of the study which allowed to analyse our purpose from various perspectives, including as many relevant factors as possible in each step of the way and always keeping a strong position regarding the achievement of consensus within the group decisions. His organization skills help coordinate and keep track of the on-going tasks which were essential for the project.

Throughout our work period we have had a fun and cheerful but strongly committed working environment.

We wish to express that we have learned a lot as a group and from each other throughout this extensive and interesting process. Furthermore, it is important to state that we believe this work would not have reached where it reached if we were to perform it individually. The power of co-creation fulfilled our expectations and we are proud of what we have achieved.

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Executive Summary

Introduction

Today’s societal development is not sustainable and the potential role of the transportation sector to contribute to a sustainable societal course is large. (Cars and Röbert 2008) The transportation system is part of the broader socio-ecological system that is facing a sustainability challenge. This can be illustrated with a funnel metaphor which describes the declining possibilities to manoeuvre for society as a whole, as the demand for resources and ecosystems services increase over time while the Earth’s capacity to provide those resources is relatively diminishing.

The sustainability challenge of the transportation sector is linked to the large flows of materials and resources which directly contribute to climate change, negatively affect land use, and have other negative environmental and social impacts. Besides these issues which directly degrade the eco-systems, the transportation sector also faces a significant waste of resources which contributes to global inequalities by jeopardizing access to basic human needs and fostering local, regional, national and geopolitical tensions (Cars and Röbert 2008). Public transportation has a large potential role in moving the transportation system towards sustainability. This is due to the improved efficiencies that it could bring to the current system, through dematerialization and substitutions. Indeed, increasing the use rate of a public transport system in an urban area and having a strategic approach with regards to the use of potential financial income from that increase could make more affordable the investments in developing sustainable technologies (Röbert 2007).

To be strategic when planning for a sustainable public transport system, a clear definition of the term “sustainable society” is needed and would serve as a goal when aiming for sustainability. As stated in the idea sketch co-written by Karl-Henrik Röbert and Göran Cars (2008): “If we cannot define where we want to be, we cannot, per definition, be strategic”.

In complex systems, a planning technique that would allow to aim for a desirable future is backcasting, where planners start by building a vision of success in the future and ask themselves “What do we need to do today to reach this vision?”. By backcasting from basic principles (i.e. conditions that must be met for a system to continue in a certain state) it is possible to define a vision of success (Holmberg and Röbert 2000).

The Framework for Strategic Sustainable Development (FSSD) is a scientifically robust conceptual framework which allows to plan effectively in complex systems and move strategically towards a common goal, bounded by four sustainability principles (Röbert et al. 2002):

"In a sustainable society, nature is not subject to systematically increasing...

I. ...concentrations of substances extracted from the Earth's crust;

II. ...concentrations of substances produced by society;

III. ...degradation by physical means;

and, in that society...

IV. ...people are not subject to conditions that systematically undermine their capacity to meet their needs"
The FSSD is based on a Five Level Framework (Robèrt et al. 2002), which provides an organised mental model to plan effectively and move strategically towards a common goal within complex systems (Robèrt et al. 2002). It explicitly divides the relevant information that is needed for planning into five interrelated levels, which are System, Success, Strategic, Actions and Tools. The FSSD invites organizations to define the relevant subsystems to be studied (System) and understand the basic outlines and behaviours that are relevant to the overall goal. The principled definition inherent to this framework (Ny et a. 2006) describes the minimum conditions that are necessary for a sustainable society (Success). Additionally, in order to backcast strategically from the vision, actions should be prioritized according to strategic guidelines (Strategic) to be able to implement the most promising actions with a step-wise approach (Actions). The planning process can be supported by tools which aim to help planners reach success (Tools).

When aiming to increase the use rate of public transport as a goal, one needs to understand people’s travel behaviours. Understanding the reasons behind the relationships of people with transports is complex, especially when it comes to studying the relations between individuals and cars. Not only people are basing their transport choices on functional aspects such as comfort, speed and reliability (Van Exel et al. 2011), but there are also significant symbolic-affective motives such as social status, freedom, independence, which have to be taken into account (Steg et al. 2001). The scope of this thesis is the transportation of people occurring in urban areas, as a large share of transportation occurs in cities and is likely to keep increasing (World Bank 2011). Besides, most of the travels are currently made by car and one possible scenario is that, with the current trend of urbanization, 11.5 billion private motorized trips will be made every day in cities worldwide by 2025 (UITP 2012). Indeed, public modes of transport appear to be marginal in urban areas as 84% of the land passenger travels are made by cars (Eurostat 2010; Van Exel et al. 2011), despite the potential of urban public transportation to move the whole transportation system towards sustainability.

In sum, there seems to be a gap between the current use rate of urban public transportation and the use rate that could be observed in a sustainable society, and the purpose of this research is to help providers of urban public transportation to bridge this gap in order to reach success. Bridging the gap implied to deepen the understanding of the travellers’ needs and their current satisfaction regarding the use of public transport. This allowed some recommendations to be made to public transport providers in order for them to implement strategic actions that would maximize the use rate of these services, while strategically moving towards sustainability.

Research questions

Main Research Question: For society to move further towards sustainability, how could the use rate of urban public transportation be maximized by taking into account both the users’ needs and the public transportation providers’ perspective?

Research Question 1: Taking into account both the users’ needs and the public transportation providers’ strategies to address those needs, what are the current gaps that prevent urban dwellers from using urban public transportation and the barriers that prevent providers from reaching success?

Research Question 2: How could these gaps and barriers be addressed in order to attract more users to urban public transportation, while strategically moving towards sustainability?

Methodology

In order to structure the thesis the interactive model for qualitative research from Maxwell (2005) was used. This model is not designed to be linear but to inspire interaction between five modules of research.
Additionally, the implementation tool of the FSSD (i.e. ABCD) was used to guide the authors thinking throughout their research by backcasting from a sustainable public transportation system (Success level). The ABCD strategic planning process is organized in four steps: A. Building a shared understanding and a vision; B. Assessing the current reality; C. Brainstorming actions to close the gap; D. Prioritizing actions.

A tool inspired by a Product-Service System to better understand users’ needs is the User Journey Map. This tool allowed the authors not only to obtain a deeper understanding on the user experience when travelling but also to inform and structure the data collection, and additionally to analyse the results and to structure the discussion.

The data collection consisted of both quantitative and qualitative data. The quantitative data was gathered through a broader survey with segmentation questions to separate public transport users from car drivers, which allowed to find differences and similarities between the two segments. The qualitative data collected consisted of interviews with users of public transport while using the service to better understand the users direct feelings and satisfaction regarding public transport, but also to gather more in depth answers regarding the overall user experience. In order to understand the providers’ strategies to attract more users and their perspective on opportunities and hinders in providing public transport, interviews with providers were held. The providers were also asked questions regarding their stakeholders, decision making process and their perception on a holistic approach in public transportation.

**Results**

As described in the Methods section, the Results are organized through a User Journey Map which is divided into three phases: pre-use, use, and post-use. These correspond to a generic journey of a user of public transportation. Additionally inputs from the providers’ perspective are presented.

**Pre-Use phase:** By being aware of the importance of users’ preferences related to proximity and distance to mean of transportation, providers not only currently take measures to address them, but also aim to raise awareness to highlight the benefits of using public transportation. It was also highlighted that having a daily access to a car does not prevent people from using public transport.

**Use phase:** Users' preferences related to time – such as travelling time, waiting time, arrival in time and time information – were highlighted by users as being the most important in their overall journey. Providers are aware of the importance of these functional preferences and are currently addressing them by implementing actions that aim to reduce the time spent using the service, such as real time updates. Furthermore, it was clear that providers address different users' preferences with the information they obtained from regular surveys. It also stood out that car drivers and public transport users had similar preferences with regards to functional aspects (such as time related aspects and price) but three criteria with larger gaps could have been identified (Time travelled, convenience, comfort).

**Post-Use phase:** In this phase not only it stood out that most of the respondents tend to associate aspects to car and public transport that were in total opposition, such as freedom associated to cars and lack of freedom associated to public transport, but also it was emphasized that these deeper motives could bias the expected and remembered satisfaction of people when using both mode of transport.

**Stakeholders and the decision-making process:** In what concerns the stakeholders of these public transportation providers and the decision making processes regarding public transportation, results pointed out that usually long term decisions that take some time to be put into practice not only due to the several stakeholders involved (e.g. municipality, the politicians and other related departments), but also due to the dependence of these stakeholders that appears under a highly hierarchical decision making process.
Providers' perspective: It appeared to be very little or at least limited knowledge from the providers answers with regards to having a holistic approach in their overall strategy and when addressing the challenges that public transportation faces in today's dynamic, interrelated and complex world. In what concerns sustainability, the interviewed providers (particularly Växjö which has the goal of become Europe's greenest city), pointed out actions that are being taken with regards to environmental practices at their reach and showed to be willing to make progress in this field, should they have the right conditions to do so.

Discussion

Gaps identified through a User Journey Mapping tool

In the pre-use phase of public transport (i.e. need of mobility, considering mean of transportation, time and route information, going to mean of transport) there was a clear emphasis of the real time updates on screens at bus stands. Balcombe et al. (2004) has shown that by improving the facilities of public transport it was possible to reduce the negative effects of the waiting time in public transport. In the use phase of public transport (i.e. waiting time, payment, travelling, end of use) the time spent in public transport was of high importance. The time spent includes travelling time, waiting time, arrival in time and time information. An important finding was that car drivers in relation to public transport users’ preferences of speed and convenience were of higher priority to respondents that saw themselves as car users, which would imply that if a provider would like to attract these users they should take that into consideration. The price of travelling with public transport was also important according to respondents, but not of very high importance to users of public transport according to Witte et al. (2006) and Steg (2003). Respondents said that the drivers’ behaviour, both the driving style and the drivers’ interaction with the users’ seemed to influence their overall satisfaction when using public transport. In the post-use phase (i.e. first feeling, further reflections) most respondents were pleased with the travel.

The providers were aware of these functional aspects of public transport, as they gathered data about their users through surveys and smart cards (e.g. analysing their travel behaviours). The providers addressed these functional elements of public transport by assessing them and taking means to reduce the negative and increase the positive effects to users of public transportation.

The overall satisfaction for the user will be remembered when making a decision regarding the choice of mean of transport for the next travel. In line with the study on the expected and the remembered satisfaction (Pedersen 2011) and the symbolic-affective motives attached to cars (Steg et al. 2001), it has been found that some deeper motives related to the symbolic functions of cars are to be taken into account when approaching the resistances that public transport usage faces. The use rate of cars is reinforced by cultural aspects that are really strong in people’s mind and affect their travel behaviour, whereas public transport is granted with expected needs satisfactions that seem to be of low importance for travellers.

From a different angle it was possible to understand that the providers of public transportation had a slow decision making process in which the politicians of the municipality had a decisive influence in the directions of public transport of the municipality and there was no perspective in how the different stakeholders influenced each other. Additionally the providers of public transport wanted more collaboration between stakeholders of public transport in order to improve their services. The providers’ perception regarding sustainability seemed to be limited to the environmental benefits of using public transport.

Addressing the gaps

The suggested recommendations to providers of public transport are to maintain and improve the functional aspects, as they currently seem to be doing, once all the functional aspects studied appear to be of importance for public transport users. Providers could put a particular
emphasis on aspects where the largest gaps between expectations of car drivers and PT users, such as Travelling time, convenience and comfort in order to maintain and increase the use rate of public transport. More importantly, the main reasons of not using public transport could be found in the lack of freedom and the dependence that are associated to public transportation. In order to address these gaps the authors suggest incorporating in the public transportation system cars or other modes of transport capable of fulfilling the users’ expected needs satisfaction of freedom and independence and also to make evident through media how these expected need satisfaction can be fulfilled through public transport.

This study highlighted that both providers of public transportation interviewed wanted to have more collaboration with stakeholders in order to improve their service, and that was seen as an important factor to be able to attract more users. Additionally, it has been shown that more collaboration between stakeholders of relevant subsystems of the public transport system could lead to a significant improvement of the quality of the service and an increase in the use rate.

**Conclusion**

Studying peoples’ travelling needs through a User Journey Map, and inspired by a Product-Service System led the authors to deepen the understanding of peoples' travel behaviours which revealed the complexity of this field of research.

Despite these clear and personal relationships with transport, it appeared that car drivers and public transportation users had a very close travel preference which was a sign that these preferences were not enough to explain the choice of using either a private or a public mode of transport. However, it seemed that the expected needs satisfaction of people when using public transport was underestimated, while the expected needs satisfaction of driving a car was overestimated, which highlighted a major gap linked to potential misjudgements that would bias the choice of the mode of transport. Although it seemed that the users’ satisfaction was one of the top priorities for public transportation providers, it has been emphasized that the decision making process lacked of reactivity and of a broader system perspective to efficiently address users' needs in order to attract more users. Furthermore, even though their visions of success incorporated an environmental dimension, it was clear that these were incomplete to reach sustainability and thus, the vision of success for public transportation set by the authors. It was then possible to brainstorm recommendations that would be likely to address the previously presented gaps and therefore increase the use rate of the public transport system. The authors focused on the recommendations that would address the functional preferences (e.g. speed and comfort) where the main gaps were identified between car drivers and public transport users, as well as the recommendations that would address the gaps identified in the sociological and cultural motives (e.g. freedom and independence) when choosing the mode of transport.

To ensure that the public transportation system reaches strategically its vision of success while potentially bringing the whole transportation system towards sustainability, it has been underlined that public transportation providers should implement and prioritize future actions by defining a criteria that would ensure that the users’ needs of importance highlighted in the study are fulfilled and that those needs could be more easily identified and addressed by using a tool such as a User Journey Map. Providers were also advised to prioritize the actions with the three prioritization questions, as defined in the introduction.

By scoping down to the drill hole of public transportation, the authors have understood the potential role of public transport to shift the transportation system towards sustainability by reaching its own vision of success. Furthermore, the holistic and strategic approach used in this study allowed them to understand the required collaborations between all subsystems involved in the socio-ecological system to bring Society as a whole towards sustainability.
Glossary

**ABCD strategic planning process**: A process to implement the conceptual Framework for Strategic Sustainable Development in an organisational context to facilitate backcasting from sustainability principles.

**Agenda 21**: Is the document elaborated in consensus between governments and civil society institutions of 179 countries, and approved in 1992 during the United Nations Conference on Environment and Development, held in Rio de Janeiro. It translates into actions the sustainable development concept.

**Backcasting**: A method in which a successful outcome in the future is imagined and steps are defined to reach that vision of success in the future.

**Backcasting from Sustainability Principles**: As above but ensuring that the vision includes complying with the four sustainability principles so the goal being worked towards in feasible in a sustainable society.

**Bus Rapid Transit (BRT)**: A high-quality bus based transit system that delivers fast, comfortable, and cost-effective urban mobility through the provision of segregated right-of-way infrastructure, rapid and frequent operations, and excellence in marketing and customer service. BRT essentially emulates the performance and amenity characteristics of a modern rail-based transit system but at a fraction of the cost.

**Decision-making**: A person who has the authority to make decisions. Decision-makers do not always have formal authority; they can also be the individuals within an organization or community that make decisions behind the scenes.

**Dematerialization**: The reduction of resources needed to satisfy the same function or need. In simple terms it means ‘Providing the same service with less resources’.

**Five Level Framework**: A generic framework for planning in complex systems. It comprises five interdependent levels: (1) system, (2) success, (3) strategic, (4) actions and (5) tools.

**Framework for Strategic Sustainable Development (FSSD)**: A systems based framework that identifies the ecological and societal conditions necessary for human survival within the finite limits of the biosphere. The FSSD is structured in 5 levels (System, Success, Strategic, Actions and Tools) and a key aspect is the strategic use of backcasting from the four Sustainability Principles.

**Holistic**: Originates from the Greek word ‘Holism’, meaning ‘whole’, and was described by Aristotle as follows “The whole is different from the sum of its parts”. It implies that the parts in a system can only be understood once you understand the system they are in.

**Product-Service System**: or PSS is a system of products (tangible) and services (intangible) and the supporting networks and infrastructure needed to deliver them. The underlying goal of a PSS is to meet user needs and be more sustainable than traditional business models.

**Public Transportation (PT)**: Transportation can be defined as any way of moving someone or something from a point A to a point B.
**Reductionism**: A particular way of thinking about systems, proposing the notion that if every detail in a system is studied with scrupulous care, the entire system will eventually be understood.

**Servitization**: The process of shifting a product-centric value offering to a service oriented value offering.

**Socio-ecological System**: The combined system made up of the biosphere, human society, and their complex interactions.

**Stakeholders**: Stakeholders are defined as entities or individuals that can reasonably be expected to be significantly affected by the organisation’s activities, products, and/or services; and whose actions can reasonably be expected to affect the ability of the organisation to successfully implement its strategies and achieve its objectives.

**Strategic**: Using strategic guidelines to select and prioritise tools and actions that help reach success within a sustainable society. From the perspective of project management on EV projects, strategic means acting and planning intentionally in a premeditated, coordinated and tactical manner towards a set goal.

**Strategic Planning**: A systematic, forward-thinking process whereby organisations plan their future direction and define the strategic steps towards their set goal.

**Strategic Sustainable Development**: Using strategic guidelines based on ‘backcasting from sustainability principles’ to plan and implement actions that assist society to move towards a sustainable future.

**Substitutions**: Changing to new types of materials, flows, management routines for ecosystems or even mind-sets.

**Sustainability**: A state in which the socio-ecological system is not systematically undermined by society. Society must be in full compliance with the four SPs to achieve full sustainability.

**Sustainability Principles**: Principles that are meant to be used in order to achieve sustainability.

**Sustainable Development**: A term first used in 1987 by the Brundtland Commission report entitled *Our Common Future*. Sustainable development refers to ensuring that, as a society, we “meet the needs of the present without compromising the ability of future generations to meet their own needs.”

**Systems Thinking**: A way of understanding systems by focusing not on the individual parts but on the interactions between them and other systems and the resulting behaviours and outcomes.

**The 5-level Framework**: A generic framework for planning and decision making in complex systems, consisting of 5 distinct, non-overlapping levels: Systems, Success, Strategic, Actions and Tools Levels.

**User Experience**: Comprises the interactions a user has with a company, its products and/or its services that make up the user's feelings and perceptions. A user judges the quality of the
experience based on their needs and motivations, the utility, the ease of use of the system and the context and time in which the experience is occurring.

**User Journey Map:** A visualization used primarily in service design to capture and present the user's service experience. It is made up of a series of touchpoints or interactions along the customer's service journey, accompanied by comments and emotional information to construct a detailed account of the overall journey.

**Vision:** A long-term view that envisages a desired future and concentrates on what an organization wants to be, or how it wants the world in which it operates to operate. It is comprised of core ideology (core purpose and values) and an envisioned future (strategic goals and vivid description of the desired future).
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1 Introduction

Today’s societal development is not sustainable and the potential of the transportation sector to contribute to a sustainable societal course is large. A part of the solution might be found in the several challenges and opportunities that are present in the transportation sector. For its central position in the societal structure, the transportation sector gathers many actors from several sectors, which highlights its possibility of co-creating and dynamising the shift towards a sustainable society (Cars and Robèrt 2008).

Furthermore, the transportation sector has not only a large potential to contribute to a sustainable societal course and but it also refers to the need of mobility which is universal (Cars and Robèrt 2008) and necessary in today’s globalized societies.

1.1 Sustainability challenge

As the Agenda 21 final paper stated at the Rio conference in 1992:

“Unsustainable patterns of production and consumption, particularly in the industrialized countries, are identified (...) as the major cause of continued deterioration of the global environment” (Brundtland 1987)

These unsustainable patterns of production and consumption began with the industrial revolution which took place in the late part of the 18th century (Ashton 1934). It is considered as a revolution, as human society shifted its economy from an agricultural to an industrial based economy. It is correlated to a dramatic increase of the labour productivity and the production of goods and services during the 19th century (Voth and Antras 2000). This period brought wealth and prosperity to the populations involved, but signed the beginning of the Anthropocene era (IPCC 2007). This era is characterized by greater impacts of human driven activities that are changing the ecological system by systematically extracting, mining, burning, transforming natural resources and degrading nature by using physical means (e.g. Biodiversity loss, Nitrogen cycle, Climate change, Ocean acidification).

These changes of the ecological system have been for instance presented in the “Planetary Boundaries” framework (Rockström et al. 2009) where the authors presented nine “planetary life support systems” and their predicted thresholds. So far, three thresholds (i.e. climate change, biodiversity loss, nitrogen cycle) have been crossed which may have already triggered catastrophically abrupt and non-linear environmental changes.
Furthermore, today’s human population is close to seven billion people and it is predicted that it will grow up to nine billion people in 2050 (UN 2010). Thus, the unsustainable patterns of consumption and production are reinforced by a growing population which tends to increase the pressure on the global socio-ecological system.

The sustainability challenge and this increasing pressure on the life support systems can be described through the metaphor of a funnel (Figure 2), which provides a visual representation of the systematic degradation and impoverishment of the socio-ecological system over time. Hence, it illustrates the declining possibilities to manoeuvre for society as a whole, as the demand for resources and ecosystems services increase over time.

**Figure 2 - The Funnel Metaphor (TNS 2012)**
Society needs to overcome this sustainability challenge by aiming for a development which does not undermine the fundamental life support systems and creates well-being for all within ecological limits (Robèrt et al. 2000).

Organizations should avoid hitting the walls of the funnel in order to avoid stricter legislation, higher costs for natural resources, higher cost for waste management, stricter environmental taxes or increased competition from organizations already being proactive and investing in sustainable practices to meet new market demands (Holmberg and Robèrt 2000).

Furthermore, for organizations to move towards sustainability there is a need for a strong commitment. A leverage point for this commitment could lay on the financial improvements such as Willard (2012) describes in his book about the business case for sustainability. In total there are seven potential economic benefits for organisations pursuing sustainability (i.e. increased revenue and market share, reduced energy expenses, reduced waste expenses, reduced materials and water expenses, increased employee productivity, reduced hiring and attrition expenses and the reduced strategic and operational risks (Willard 2012).

1.2 Planning strategically towards sustainability

Regarding the funnel metaphor there is a great need for human society to move in a sustainable direction and not in the direction where damages to the ecological system are nearly or completely irreversible (Rockström et al. 2009). The Brundtland Commission defined sustainable development as the “development which meets the needs of the present generation without compromising the ability of future generations to meet their own needs” (Brundtland 1987).

The definition for sustainability given by the Brundtland Commission is often considered too theoretical to provide operational and strategic support in order to move towards sustainability.

To be strategic when planning for a sustainable socio-ecological system (i.e. Society within the biosphere), a clear definition of the term “sustainable society” is needed and would serve as a guide when aiming for sustainability. As stated in the idea sketch co-written by Karl-Henrik Robèrt and Göran Cars (2008):

“If we cannot define where we want to be, we cannot, per definition, be strategic”

In other words, to move strategically towards sustainability, one would need to define what a sustainable society would look like and aim for it instead of aiming for a future through the mirror of the past (Holmberg and Robèrt 2000).

In order to build an effective strategic planning process for sustainability it could be helpful to identify techniques suitable to serve as a foundation of planning.

A technique used by many organisations when planning is forecasting, which takes into account current trends and information and uses it to predict the future (McCalman 2012). Relying on forecasting to predict the future, based on the current unsustainable trends and degradation of the socio-ecological system, could be a risk when planning towards a sustainable society (Holmberg and Robèrt 2000).
In complex systems, a planning technique that would allow to aim for a desirable future is backcasting, where planners start by building a vision of success in the future and ask themselves “What do we need to do today to reach this vision?” (Holmberg and Robèrt 2000). Backcasting is especially useful for solving problems that have any of the following characteristics: complex, need for major change, dominant trends as a part of the problem, problem is a matter of externalities and the time horizon is long enough to allow deliberate choice (Dreborg 1996).

It is possible to backcast from scenarios as the future vision of success. A scenario is a simplified image of the future, which is helpful to deal with emotionally-charged decisions (Robinson 1990). There are a number of disadvantages with backcasting from scenarios when planning for sustainability, such as the difficulty for different people to agree on a detailed picture of a successful sustainable result, or the technological innovations that could change the conditions for planning and making the scenario irrelevant (Dreborg 1996).

By backcasting from basic principles (i.e. conditions that must be met for a system to continue in a certain state) it is possible to define a vision of success (Holmberg and Robèrt 2000). The basic principles of success should be, necessary to achieve the goal, sufficient to achieve the goal, general enough to be used in different contexts, concrete enough to guide actions and non-overlapping, or mutually exclusive, in order to enable comprehension and structured analysis of the issues (Holmberg and Robèrt 2000).

1.3 The Framework for Strategic Sustainable Development (FSSD)

When planning in complex systems a conceptual framework can be used as a mental model, which could simplify and categorize a complex system. The conceptual framework known as the Five Level Framework (5LF) could be used for this purpose. The 5LF provides an organised mental model to plan effectively and move strategically towards a common goal within complex systems (Robèrt et al. 2002). It explicitly divides the relevant information that is needed for planning into five interrelated levels (see Figure 4).

The FSSD, based on the 5LF (see Figure 4), is the conceptual framework which serves as a problem analysis, planning, and decision-making tool for organisations wanting to move towards sustainability, by helping them to focus their planning and strategic decision making within the complex systems in which they operate (Robèrt et al. 2002).

At the System level, the FSSD invites planners to understand the basic outlines and behaviours of the system that are relevant to the overall goal (Success level). The relevant subsystems have to be defined and analysed through the principled definition of sustainability to plan in a coordinated way while aiming for the vision of success (Cars and Robèrt 2008).

At the Success level, the principled definition (Ny et al. 2006) describes the minimum conditions that are necessary for a sustainable society (Figure 3). The principles are derived by clustering known sustainability related impacts to find basic mechanisms behind those impacts, which would systematically degrade the eco-systems. By putting a “not” in those mechanisms, Holmberg and Robèrt (2000) defined basic principles which serve as guidance and trigger creativity around “out-of-the-box” solutions when planning for sustainability. These principles were scientifically agreed upon through a consensus process from various fields of research and were designed to be:
- "General enough to be valid for all imaginable scenarios of a future sustainable society;
- Necessary to achieve sustainability;
- Sufficient to cover all aspects of sustainability;
- Concrete enough to guide actions and problem solving;
- Non-overlapping, or mutually exclusive in order to enable comprehension, structured analysis of the issues and facilitate monitoring" (Broman et al. 2000).

"In a sustainable society, nature is not subject to systematically increasing...
I. ...concentrations of substances extracted from the Earth's crust;
II. ...concentrations of substances produced by society;
III. ...degradation by physical means;
and, in that society...
IV. ...people are not subject to conditions that systematically undermine their capacity to meet their needs"

Figure 3 - The Four Sustainability Principles (Ny et al. 2006)

At the micro-economic scale, an organisation that would strive for sustainability should eliminate its contribution to the violation of the sustainability principles.

At the Strategic level, actions to attain the vision should be prioritized according to strategic guidelines (and complementary guidelines adapted to the system) to identify the stepping stones and the low hanging fruits in order to implement the most promising actions that would lead to the vision (see figure 4). As planning in complex systems (i.e. socio-ecological system), requires a flexible and strategic approach due to the unpredictability inherent to such systems, backcasting from principles would allow to keep the overall goal clearly in mind throughout the planning process.

At the Actions level, actions should be strategically implemented with a step-wise approach that would permit to build actions upon each other, by taking advantage of the early return on investment allowed by the low hanging fruits and their flexibility, in terms of technical and ecological characteristics (Robèrt and Holmberg, 2000), according to the strategic guidelines presented at the Strategic level. The planning process can be supported by tools which aim to help planners reach success (Tools level).
The sustainability objectives explained through the sustainability principles can be achieved through the two mechanisms of dematerialization (i.e. reduction of material flows to produce the same goods or services) and substitutions (i.e. exchange of type of flows and or activities) (Robért et al. 2002). These two mechanisms can be paralleled and on different scales (Robért et al. 2002) which would not only decrease the material flows but also allow substitutions in line with the referred sustainability principles (e.g. changing from oil to a more efficient fuel).

Thus, in order to be strategic about achieving sustainability, backcasting from the sustainability principles is required to know what to substitute for and to be strategic when dealing with trade-offs from different decisions (Robért et al. 2002).

### 1.4 The sustainability challenge of the transportation sector

Based on the global sustainability challenge, it is possible to describe a sustainability challenge for the current transportation sector. This challenge is first linked to the flows of materials and resources which directly contribute to climate change especially through the combustion of fossil fuels either to produce vehicles and infrastructures or to fuel the current engines. All flows of chemicals, metals and gases are part of the industrial lifecycle of the traffic components as well as the sourcing and use of its energy supply that are part of a
growing problem. The challenge is also a matter of land use either for the resource bases, or for the road infrastructures and the sizes of the cities their selves. Besides these issues which directly degrade the eco-systems, the transportation sector also faces a waste of resources which contributes to global inequalities by jeopardizing access to basic human needs and fostering local, regional, national and geopolitical tensions (Cars and Robèrt 2008).

To approach and plan strategically within the transportation sector, Cars and Robèrt (2008) make the distinction between five interlinked subsystems on which this system is dependent on. All these subsystems and its interactions have to be considered when planning for sustainability within the transportation sector.

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Oilfields, coal mines, uranium mines, natural gas fields, bio alcohols from corn fields, waste, sun energy, wave energy</td>
<td>Gasoline, diesel, electricity, natural gas, ethanol (...)</td>
<td>Otto engines, diesel engines, sterling engines, hybrids (...)</td>
<td>Physical infrastructures, space available, spatial planning, soft infrastructures (education system, culture...)</td>
<td>Decision making, values, preferences, needs, political influences, peoples’ behaviour</td>
</tr>
</tbody>
</table>

Figure 5 - The five subsystems of the transportation sector (Cars & Robèrt 2008)

### 1.5 Urban public transportation as a contributor to a sustainable societal course

A public transport system in this thesis is defined as:

“A system of shared vehicles organized to fulfil users’ needs of moving from A to B”

Moving towards a more integrated and environmentally conscious strategy of economic decision-making is crucial in today’s business world (Robèrt et al. 2002).

To do so, there is a need to improve efficiency and eliminate waste by increasing resource productivity while moving towards having more function-oriented business approaches which focus on the delivered service rather than the product itself. This perspective allows to combine business efficiency through dematerialization and substitutions with a shift in current human driven activities to avoid continuously overusing many of the increasingly scarce resources (e.g. lithium) of the ecological system, having the current increasing concentrations of compounds in nature (e.g. NOx), degrading nature by using physical means (e.g. overharvesting) and to avoid preventing people’s ability from meeting their needs (e.g. scarcity of food) (Robèrt et al. 2002).

Public transportation has a large potential to move the transportation system towards sustainability for all the additional efficiencies that it could bring to the current system, through dematerialization and substitutions. However, despite this large potential of contributing to a sustainable societal course, the public transport usage is marginal compared
to the use of personal vehicles, as in 2010 84% of the inland travels were made by passenger cars (Eurostat 2010). Increasing the use rate of a public transport system could bring dematerialization to the overall transportation system by optimizing the use of the existing vehicles and thus become more resource efficient. Increasing the use rate would make more affordable impactful investments in substitutions to dynamise the shift towards a sustainable transport system (i.e. investing in sustainable technologies for a more efficient mobility management through, for instance, a more systematic use of information technologies (Robèrt 2007)).

Oksana Mont (2000) defined dematerialization as a concept that aims to reduce the environmental impact per unit of economic activity, which implies the possibility of producing the same product/service with fewer natural resources.

Not only the public transportation system has the potential to be part of the shift towards a sustainable society in terms of ecological sustainability, it has also the potential to increase the ability for people to satisfy their own needs. One could argue that through the potential dematerializations implied by an increasing public transport use rate, access to resources would be less problematic as for the geopolitical tensions fostered by the use of scarce resources in the transportation sector.

The current transportation system does not comply with the minimum conditions for sustainability (i.e. Success level) and actions should be implemented in a coordinated way in all the subsystems involved to move the system towards sustainability. The transportation system is made of the five subsystems mentioned previously which are necessarily connected to other systems. In other words, when planning in complex systems, changes have consequences on other systems that can be counterproductive when aiming for a desirable future. Considering relevant subsystems is a prerequisite when planning in the transportation system in order to identify the current critical flows and practices and ensure that the actions are taken in a coordinated way (Cars and Robèrt 2008). Analysing the five subsystems in relation to the four sustainability principles, is the required connection between all the subsystems involved in the transportation sector.

Moving the public transport system towards sustainability appears to be a step to move the global transport system towards sustainability, due to the dematerialization and substitutions implied. However, the public transport system on its own might not have the capacity to bring the entire transportation system towards sustainability as reaching the vision of sustainability has to be done in a coordinated way between all the subsystems involved.
In the same line of thought, moving the transport system towards sustainability does not have the capacity to move the whole socio-ecological system towards sustainability. However, firstly for the central position of the transportation system in the societal structure and the many actors from several sectors involved, and secondly for the current unsustainable trends inherent to it, there is a great possibility of co-creating and dynamizing the shift towards a sustainable society (Cars and Robert 2008).

1.6 The successful case of Curitiba

Curitiba is located in the south of Brazil and has 1.8 million inhabitants (City Hall of Curitiba 2013). Curitiba is best known for its innovative public transportation system that is based on buses, which it is one of many initiatives that have developed the quality of life and the environment in the city (Rabinovitch 1992). The public transportation system in Curitiba has been developed since 1970 when the authorities pointed out that the integrated transport system should aim to preserve the environment, cultural services and meeting human needs (Rabinovitch 1992). With these goals in mind, the struggle of a growing population and without the financial resources to invest in a rail system (Kubala and Barton 2003) the city of Curitiba developed and implemented the Bus Rapid Transit (BRT).

Due to the efficiency of public transport in Curitiba, the use rate of buses in the city adds up to 70% (Goodman and Scwenk 2006). Goodman and Scwenk (2006) described the BRT's similarities with a subway systems characteristic (i.e. speed, efficiency and reliability) and the recipe for success was to have an integrated planning, exclusive bus lanes, signal priority for buses, pre-boarding fare collection, level bus boarding from raised platforms in tube stations, free transfers between lines and large transportation capacity. The BRT systems integrate the whole city with circular lines connecting the outskirts of Curitiba (see Appendix A).
In the development of the BRT it was important to communicate the new public transportation plans to key stakeholders (ITDP 2007). Volvo collaborated with the city of Curitiba to manufacture a special type of bus (i.e. bi-articulated busses can hold 270 passengers) that was suitable for the city (Rabinovitch and Hoehn 1995). Public transportation in Curitiba is provided in partnership with private firms, where the city sets standards and the firms provide the capital, labour and management to provide the service (Rabinovitch and Hoehn 1995). The overall development of public transportation in Curitiba has mostly been driven by the municipality's policies (Friberg 2000; Pienaar et al. 2005; Rabinovitch and Hoehn 1995).

As a matter of fact, through an efficient planning process with a strong focus on the collaboration between several subsystems involved in public transportation, Curitiba was able to increase the use rate of public transportation to 70%. However, to plan strategically for a successful transport system, one could emphasize the need to understand people’s travel behaviours.

### 1.7 Travel behaviours

As Cars and Robêrt (2008) suggested in their idea sketch, almost all people have clear and personal relationships with transports which highlights the differences in terms of travel behaviour between individuals. These differences are observed through the choices of people when selecting a mode of transport to commute in urban areas.

There are different alternatives for commuting which can be classified either in the public transport system or in the private transport system. Car is today the dominant mode of transport as in the European Union (EU), as 84% of land passenger kilometres were travelled by car (Eurostat 2010), only nine per cent were travelled by bus and seven per cent by railway, tram or metro (Eurostat 2010).

Understanding the reasons behind the relationships of people with transports is complex, especially when it comes to studying the relations between individuals and cars. Not only people are basing their choice on functional aspects such as comfort, speed and reliability (Van Exel et al. 2011), but there are also significant symbolic-affective motives (e.g. Social status, pleasure, freedom, independence) which should be taken into account when aiming to shift travellers' behaviours (Steg et al. 2001). Thus, the motives behind the choice of a mode of transport cannot be reduced to the trade-offs between perceived costs and benefits (Steg et al. 2001). It is also taken for granted that people’s choices reflect their true preferences which would be measured by a certain degree of satisfaction provided (Pedersen 2011). However, with public transport, people tend to underestimate their predicted satisfaction and rely on often biased remembered satisfaction which negatively influences their current choice of travel (Pedersen 2011).

Concerning preferences linked to public transportation, previous researches regarding satisfaction have shown that the preference of waiting time was the most important on desired quality of public transportation (dell'Olio et al. 2010; dell'Olio et al. 2011). Further research has shown that the facilities (e.g. bus stands, information, and vehicles) could be improved to reduce the negative impact of the waiting time (Balcombe et al. 2004). Furthermore, according to Friman et al. (2001), punctuality was the most important factor to users. The importance of a low price to use public transportation has also been pointed out to be important to users, especially on shorter trips (Balcombe et al. 2004). Even if the price is
an important criterion to users of public transportation it is not the entire reason for not using public transportation. For instance, in Brussels, students were given the opportunity to use public transportation for free (i.e. bus) and the use rate increased but not significantly (Witte et al. 2006). It has also been shown that the drivers’ behaviour could lead to user satisfaction or dissatisfaction concerning the service (Edvardsson 1998). Moreover, the time spent on buses in public transport is of value for users (Cornet 2012). Jain and Lyons (2008) suggested that at least for the individual user, the travel time should be perceived and experienced as a gift rather than a burden.

1.8 The importance of user satisfaction

Everett and Watson (1987) described that in public transportation there has been a focus on the technical aspects of the service provided and the psychological and social aspects were not taken into account which could be even more important in the circumstance of increasing the use rate of public transport. More recently, research has shown that the psychological aspects of transportation are important in order increase user satisfaction (Steg et al. 2001; Steg 2003).

User satisfaction is important to attract users to public transportation, especially when providers of public transportation have a low use rate of their services (Andreassen 1995; Banister 1992). When providing a service user satisfaction is vital for the overall success of the organisation as value is now in the centre of the satisfaction of users (Gentile et al. 2007). Thus, organisations need to differentiate themselves and create a competitive advantage from similar services in order to generate more satisfaction to users (Edvardsson et al. 2010). As well as promoting satisfaction amongst users, it is also vital to decrease or aim to eliminate dissatisfaction, which is more decisive than satisfaction when users take the decision of using again the provided service with its previous experience in mind (Edvardsson 1998).

Additionally, researches have highlighted the importance of the user experience in the value proposition and according to Gentile et al. (2007):

“Living a positive Customer Experience can promote the creation of an emotional tie between a firm's brand and its customers which in turn enhance customer loyalty.”

This hedonic value implies the involvement of the users in the co-creation of the value proposition and i.e. the existence of unique and personal experiences (Caru` and Cova 2007). Companies have in fact two levers when creating the value that lays in the product which are the utilitarian value (i.e. directly linked to the functionalities provided by the product) and the hedonic value (i.e. the user experience). To enhance the hedonic value, Schmidt (1999) stated that companies have to provide the right environment and setting for the preferred user experiences to occur.

An emerging field of research that supports a user-centered approach is PSS, explained in the following section.

1.8.1 A user-centered approach

Due to the low and steady use rate of public transport throughout the countries of the European Union between the time period of 2000 and 2010 (Eurostat 2010), the authors aimed to present a different approach in order to find ways to attract more user to public transport. The approach drew inspiration from a Product-Service System (PSS) where the
starting point is a user need (Tukker and Tischner 2006) and which would have the potential to increase user satisfaction (Manzini and Vezzoli 2003).

The concept of PSS has been defined as:

“A system of products, services, supporting networks and infrastructure that is designed to be: competitive, satisfy customer needs and have a lower environmental impact than traditional business models.” – (Mont 2001)

“A PSS consists of tangible products and intangible services, designed and combined so that they are jointly capable of fulfilling specific customer needs. Additionally PSS tries to reach the goals of sustainable development.” – (Brandsotter 2003)

PSS highlights the shift from only selling physical products or immaterial services to selling the result of a mixture of products and services (Manzini and Vezzoli 2003). The offered value proposition from an organisation consists of tangible products and intangible services which aim to fulfil a customer need (Tukker and Tischner 2006). The assumption is that users do not really demand a product or a service itself but the function of these products and services (Manzini and Vezzoli 2003). If the user satisfaction is evident the users could see a PSS as a preferable choice (Manzini and Vezzoli 2003). The PSS concept objective is to start from a user need for business development rather than a product fulfilling this functionality and expanding the business system that provides this functionality with an environmentally friendly mind-set (Tukker and Tischner 2006).

The PSS combines products with services in a system. The process of a PSS is servicization of products and productization of services (Baines et al. 2007), as shown in Figure 7.

Figure 7 - Evolution of the Product Service-System concept. (Baines et al. 2007)

A possible enabler for sustainability

There are diverse types of PSS. Tukker (2004) identified 8 different types of PSS in three categories, ranging from Product oriented to Result oriented. The result oriented PSS is providing a function or result and it is the one with the largest potential for sustainability. It has the potential to reduce the use of energy and materials with up to 90 % (Tukker 2004),
which is attractive for organizations in both environmental and financial terms (Mont 2000; Tukker 2004; Baines et al. 2007).

**Increased user value**

PSS is also described as a way to provide more value to the customers through more customization and higher quality (Baines et al. 2007). More customization is linked to the idea of user involvement through co-production of the product-service (Mont 2000). As the user would be involved in the production process, it may be a way to better suit their needs (Baines et al. 2007; Mont 2000). The value creation and proposition in a PSS is highly important in order to offer more value to users and increase user satisfaction i.e. an individual service created especially for the user by having the users' participation (Tukker and Tischner 2006). The PSS has the potential to increase competitiveness and customer satisfaction in an innovative way (Tukker and Tischner 2006).

**A possible enabler for collaboration**

Furthermore, organizations implementing the concept of PSS face the need to change their traditional structure due to the close co-creation with users (Mont 2000), making the starting point of a PSS the users’ need (Tukker and Tischner 2006). To address the users' need through a PSS, more collaboration with stakeholders of the organization is important (Mont 2002; Morelli 2006). Through partnerships between participative actors in the sector (e.g., manufacturer, government) that are involved in PSS the users' needs could be met more effectively (Morelli 2006) and the PSS would help maintain competitiveness (Durugbo 2011).

An important element in the collaboration between stakeholders is effective information sharing across the stakeholder network (Locket et al. 2011). The PSS concept deepens the collaboration with stakeholders of the organization providing PSS (Durugbo 2011). Locket et al. (2011) found that the adoption of PSS could have a negative effect on stakeholders if they are not well integrated into the PSS delivery.

**1.9 Scope and limitations**

The scope of this thesis is the transportation of people occurring in urban areas, as a large share of these occur in cities and are likely to keep increasing (World Bank 2011).

In fact, 52% of the world population was located in urban areas in 2011 and 60% of the world population will be located in those areas by 2025 (World Bank 2011). Based on these predictions, a scenario points out that, with the current trend of urbanization, 11.5 billion private motorized trips will be made every day in cities worldwide by 2025 (UITP 2012).

With regards to OECD countries, 80% of that population was living in urban areas (World Bank 2011). This accounted for less than 10% of the total OECD geographical land area (OECD 2011). Also according to the World Bank (2011) every second person in the world has a car which would highlight that 40% of the worldwide cars would be circulating in urban areas of OECD countries which would represent less than half a per cent of all the countries land area in the world.
With regards to the 27 countries of the European Union, of the total inland travels made by people in 2010, 84% were made by passenger cars, 8,9% by busses and 7,1% by railways, trams and metros (Eurostat 2010). Between 2000 to 2010, there has been an increase in car passenger transport of 1,1%. On the one hand, travels with bus and coaches has decreased with 0,7% but there has been an increase in railways, trams and metros of 0,4% between 2000 and 2010 in the 27 European Union countries (Eurostat 2010). A particular increase in passenger car transports were felt in Bulgaria, Poland, Estonia and Slovakia regarding busses, coaches, railway, trams and metros (Eurostat 2010). Additionally, the largest decrease in car passenger transport were made in Luxembourg with 9,2% and Belgium with an decrease of 4,8% (Eurostat 2010). In summary, there has been marginal increase in car passenger travels in the Europe Union between the years of 2000 to 2010 and in the same time public transport has remained at a steady use rate throughout the European countries.

Nevertheless, this research does not aim to present only strong arguments in favour of public transportation, as the only possible transport system that would contribute to a sustainable societal course and does not aim to present arguments against cars. Instead, it aims to demonstrate how to increase the use rate of urban public transportation in those same urban areas as a stepping-stone to improve the current overall transportation system and for the benefits in terms of social and ecological sustainability presented above. Being the main alternative to the use of private motorized vehicles in urban areas, the public transport system appears to be a way to decrease the use rate of those private vehicles in urban areas while provided the same function of moving urban dweller from a point A to a point B.

### 1.10 Research purpose

Today, public modes of transport are marginal in urban areas as most of the travels are made by cars (Eurostat 2010; Van Exel et al. 2011), despite the potential role of urban public transportation to move the whole transportation system towards sustainability.

Success is achieved when the maximum number of people commutes with public transport in urban areas, while urban public transportation system complies with the four sustainability principles, as minimum conditions for sustainability.

In sum, there seems to be a gap between the current use rate of urban public transportation and the use rate that could be observed in a sustainable society, and the purpose of this research is to help providers of urban public transportation to bridge this gap.

### 1.11 Research Questions

**Main Research Question:** For society to move further towards sustainability, how could the use rate of urban public transportation be maximized by taking into account both the users' needs and the public transportation providers’ perspective?

**Research Question 1:** Taking into account both the users' needs and the public transportation providers’ strategies to address those needs, what are the current gaps that prevent urban dwellers from using urban public transportation and the barriers that prevent providers from reaching success?

**Research Question 2:** How could these gaps and barriers be addressed in order to attract more users to urban public transportation, while strategically moving towards sustainability?
2 Methodology

2.1 Research design

To structure the research, the authors used an interactive model for qualitative research design suggested by Maxwell (2005). This model is not designed to be linear but to inspire interaction between five modules of research (Maxwell 2005). These five modules and the interactions between them are shown in the Figure 8 below.

![Maxwell research design](image)

*Figure 8 - Maxwell research design (Maxwell 2005)*

The basis of this thesis derives from review of qualitative and quantitative data gathered from scientific articles, reports from organisations and institutions, books, and media regarding the subject.

Furthermore, to understand the user experience and travel behaviours, a survey was created to gather data regarding the preferences of importance to travellers and their expected needs satisfaction associated with public transportation and cars.

To deepen the understanding and collect the direct satisfaction instead of the remembered satisfaction (Pedersen 2011) of public transportation users, interviews were conducted before, during and after the respondents travelled with bus. To have a deeper understanding of the public transportation providers’ strategies to address users’ needs, the authors conducted interviews with providers of public transportation.

The data collection for the two research questions to answer the main research question is described in Figure 9 below:
2.2 **ABCD strategic planning process**

The ABCD is a four-step process designed to implement the FSSD by backcasting from the four Sustainability Principles for organizations to plan strategically towards sustainability. This planning process outline allows people to disaffiliate from current trends, rather than forecasting today’s problems into the future.

The four steps of the ABCD process (see Figure 10) are the following:

*Figure 9 - The methods to answer the research questions*
ABCD – Strategic Planning Process

A-Step: Building a Shared Understanding and Vision

In the A-step, there must be a shared understanding of what is the socio-ecological system and how it relates to the organization; the sustainability challenge, and how this is connected to the organization; the funnel metaphor; the overall concept of backcasting from the four sustainability principles; the three prioritization questions and the ABCD process (Ny et al. 2006).

After reaching a shared understanding of the strategic sustainable development the organization can then move on to the second part of the A step which consists in creating a compelling vision of their organization within a sustainable society that has the four sustainability principles as boundaries conditions. The question that should be answered to create such vision is "What do we want to create as an organization?", as well as addressing the question "How to integrate current values and goals into a envisioned, sustainable society?". (Ny et al. 2006)

B-Step: Assessing the Current Reality

Conduct a current reality assessment of the organization's current activities, highlighting where the organization is not aligned with the created vision (bounded by the 4 SPs).

C-Step: Brainstorming actions to close the gap
In this step creative thinking comes into action by brainstorming a list of actions (taking into account the 4 SPs at all times), in order to bridge the gap between the future vision and the current reality.

**D-Step: Prioritizing Actions**

In order to move towards the future vision it is essential to successfully implement the brainstormed actions. For that to happen, it requires the definition of a strategic action plan where actions are prioritized according to the prioritization questions (Figure 10) and additional preferences that could help shape this strategic action plan.

### 2.2.1 ABCD as a structured guidance process

Through the structured approach of the FSSD it was possible to understand how the urban public transportation system is connected to the global transportation system, which is in turn connected to the global sustainability challenge.

By understanding the connections between the systems previously mentioned, the authors were able to define a vision of success for the relevant system of study, by always keeping in mind the alignment with the vision of success of the socio-ecological system, in order to plan in a coordinated way towards sustainability.

Combining backcasting from success with the prioritization criteria would allow selecting actions that strategically move all the three referred connected systems towards success. The connection between the FSSD and the studied system is described in the figure below (Figure 11).

<table>
<thead>
<tr>
<th>Systems</th>
<th>Urban public transportation system within the transportation system within the Society in the Biosphere</th>
<th>Transportation system within the Society in the Biosphere</th>
<th>Society in the Biosphere</th>
</tr>
</thead>
<tbody>
<tr>
<td>Success</td>
<td>Maximize the use rate of urban public transportation, while this system complies with the four sustainability principles.</td>
<td>Satisfying transportation needs in society while complying with the Four Sustainability Principles</td>
<td>Four Sustainability Principles as minimum requirements for sustainability</td>
</tr>
<tr>
<td>Strategic</td>
<td>Strategies to achieve success in the urban public transportation system, guided by the three Prioritization Questions</td>
<td>Transportation system as a leverage point to move the Society in the Biosphere towards success, guided by the three Prioritization Questions</td>
<td>Backcasting from success combined with the three Prioritization Questions</td>
</tr>
<tr>
<td>Actions</td>
<td>Actions in line with the strategy to reach success in the urban public transportation system</td>
<td>Actions in line with the strategy to reach success in the transportation system</td>
<td>Actions in line with the strategy in order to reach success</td>
</tr>
<tr>
<td>Tools</td>
<td>Tools to support achieving success</td>
<td>Tools to support achieving success</td>
<td>Tools to support achieving success</td>
</tr>
</tbody>
</table>

*Figure 11 - Interphase table*
In order to give some recommendations to planners of the studied system, for them to be able to backcast from the vision of success, deepening the understanding of the current reality of the relevant system was the next natural step. This current reality analysis was done by assessing travellers' needs and the providers' current strategies to address those needs, which helped to understand the existing gaps that prevent providers from reaching success. Furthermore, it was also possible to assess the current providers’ perspective from a different angle, to identify other barriers potentially linked to the decision making process and a systems’ thinking approach, that could prevent providers from reaching success.

In the same line of thought, the authors brainstormed recommendations with a particular emphasis on the leverage points identified as the ones with most potential to attract car drivers.

To bridge the identified gaps and barriers by keeping in mind the vision, recommendations would need to be transformed into actions and prioritized according to the three prioritization questions and an additional criterion that would support those actions to fulfil users' needs in public transport.

### 2.3 Segmentation of travellers

The segmentation was based on Jensen (1999), where the authors identified three types of car drivers (i.e. the passionate drivers, the everyday drivers and the leisure time drivers) and three types of public transport users (public transport users of heart, public transport users of convenience and the public transport users of necessity). By asking the respondents to identify themselves with the segments where they felt that they belonged to, it was possible to identify difference and similarities of users’ needs between the various segments of users and currently non-users of public transport and their expected needs satisfaction associated to both modes of transport.

### 2.4 User Journey Map

A PSS-inspired tool to better understand users' needs is the User Journey Map. It delivers an understanding from the perspective of the user of the service to identify which touchpoints (Delitca 2010) these users have interactions with. The idea is based on "walking in the user's shoes" to better understand the journey that the user undertakes. The interactions with the provider of the service could then be improved in order to increase the overall users’ satisfaction regarding the provided service. In order to create the user User Journey Map the authors followed Temkins (2010) guidelines on mapping out the User Journey Map. The process consisted of five steps: collect internal insights, develop initial hypotheses, research user processes, needs and perceptions, analyze user research and map the user journey. In order to improve the User Journey Map the authors aimed to find relevant touchpoints for users in their overall travel and that would also help them understand the public transport provider's strategies to improve the most relevant touchpoints. In addition the authors brainstormed a simulation of a complete journey which allowed to complement the final customized User Journey Map.

This tool also allowed the authors not only to inform and structure the data collection, but also to analyse the results and to structure the discussion.
The structure of the User Journey Map consisted of three phases, Pre-Use (i.e. before using the service), Use (i.e. while using the service) and Post-Use (i.e. after the service was used) as shown in figure 12:

<table>
<thead>
<tr>
<th>Pre-Use</th>
<th>Use</th>
<th>Post-Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need of mobility</td>
<td>Consider mean of</td>
<td>Time and route</td>
</tr>
<tr>
<td></td>
<td>transportation</td>
<td>information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Go to mean of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>transportation</td>
</tr>
<tr>
<td>Waiting time</td>
<td>Payment</td>
<td>Travelling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>End of use</td>
</tr>
<tr>
<td>First feeling</td>
<td></td>
<td>Further reflections</td>
</tr>
</tbody>
</table>

*Figure 12 – Customized User Journey Map for public transport, adapted from 3D people (2013)*

As this study aims to move public transportation towards sustainability by maximizing the use rate of public transport, it was strategic to segment the users in two main groups: current users and non-users of public transport, to find similarities and differences between these.

### 2.4.1 Survey based on a User Journey Map

Through literature review on users and non-users of public transportation, a clearer picture of important factors for usage (or not) of public transportation emerged.

Based on the literature review a pilot survey was created in order to identify problems with questions, formatting, clarity, and survey length (Monroe 2012). This pilot survey was created in order to conduct a broad survey on the user experience of public transportation and travel behaviours. The questions in the survey were divided into three parts:

The first part consisted of a segmentation question on a sociological analysis on transport behaviour which highlighted two main types of travellers: car drivers and public transport users. Based on Jensen’s segmentation (1999), three types of car drivers (i.e. the passionate drivers, the everyday drivers and the leisure time drivers) and three types of public transport users (public transport users of heart, public transport users of convenience and the public transport users of necessity) have been identified. The segmentation of the types of users aimed to point out the differences and similarities regarding the travel preferences of car
drivers and public transportation users, and their expected needs satisfaction associated to both modes of transport.

In addition to the segmentation questions, 13 demographic (e.g. gender, age, cars in household, location) questions were included in the first part of the survey. The second part consisted of 13 questions to assess preferences that the respondents answered on a scale from one to five. The third part of the survey had questions about positive and negative expected needs satisfaction associated to public transportation and cars.

These preferences (Van Exel et al. 2011) and needs (Steg 2003; Steg et al. 2001) were inspired from literature review concerning surveys and research within the field of transportation. The last question was an open question regarding the respondents own thoughts on improving public transportation, which aimed to gather additional information from the respondents (Evans and Mathur 2005).

The purpose of the survey was to better understand the user experience and people’s travel behaviours and gather a basis in order to create more relevant interviews and user journey related questions. Regarding the purpose of the survey, a high number of answers and rapid data gathering were preferred. To get a high number of respondents the online survey was designed to be easy to follow and to be answered within a short time frame (Evans and Mathur 2005). It was sent online to all students on Blekinge Institute of Technology, friends and relatives of the authors and posted on several social networks between the 18\textsuperscript{th} of March and the 25\textsuperscript{th} of March 2013. The survey was created by an online service from Google, termed “Google Forms”.

\subsection*{2.4.2 \textbf{User Journey Map based interviews}}

The interviews were based on a User Journey Map (Temkin 2010) and therefore held with respondents before, during and after using public transport. The data gathered from interviews enabled the authors to draw out the meaning of what the respondents answered in more depth compared to the survey method (Kvale 1996). Interviews were useful to gather the story behind the respondents’ experiences and pursue more in depth answers regarding the topic (McNamara 1999).

The rationale for conducting interviews with users while using a service (i.e. the bus) was to capture the direct experience and not the remembered one, since people tend to not remember the strength of their emotions connected to the user experience (Kahneman 2000), as people also tend to overestimate the remembered experience and not the actual experience (Wirtz et al. 2003). Furthermore, the memories that people have from past experiences serve as a basis for their current activities and behaviour (Levine et al. 2009). It is therefore more relevant to assess the experience during the time it occurs and not collect remembered experience to avoid the bias of the remembered and predicted satisfaction when choosing a mode of transport (Pedersen 2011).

The user journey map based interviews were held in the urban area of the city of Karlskrona by going to bus stops and asking users if they were willing to answer some questions regarding public transportation. The interviews were held with users before using, during and after usage of busses concerning the public transportation services.

The interviews were prepared in such a way that they could be held both in Swedish and in English not to exclude groups of people unwilling or unable to speak one of the languages.
The average length of the interviews was around 12 minutes and 9 interviews were conducted. Each interview was recorded with a mobile phone to capture everything said in the interviews (Morgan 1997). The reason for recording the interviews was to transcribe the results, draw conclusions, and derive quotations (Patton 1987). To draw conclusions, information rich answers were chosen, in which there were often repeated words in most interviews (Patton 1987).

### 2.4.3 Structured interviews with providers of public transport

In order to gather the providers' perspective on public transportation, interviews with two providers were conducted. The questions asked were based on both the survey and the User Journey based interviews in order to find gaps between the users' experience and the providers' perspective on important factors to satisfy users' needs. Additionally, questions regarding the decision making process and the systems perspective were asked. The purpose of these questions was to understand the providers' perspective in whether they had a holistic perspective and how decisions were made to better understand the providers' limits and opportunities.

The authors were able to understand more deeply the providers' perspective by covering both factual and meaningful answers (Kvale 1996). The selected providers are located on the geographical region of south Sweden and Denmark, and that had the positive aspect of conducting interviews “face to face”. Another factor taken into account when selecting the providers of public transportation was that one would be in a metropolitan city and the other in a smaller city to see the differences and similarities between cities of different dimensions.

E-mails were sent to the selected providers with the goal of explaining the purpose of the interview and to provide information regarding the type of questions that would be presented. The e-mails were followed up with a phone call in order to schedule the interviews. An interview with two different providers was conducted in order to assess their current strategies to address users' needs and also to understand providers' current and future actions regarding the various touchpoints that integrate the User Journey Map, throughout its three different phases (i.e. pre-use, use and post-use).

The first interview was held on the 3rd of April 2013 and took place in Växjö with Länstrafiken Kronoberg and the person interviewed was Emma Johansson, responsible for the Marketing Department. The interview lasted approximately one and a half hours.

The second interview was held on the 12th of April 2013 with Torsten Rasmussen from Movia (located in Copenhagen), advisor for the Traffic & Counselling Department. The interview lasted approximately one hour and 15 minutes.

### 2.5 Data analysis

The survey was analysed via an excel spread sheet to create tables and graphs to draw out conclusions from the gathered data. By having designed Excel tables that allow to compare how high or low respondents ranked the preferences, it became clear which of these preferences were of higher importance, that were after matched up to other research to support validity of the findings.
Additionally, another table was created with the sole purpose of establishing possible correlations among the several criteria included in the survey (e.g. correlating the criteria such as having access to a car or distance to mean of transportation with number of times that a traveller uses public transport).

Furthermore, it was also used to segment car drivers and public transportation users to see if any differences or similarities were found in people's travel behaviours.

The recorded user journey interviews enabled the authors to transcribe these into a document. The document was analysed by looking for information rich answers of users which are often repeated words in all the interviews (Morgan 1997) in order to find similarities and differences amongst users. By having the interviews with providers transcribed it was possible to draw out quotations and compare the data with the users’ experience of public transportation.

To analyse the gathered data as a whole, a table was created (Appendix B). The table included the survey, user journey and providers input in columns. The questions (i.e. preferences of importance, expected needs satisfaction with public transportation) were placed in rows to compare the results and find gaps between user needs and how the providers' strategies were addressing these preferences and expected need satisfaction. The data was then summarized in an extra column to find the gaps between users and providers.
3 Results

This section consists in the presentation of the research findings organized through a User Journey Map, as described in the Methods section. Results are presented in three different phases (i.e. the Pre-Use phase, Use phase and Post-Use phase) which all together correspond to a generic user's journey with public transportation. The Pre-Use phase concerns the users' primary need of mobility and the choice of a mean of transport; the Use phase consists of the travel itself with all its interactions (e.g. payment); the Post-Use phase relates to the users' feelings and thoughts after a journey is completed. Each phase includes several touchpoints, i.e. any interaction between a user and a product or service.

Furthermore, the findings from the various methods utilized are presented in the following way throughout every phase: survey findings, then interviews with users' of public transport findings and finally interviews with providers of public transport findings.

3.1 Survey results from segmentation

A large majority (80%) of the survey respondents looked upon themselves as public transportation users and the last 20% were looked upon themselves as car drivers in the survey based on Jensens' (1999) sociological segmented groups within transportation.

- 36% are PT users of necessity which would mean that what these users have in common is that they cannot really afford a car at the time but that they would not mind having one.

- 20% are PT users of convenience which would mean that they usually use PT because it is the fastest and the cheapest way for them to move around. PT suits their needs today which do not mean that they would not use a car if their situations were to change.

- 25% are PT users of heart which would mean that they always use PT services which does not mean that they are entirely satisfied with the current services provided.

Only 20% of the survey respondents identified themselves as car drivers, with:

- 9% as Passionate car drivers, those who only use car and really enjoy driving. They would not use any other alternative mode of transport.

- 6% as daily life car drivers, which would mean people who use only a car to move around but that would consider using an alternative mode of transport if it was as efficient as a car.

- 6% as leisure car drivers, which would mean people who use a car for most of their travels but who do not give any importance to the car itself. For them it is just a very efficient way to move from a point A to a point B.
3.2 Survey demographic results

The demographic results from the conducted survey are presented in the table (Figure 13) below:

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Genders</th>
<th>Ages</th>
<th>Living area</th>
<th>Geographical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>Female</td>
<td>18-24</td>
<td>25-34</td>
</tr>
<tr>
<td># Respondents</td>
<td>287</td>
<td>167</td>
<td>120</td>
<td>128</td>
<td>131</td>
</tr>
<tr>
<td>% Respondents</td>
<td>100</td>
<td>58%</td>
<td>42%</td>
<td>45%</td>
<td>46%</td>
</tr>
</tbody>
</table>

Figure 13 - Demographic results table

3.3 Analysing the results through a User Journey Map

As mentioned in the Methods section, the user journey is structured in three different phases, through which results were analysed. Below are the most relevant (i.e. the findings which were comparable taking into account both the users' and providers' perspective) results from the survey, users' interviews and providers' interviews, organized through the User Journey Map.

3.3.1 Pre-Use Phase

- Survey -

Need of moving
The survey suggests that the greater the daily distance travelled, the more people tend to use a personal car. Seventy percent of the respondents that consider themselves as car drivers travel everyday more than five kilometres, whereas, more than half of the respondents that consider themselves as public transportation users travel less than four kilometres every day.

**Considering mean of transport - Going to mean of transport - Time and route information**

---

**Figure 14 - Average daily distance travelled vs. % of travellers (survey)**

**Figure 15 - Trend between car ownership and public transportation usage**
Results point out that having daily access to a car does not prevent travellers from using public transportation when considering a means of transport to commute in urban areas.

Regarding travellers that have a daily access to a car, only 25% do not use public transport, which shows that a very significant percentage of those travellers use public transport. The curve clearly decreases concerning the rate of travellers that would use public transportation more than 4 trips (32% of travellers) a week and most people that have a daily access to a car use it less than 4 trips per week.

For the travellers that do not have a daily access to a car, very few do not use public transportation at all (8%) and most of them use it more than 4 trips a week.

Figure 16 - Relation between daily access to car and trips per week in public transportation
In what concerns the relation between the public transportation use and the distance to those means of transport, the result emphasizes that a majority of people lives less than 200 meters from a public mode of transport (63%) and these people tend to use public transportation more often than those who live further than 200 meters.

- **Users** -

**Considering mean of transport - Going to mean of transport - Time and route information**

All of the interviewees were satisfied with the location of bus stops. When asked about their feelings while waiting for the bus the respondents answer neutral to positive. There was only one respondent who thought that waiting for the bus took a lot of time, but the majority were neutral or thought that it was relaxing and pleasant to wait for the bus. In addition, a majority of the respondents would like to have more real time updates on screens by the bus stops.

“It is okay. It would be better if they had a screen with real time updates as they have in the city centre for every bus stop because that one is great.” – Respondent 3

“I think it is good. In the centre with the live updates it is really good, there should be more of those.” – Respondent 7

“I watch the bus timetable, but I cannot know if it is late. I like the updated bus tables in town, that would be great to have in more places.” – Respondent 8

- **Providers** -
**Considering mean of transport - Going to mean of transport - Time and route information**

Providers promote campaigns to raise **awareness** regarding the benefits of using public transportation in order to attract more users and improve the current user service.

**Movia:** "In the travel pass users have an off-peak discount of about 20% that covers the period between the peak hours (from Monday to Friday) and on evenings and weekends. We tried to get people to use this travel pass and lead them to travel more off-peak."

**Länstrafiken Kronoberg:** "We are bringing information to people through media to advertise new tickets or travelling modes in order for people to be aware of all existing possibilities. Price campaigns to attract users, throughout the year, sometimes to specific target groups (university students)."

Providers saw as crucial aspects the **proximity and distribution of the public transport.** In Copenhagen, they are using information given by the municipality to make sure that every dweller has access to a public transport in a 400 meter diameter.

To address users preferences and needs such as **distance to mean of transportation** providers aim to improve conditions for users to get to those means. To do so, stops can be re-located or new ones can be created should there be a need to cover a certain area and to ensure proximity to users.

**Länstrafiken Kronoberg:** "We have the possibility to re-locate bus stops but also to implement new ones should a certain area or location have that need."

### 3.3.2 Use Phase

- **Survey** -

  **Traveller's preferences**
It seemed that car drivers and public transport users’ preferences were very similar and, from the survey results, where the widest gaps were found for “comfort”, “travelling time” and “waiting time”, but these gaps do not exceed a difference of 0.5 on a scale of 0 to 5.

- Users -

Travellers' preferences

Amongst the respondents there were many opinions about the payment system: the answers varied from more flexible payment system with many options regarding payment (e.g. cash, credit-card, sms-ticket) to having more flexible fares according to users' different needs (i.e. student fares and retirement fares).

The drivers behaviour both when driving the bus and welcoming the respondents aboard the bus was of influence to the respondents. Only one respondent answered that the driver’s behaviour did not have any influence on the respondent. The majority of respondents answered that it influences them or influence them a lot. The answers were varied from the drivers behaviour when welcoming respondents to driving the bus in a safe and comfortable way.

“Most are positive, nice and pleasant, it is positive. If they were in a bad mood maybe I would take the car or bicycle it wouldn’t matter if it was more expensive. Maybe some are a bit negative but overall positive.” – Respondent 1

“A lot! The drivers behaviour when driving affects me, if they are rude to other cars or even busses. It might be because they have a bigger vehicle and some drivers aren’t driving that friendly. “ – Respondent 3
“It means a lot, there is this one guy that is very nice. He says hello and welcome and have a nice day. I feel very positive then, sometimes they are grumpy and I do not like that.” – Respondent 4

When asked how the respondents felt while travelling by bus most answered that they did not feel anything in particular or that it was relaxing.

Concerning the respondents’ answers on what was important for them while commuting with a bus, punctuality and safe driving were the most common answers.

Almost no one used a complementary mean of transportation, and the reason generally given was that they lived near the bus stop and did not have a need for it.

- Providers -

Travellers' preferences

Both providers interviewed are taking actions to address every user’s preferences. The preferences of high importance for both car drivers and PT users (i.e. travelling time, waiting time, arrival on time, price, distance to mean of transportation and time information) are addressed through several actions. These are explained in the rest of this section.

Travelling time - arrival on time - time information

Time related preferences are addressed through several actions that are often common to both providers but sometimes differ. For providers, there are variable costs linked to the travelling time, as they pay the operators per hour and per bus and they were both aware that better time information could improve users’ experience. For that reason time constraints are of very high priority for them.

Distance to mean of transport

To increase use rate and provide the best possible service, both providers make significant efforts to cover the largest area that they are responsible for providing public transportation.

Länstrafiken Kronoberg: "It is important to have central stations but it is also very important that the stops are equally distributed in the city."

Movia: "Currently the Metro system is being developed in a way that they are constructing a new metro line around the city of Copenhagen with approximately 17 new stations."

Price

In what concerns prices, providers are bound by higher decision-making entities as well as by the law.

Movia: "And by law (in Denmark) the average prices for using public transport shouldn't be higher than the expenses the provider has. The provider cannot raise the prices just to profit. It is a public service."

Länstrafiken Kronoberg: "Price is important but decisions are taken by the municipality and politicians. Länstrafiken Kronoberg cannot really do anything about it."
There are, however, three preferences that can be highlighted for having the largest gaps observed between PT users' and car drivers' preferences:

**Waiting time**

Waiting time is addressed by allowing the users to have real time updates on electronic devices (by accessing through an app or website) and also on the stops, through an electronic display. Waiting time is also addressed by improving the inter-modality between means of transport and by increasing the frequency of transports when necessary.

*Länstrafiken Kronoberg:* "We have real time updates on bus schedules that transmits the exact time the bus comes (by using an app or the website). This reduces the waiting time for the user."

*Movia:* "We are moving from paper information to digital information. We have the Movia app which provides information regarding route and time. There is the possibility to send SMS to the system and get the exact times on the next busses."

**Comfort**

The providers are trying to address the comfort preferences of travellers but they are limited as the cleanliness and comfort inside the vehicles is the subcontracted bus line operators' responsibility. Providers are part of the decision making process when it comes to choosing the vehicles and they take into account users' input by conducting annual surveys.

*Movia:* "All the traffic is tendered to private operators and Movia asks about 25,000 to 30,000 users every year how satisfied are they with comfort and cleanliness of the busses. The same inquiries are made regarding Metro and Train."

*Länstrafiken Kronoberg:* "We subcontract different companies or private entrepreneurs and they are responsible for everything regarding the busses."

**Travelling time**

Travelling time is a preference of high important for providers and both providers are trying to address this preference not only to improve users' experience but also because decreasing travelling time is cost effective. It is more obvious in Copenhagen as they have to face the congestion problems of a capital city with a high population density. Indeed, busses rarely stopped at traffic lights and have some dedicated bus lanes in some places. Moreover, they are currently introducing a Bus Rapid Transit (BRT) lane.

*Movia:* "For instance through radio signal bus can communicate with the traffic lights system and have the green light prolonged in order to skip red lights and make the service faster and having own bus lanes."

*Movia:* "The faster the bus goes, the cheaper it is for Movia."
3.3.3 Post-Use Phase

- Users -

First feeling

The respondents from the user interviews had an overall positive first feeling regarding the whole journey.

"I got home without problem, it was a nice trip and a good feeling. I got home alive! Hahaha." - Respondent 1

"That was that. It was easy and relaxing, no stress." - Respondent 3

"It was nice as usual." - Respondent 8

- Providers -

First feeling

With reference to post-use touchpoints both providers have the concern of actively answering any user complaints regarding the service provided and also providing online support by answering as soon and as accurate as possible to any given question (e.g. special services).

Länstrafiken Kronoberg: "Media is also something that has some influence as we have platforms where users can share their thoughts."

Movia: "When users make complaints Movia always make sure that an answer is provided and try to ensure the user will not have the same experience some other time."

- Survey -

Further reflections (Expected users’ needs fulfilment in public transportation)

The respondents were asked to associate expected needs satisfaction to public transport and cars, both on the positive and negative expectations of these modes of transport. They were asked to associate a maximum of three expectations that were the most representative for them. In the tables below the percentage of each associated aspect of public transport and car are presented. For example, 1% of the respondents associated lack of freedom to cars whereas 16% associated lack of freedom with public transportation.

The two following figures (Figure 19 and Figure 20) illustrate the expected need satisfaction associated with cars and public transportation:
## Figure 19 - Differences between cars and public transport regarding positive expectations

<table>
<thead>
<tr>
<th>Positive Expectations</th>
<th>Cars</th>
<th>Public Transport</th>
<th>Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freedom</td>
<td>25.2</td>
<td>5.0</td>
<td>20.2</td>
</tr>
<tr>
<td>Indepedance</td>
<td>21.7</td>
<td>5.9</td>
<td>15.8</td>
</tr>
<tr>
<td>Social status</td>
<td>4.0</td>
<td>1.4</td>
<td>2.6</td>
</tr>
<tr>
<td>Pleasant</td>
<td>7.5</td>
<td>7.1</td>
<td>0.4</td>
</tr>
<tr>
<td>Control</td>
<td>14.8</td>
<td>3.4</td>
<td>11.4</td>
</tr>
<tr>
<td>Privacy</td>
<td>14.7</td>
<td>0.7</td>
<td>14.0</td>
</tr>
<tr>
<td>Environmental friendly</td>
<td>0.4</td>
<td>24.0</td>
<td>-23.6</td>
</tr>
<tr>
<td>Sexy</td>
<td>2.5</td>
<td>1.2</td>
<td>1.3</td>
</tr>
<tr>
<td>Useful time (not wasted time)</td>
<td>7.5</td>
<td>14.1</td>
<td>-6.5</td>
</tr>
<tr>
<td>Social interaction</td>
<td>0.4</td>
<td>8.2</td>
<td>-7.8</td>
</tr>
<tr>
<td>Healthy</td>
<td>0.6</td>
<td>5.6</td>
<td>-5.0</td>
</tr>
<tr>
<td>Affordable</td>
<td>0.7</td>
<td>23.5</td>
<td>-22.7</td>
</tr>
</tbody>
</table>

\[n=825 \quad n=733\]

## Figure 20 - Differences between cars and public transport regarding negative expectations

<table>
<thead>
<tr>
<th>Negative Expectations</th>
<th>Car</th>
<th>Public Transport</th>
<th>Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of freedom</td>
<td>1.0</td>
<td>16.1</td>
<td>-15.1</td>
</tr>
<tr>
<td>Dependance</td>
<td>3.2</td>
<td>17.8</td>
<td>-14.6</td>
</tr>
<tr>
<td>Lack of social status</td>
<td>1.5</td>
<td>2.2</td>
<td>-0.6</td>
</tr>
<tr>
<td>Unpleasant</td>
<td>1.4</td>
<td>7.1</td>
<td>-5.7</td>
</tr>
<tr>
<td>Lack of control</td>
<td>0.4</td>
<td>14.6</td>
<td>-14.1</td>
</tr>
<tr>
<td>Lack of privacy</td>
<td>0.4</td>
<td>13.4</td>
<td>-13.0</td>
</tr>
<tr>
<td>Pollution</td>
<td>31.1</td>
<td>2.3</td>
<td>28.8</td>
</tr>
<tr>
<td>Unsexy</td>
<td>0.8</td>
<td>2.4</td>
<td>-1.6</td>
</tr>
<tr>
<td>Wasted time</td>
<td>6.6</td>
<td>10.7</td>
<td>-4.1</td>
</tr>
<tr>
<td>Lack of social interaction</td>
<td>10.2</td>
<td>1.3</td>
<td>8.9</td>
</tr>
<tr>
<td>Unhealthy</td>
<td>10.2</td>
<td>3.4</td>
<td>6.9</td>
</tr>
<tr>
<td>Expensive</td>
<td>33.0</td>
<td>8.8</td>
<td>24.2</td>
</tr>
</tbody>
</table>

\[n=713 \quad n=776\]

From the associations, it has been highlighted that most of the respondents tend to associate values that are in total opposition, demonstrated as follows:

- **While cars are associated to freedom, public transportation is associated to lack of freedom**
- **While cars are associated to independence, public transportation is associated to dependence**
- **While public transportation is associated to environmental friendly, cars are associated to pollution**
While public transportation is associated to affordable, cars are associated to expensive

- Providers -

Further reflections (expected needs satisfaction associated to cars and PT)

- While cars are associated to freedom, public transportation is associated to lack of freedom

Movia: “Movia tried to work on that aspect, focusing on the social integration aspect. There are some possibilities to explore there. Also to ensure that people change their conception of the bus and see it as a modern transport and real time, etc.”

Movia: "We would like to show the users how they could enjoy freedom in so many ways (travelling on vacation for example) with the money they save for not having a car.”

- While cars are associated to independence, public transportation is associated to dependence

Länstrafiken Kronoberg: "We are making campaigns that use the "younger crowd language" in a way that using public transport becomes more hip or cooler, such as:

Instead of having your mommy pick you up...the bus will take you for 17,60 SEK.

We will place this type of advertising on the back of the busses."

- While public transportation is associated to environmental friendly, cars are associated to pollution

Movia: "Cars are associated not only with pollution but also congestion."

Movia: "Movia knows that the users don't consider that important but Movia is so pressured by politicians that it is more important than the customers think it should be."

Länstrafiken Kronoberg: "Of course, it is better for the environment than to take your own car."

Länstrafiken Kronoberg: "We have changed our logo (the old one is blue, the new is green), to associate environment with public transport and green thinking. We believe that the one that thinks about the environmental already takes the bus. We wish to reach out to a larger possibility of having new users."

Länstrafiken Kronoberg: "We are now starting to introduce bio fuelled buses."

- While public transportation is associated to affordable, cars are associated to expensive

Länstrafiken Kronoberg: "Another interesting aspect is the cost of using a car compared with the cost of using public transportation (public transportation is much lower)."
3.4 Stakeholders and the decision making process

Both providers were asked about who their stakeholders are and how they influence the planning and decision making processes. These questions aimed to understand if providers were fully aware of whom all their stakeholders were and if they had any interactions with them and how that influenced public transportation. It also aimed to find the rationale behind the current decision making process and which stakeholders had influence in those processes.

According to Länstrafiken Kronoberg "Decisions are taken in meetings that involve Trafiknämnden (i.e. local politicians), Trafik Director and LK's Director (meetings happen once every two months). Those decisions convert into actions and only after approval LK can start implementing. Because it is a state owned company, the decision making process takes months and decisions are essentially made by politicians."

"Some things come from higher decision bodies which pressure the local politicians which will then execute that pressure over LK."

Concerning Movia's insights it stood out that "We are paid by municipalities where we operate in and we are experts in how to run busses, and advise the politicians. It takes a long time to make changes in the PT system in Copenhagen. It takes one and a half year from the time the process starts until the user actually feels the effect of the change when using the public transport. Of course if a municipality really wants to make a faster change they can but it is not how it usually goes."

The main points obtained from interviews regarding the stakeholders of these public transportation providers were that the decision making processes regarding public transportation are usually long term decisions that take some time to be put into practice not only due to the several stakeholders involved (e.g. municipality, the politicians and other related departments) which gather many different concerns from each of them, but also due to the dependence of these stakeholders that appears under a highly hierarchical decision making process.

It became clear in the interviews that the stakeholders of both providers focused most of their attention on the municipalities, politicians and subcontracted bus line operators.

Additionally, both providers depended to a large extent on stakeholders such as the municipalities but even more the politicians regarding the decision making power, through a series of bureaucratic procedures (meetings, paperwork) that lead to a significant delay when aiming to reach consensus regarding a particular action.

3.5 Providers’ sustainability perspective

From the interview part regarding the sustainability perspective it was possible to understand that providers have a rather limited definition of sustainability, basing their concerns on green thinking and some environmental practices, not. From the interviews with providers, the sustainability aspects they referred to, are expressed in the quotes below:

Länstrafiken Kronoberg: “Växjö aims to be Europe's greenest city”
“The new vision of LK is the natural way of travelling in a sustainable society”

"LK is going to introduce bio-gas fuelled busses in the coming weeks."

**Movia:** "Every time Movia asks operators to bid on a bus line they set demands that the busses should be running with low energy consumption and low emissions of different kinds of noxes and particles. Whenever there is a change of busses to new busses Movia sets requirements in a way that it is the most efficient bus they can get at a fair price."

"We don't decide on bus types. The operators buy them (i.e. based on the criteria set by Movia) and clean them and do maintenance. We just control in way that ensures the operators to have the busses running at the level of air pollution that was agreed. We control this twice a year."
4 Discussion

The FSSD and the ABCD were used to structure the thesis and allowed the authors to make strategic recommendations to public transportation providers in order to increase the use rate to bridge the gap and reach success (i.e. success level).

By backcasting from the users’ needs in a successful public transport system and informed by the four sustainability principles as minimum requirements for sustainability, it was possible to suggest a strategic approach to bring the public transport system towards success (i.e. success level).

The FSSD allowed the authors to have a holistic understanding of the interconnected systems involved in the broader transportation system, the socio-ecological system at large and make the connection between the topic studied and the global sustainability challenge as shown below:

At the system level of the FSSD, there is a public transport system within the transportation system, within the socio-ecological system (i.e. society within the biosphere). In public transportation there are subsystems (i.e. resource base, energy carrier, motoring, infrastructure and the social system) whose interactions need to be understood due to the unpredictable and counterintuitive impacts on the socio-ecological system at large.

In this context, success in a public transport system is achieved when with a maximized usage of commuting with public transport in urban areas, while providers comply with the four sustainability principles as minimum requirements for sustainability.

At the strategic level, strategies must be guided by the three prioritization questions (i.e. strategic guidelines) and through fulfilment of users’ needs of transportation in public transport systems leading to success.

Actions prioritized should be supported by tools (i.e. Tools level) which would allow PT providers to implement and monitor the strategic plan through a specific focus on users’ needs, and reach success (i.e. User Journey Map, Surveys, Interviews).

4.1 Assessing the current reality (Research Question 1)

Based on the survey and the various interviews conducted with users and providers of public transportation, the aim of the first research question was to compare the providers’ strategies with the users’ needs and preferences to point out the gaps that could prevent the use rate of public transportation from increasing.

Despite the strategies implemented between 2000 and 2010 and the current trend of urbanization (World Bank 2011), the use rate of public transport has remained relatively steady as statistics from Eurostat (2010) showed that the use rate of private vehicles has increased by 1.1% during the same period. Through the usage of a User Journey Mapping tool, it was possible to organize the data collected from users and providers of public transport to obtain an exhaustive and clear understanding of the current reality concerning users' needs and providers' strategies to address those needs.
4.1.1  Gaps in the Pre-Use phase

From the survey it was possible to conclude that people that use public transport tend to travel less than four kilometres everyday and the greater the travelled distance, the bigger the probability was for people to use a car. However, the results highlighted that public transportation users can also have daily access to a car which would mean that during the pre-use phase of the users’ journey, some of the respondents still chose to use public transport, even though the majority of respondents that do not have a daily access to a car seemed to use PT more often.

From the users’ interviews, there was a clear emphasis on the benefits of the real time updates which seemed to have increased the users’ satisfaction while going to and waiting for the public mode of transport which is in line with previous studies on waiting time (Balcombe et al. 2004). Furthermore, research has shown that the facilities (e.g. bus stands, information, vehicles) could be improved and reduce the negative impacts of the waiting time (Balcombe et al. 2004). Both of the providers were trying to address these users’ preferences by being flexible when deciding the location of a bus stop and by providing more systematically real time updates.

4.1.2  Gaps in the Use phase

From the two segmented groups of respondents that answered the survey (i.e. Car drivers and PT users) it was clear that they had similar expected preferences when commuting in urban areas. However, based on Steg (2003) it appears that the car is evaluated more positively than public transport in almost every aspect by both car drivers and PT users.

There was a clear emphasis on the time spent while travelling in urban areas. Travelling time, waiting time, arrival in time, time information were among the most prioritized preferences (i.e. preferences of high importance for both car drivers and public transport users) according to the survey respondents. These results are in line with previous studies about satisfaction in public transport where the waiting time was the top preference on desired quality of public transport (dell’Olio et al. 2010; dell’Olio et al. 2011) whereas another study showed that punctuality was the most important to users (Friman et al. 2001). Movia was able to reduce the travel time through collaboration with the municipality of Copenhagen by giving busses priority at traffic lights. Länstrafiken Kronoberg introduced a mobile application with real time updates to reduce users' waiting time. Concerning the time spent in the vehicle, Länstrafiken Kronoberg is thinking about introducing a “info-tainment system” inside the
busses to increase user satisfaction by providing all sorts of information regarding their services.

From the users' interviews it was found that the travel itself was enjoyable and relaxing, which is in line with the potential value of travelling described by Cornet (2012) and Jain and Lyons (2008).

The cost or price of public transportation was, according to the survey, a preference of very high importance which is not in line with other studies. For instance, a study on the benefits of a free public transport system showed that even with free public transport, the usage did not significantly increase (Witte et al. 2006). The price was also one of the aspects of least importance according to Steg (2003). However, from the users’ interviews it has been found that users of public transportation wanted more payment options and flexible fares, as many had suggestions about different types of fares (e.g. student prices, retirement fares) in order to better suit their needs. This customization of fares for different types of users could, in the users’ opinion, increase their satisfaction.

Another finding was that the drivers’ behaviour affected people, both the driving behaviour and the social behaviour, which is also in line with previous studies showing that the drivers’ behaviour could be a root of satisfaction or dissatisfaction in public transportation (Edvardsson 1998).

In order to address these preferences the providers were constantly trying to evaluate these through surveys answered by the users to keep track of which were the most important preferences. However, in the provider’s opinion, they would best address these preferences should they have more resources (e.g. financial and human resources) available. As an example, Movia introduced discounts for users travelling in off-peak periods in order address the user need of more flexible fares when commuting. There were nevertheless some gaps to be highlighted between both car drivers’ and public transport users’ preferences. Comfort, time travelled (i.e. speed) and waiting time (i.e. convenience) were preferences where the largest gaps were observed, which is in line with the results from Steg (2003) where people were asked to rank the attractiveness of cars and public transportation, and where both car drivers and public transport users believed that a car provides much more comfort, speed and convenience.

However, it has been shown that the recollection of satisfaction with public transport is often negatively biased, which would affect the choice of travellers to instead commute with public transport (Pedersen 2011). The users’ interviews were in line with this study as respondents, either car drivers or public transport users, were satisfied overall when using public transport.

### Gaps in the Post-Use phase

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During their journey, users can have some feelings about the service after the end of use. These feelings are to be linked with the users’ remembered satisfaction and have
consequences on the future expected need satisfactions when choosing to use a mode of transport (Pedersen 2011). It could be concluded that this predicted satisfaction has managerial implications for public transport providers, as car drivers would use public transport services based on the actual remembered level of satisfaction (Pedersen 2011).

Furthermore, in line with the study on the expected and the remembered satisfaction (Pedersen 2011) and the symbolic-affective motives attached to cars (Steg et al. 2001), it has been found that some deeper motives related to the symbolic functions of cars are to be taken into account when approaching the resistances that public transport usage faces. In other words, peoples' travel behaviour is not only the result of a trade-off between perceived costs and benefits (Steg et al. 2001).

In the survey most of the respondents had to attribute positive and negative expected needs satisfaction both to cars and public transport and the results were in total opposition and definitely in favour of the car.

*Freedom and independence* were the positive expected needs satisfaction associated the most to the car whereas *lack of freedom* and *lack of dependence* were the most expected dissatisfaction associated to public transport, which was in line with conclusions from Jensen (1999) and Steg (2003). These sociological and cultural aspects (Steg et al. 2001) have been amongst the most important in western societies and it could explain why these symbolic dimensions are associated to the car (Jensen 1999).

*Environmental friendly* and *affordable* were the positive expected needs satisfaction associated to public transport, whereas it was the opposite for cars (i.e. *pollution* and *expensive*). However, it is known that the price (Witte et al. 2006; Steg 2003) and the environmental aspects (Jensen 1999) are not of high importance for travellers when choosing a mode of transport.

As a matter of fact, the use rate of cars is reinforced by cultural aspects that are really strong in people’s mind and dramatically affect people’s travel behaviour, whereas public transport is granted with expected needs satisfactions that seem to be of low importance for travellers. Because of these expected needs satisfaction, using public transport appeared to be a poor alternative to the car, which is in line with Torsten Rasmussen’s (from Movia-Copenhagen) insight “Public transport cannot compete with cars” and Steg (2003) “Considering only individual interests, it appears that public transport can hardly compete with the car”.

### 4.1.4 Reflection on gaps found in the User Journey Map:

It appeared that, essentially during the use-phase, there were a few touchpoints identified within the preferences of the service which would mean that there was not any significant gap between what should be these preferences in a system with a maximized use rate of public transport (i.e. success level) and the current state of the preferences. However, it does not mean that providers should stop improving the current services as there are some aspects that could be potential touchpoints for car drivers to use public transport more often such as *flexibility* (i.e. convenience), *comfort* and *time travelled* (i.e. speed).

Nevertheless, the expected needs satisfaction allowed the authors to point out significant touchpoints linked to the cultural and sociological aspects of travellers. These touchpoints are linked to the phases “Considering mode of transport” (Pre-use phase) and “Further
reflection” (Post-use phase). There is a gap between what expected needs satisfaction travellers should have towards public transport, and what this expected needs satisfaction is today, and this gap appeared to be the biggest barrier for car drivers to shift to public transport which is supported by Pedersen (2011).

As a matter of fact it seemed to be a touchpoint of very high priority to address and in other words, public transportation providers should take advantage of the positive expected needs satisfaction and aim to reduce the negative expectations associated to public transport. Currently, both public transport providers interviewed are trying to take advantage of these potential misjudgements of “lack of freedom” and “lack of dependence” through marketing campaigns, as shown previously in the Results section.

4.1.5 Stakeholders and the decision making process

From the interview part regarding the sustainability perspective it was possible to understand that providers have a rather limited definition of sustainability, basing their concerns on green thinking and some environmental practices, not taking into account the interconnection between the main subsystems and stakeholders of the transportation system when planning.

It also appeared that the actions implemented in public transportation often lacked coordination and collaboration between all previously referred subsystems involved by Cars and Robèrt (2008). Both providers expressed the want for more collaboration with stakeholders in the subsystems of public transportation.

Both interviews also made visible that the decision making process is not rapid in public transportation as it is heavily influenced by the politicians. As the municipalities' politicians heavily influence the direction of public transportation one could say that they are a leverage point for change in the system. For example, Länstrafiken Kronoberg changed their logotype from blue to green and is introducing bio-fuelled busses, due to established goals of the municipality. Movia is also influenced by politicians to turn more environmental friendly and to help fulfilling the municipality's goals. Also, in the case of Curitiba the overall development of public transportation has mostly been driven by municipality's policies (Friberg 2000; Pienaar et al. 2005; Rabinovitch and Hoehn 1995).

4.2 Addressing the gaps (Research Question 2)

One could argue that the actions and strategies providers are taking are not enough due to the increase of the passenger car travels rate by 1,1 % between 2000 and 2010. However, one could argue that providers are not actually failing either due to the marginal decrease of public transportation usage during the same period. From the providers side there has been a focus on the functional preferences of public transportation, which data collection mostly comes from users' surveys to inform providers’ strategies. Another approach to deepen the understanding of what users want from public transportation is to use tools suitable for the task (e.g. user journey mapping, interviews), to address the bias of the remembered and expected satisfaction (Pedersen 2011).

The thesis itself aims to draw inspiration from the user-centered approach inspired by the PSS, where the starting point is the need of a user (Tukker and Tischner 2006). The assumption is that more value and user satisfaction could be obtained with a focus on user need fulfilment rather than just providing a product or service (Manzini and Vezzoli 2003).
This user-centered approach through a User Journey Map tool (as a tool inspired by a PSS) influenced the thesis in a way that it allowed the authors to find the gaps between users’ needs and providers’ strategies to address those needs. In addition, the conducted interviews with providers aimed to understand the barriers that would prevent them from efficiently addressing users’ needs. It is then possible to give some recommendations to public transport providers on how to attract more users to reach success.

### 4.2.1 Addressing the gaps in the Pre-Use phase

Since the study pointed out that car ownership or daily access to car does not prevent people from using public transport, providers should focus on the access to information based on IT developments by having real time updates at bus stands, through their apps and websites. Through a better access to information it is believed that people would make more informed choices when considering their mean of transportation. As the convenience in public transport was identified as a touchpoint of very high importance by respondents, and supported by literature review, improving the access to information and ensuring proximity of public transportation access to users, appears to be a strategic way to increase the use rate by attracting car drivers. Furthermore, for the current users of public transport, it could be a way to increase their satisfaction as it was highlighted in the user interviews.

### 4.2.2 Addressing the gaps in the Use phase

The preferences regarding time (i.e. travelling time, waiting time, arrival in time, time information) were important to users, the authors’ recommendation is to further develop these touchpoints of the user journey. Through punctuality and speed in public transportation it is possible to maintain and possibly increase the use rate of public transportation which is in line with the successful case of Curitiba where speed and reliability were highly improved through the introduction of the BRT that lead to an increase in the use rate. Knowing that car drivers’ preference regarding the time travelled (i.e. speed) was of higher importance for car drivers compared to how public transport users ranked it, there is an opportunity to attract a larger number of non-users of public transportation with a particular emphasis on this preference.

Furthermore, the payment system of public transport needs to be further developed to better fit users' preferences as users wanted easy and diverse payment options as well as customized fares for different users (e.g. student prices, retirement fares). The recommendation is that providers would offer different ways of payment (e.g. cash, smartcard, credit card, sms-
ticket) and additional customized fares in order to increase current user satisfaction and possibly increase the use rate.

Additionally, it became visible that the drivers’ behaviour affected respondents and has been highlighted as a possible root of satisfaction and dissatisfaction. The authors do not have a particular recommendation on how to address this preference, but emphasize the fact that providers should definitely be aware of its importance.

4.2.3 Addressing the gaps in Post-Use phase

The survey results pointed out opposite expected needs satisfaction regarding public transportation and cars, and it has been highlighted that these potential misjudgements (Pedersen 2011) were a touchpoint of very high priority to address in order to attract more users. The strategy proposed is to incorporate the expected needs satisfaction of freedom and independence into public transport by improving the user experience and, using marketing campaigns to communicate those needs fulfilment as explained in the following parts.

4.2.3.1 Taking advantage of expected needs satisfaction associated to public transport and cars

Public transportation providers could take advantage of the conception of “low cost” that people have associated to public transport. Van Exel et al. (2011) showed that the quality of car travel has considerably increased, while the price level has largely remained steady relative to public transport. Thus, public transport providers should make sure that prices stay proportionally lower compared to other personal modes of transport, while improving the service in terms of speed, comfort and convenience, as these were the functional aspects which have been identified as main touchpoints to attract car drivers. Public transport providers could make more obvious that it is significantly cheaper to use public transport instead of a personal mode of transport. Furthermore, providers could take advantage of the negative associations of cars (i.e. expensive) by communicating on the lack of freedom correlated to the high transport costs associated to cars (i.e. using the cost difference to fulfil freedom in other ways).

Furthermore, there is as well a possibility to take advantage of the expected needs satisfaction associated to cars because there seems to be a paradox in relation to cars and freedom as the more people who choose to own a car the more congested the roads will become. Another possible paradox could be highlighted as well, in relation to independence and cars. Cars are a way to be independent from time and space but on the other hand, car drivers would arrange daily activities around the car which would create a certain car dependency (Steg 2003). To take advantage of these paradoxes, providers could adapt marketing campaigns to these potential misjudgements concerning the expected needs satisfaction that people tend to associate to cars, since there is a potential to lead car drivers to shift to public transportation. As an example, Torsten Rasmussen from Movia expressed that future marketing campaigns
could enhance the fact that freedom could be fulfilled by saving money when not having the ownership of a vehicle, and to use this money for other purposes.

The importance of the user experience is identified as one of the two levers to increase the user value. This extra value (i.e. hedonic value), added to the product-service, comes from the unique experience that the user would have when using the service (Caru’ and Cova 2007) and as Schmidt (1999) stated “The company has to provide the right environment and setting for the desired customer experiences to emerge”. This highlights that public transportation systems have the potential to foster a unique experience by providing distinctive ways of commuting within urban areas, while including the users in the co-creation of the service value. As freedom is often defined as the freedom of choice (Pedersen 2011), enhancing a multi-modal public transport environment would likely foster the fulfilment of the needs of freedom and independence. As a matter of fact, a recommendation inspired by a PSS could be to include cars or other modes of transport that could fulfil the user needs of freedom and independence into public transportation. In line with this recommendation is the fact that a PSS has potential to reduce the use of energy and materials (Tukker 2004) through dematerialization which can even be of further emphasis because attracting more users to public transportation could lead to the reduction of car ownership amongst urban dwellers.

4.2.4 Reflections on the authors’ recommendations:

The authors would like to highlight that the recommendations provided are based on results that appeared to be generic, as supported by other academic researches, and that there is not a unique strategy to address the specific users’ needs highlighted as leverage points to increase the use rates of public transportation. In sum, in order to fulfil users’ needs, the authors recommend providers of public transport to have a user-centered approach to identify user needs specific to their system, such as the User Journey Map tool used to structure this research.

4.2.5 Stakeholders involvement

This study highlighted that providers of public transportation wanted to have more collaboration with stakeholders in order to improve their service, and that was seen as an important factor to be able to attract more users.

Additionally, the results and other researches highlighted that more partnerships with public transport providers’ main stakeholders (i.e. municipality), and other stakeholders in the subsystems of the transportation system, could be a way of better meeting the needs of users. For instance, with more collaboration it was possible for Movia to better address users’ needs in Copenhagen (i.e. traffic light give priority to busses which decreases the travelling time). Another example is the successful case of Curitiba where there was a strong collaboration between the municipality and providers of public transportation, among other stakeholders such as the manufacturers of vehicles and city planners (Rabinovitch and Hoehn 1995). This strong collaboration between various stakeholders allowed the local public transport provider to decrease significantly the travelling time and consequently increase the users’ satisfaction. Curitiba has currently a public transport use rate of approximately 70% (Goodman and Scwenk 2006).
4.3 Validity and Limitations

Scope and Limitations: The data gathered for this study was essentially collected from providers and users of public transport mainly from the south region of Scandinavia, which may not be representative for the entire European Union. On the other hand, previous research used in this study and in the field of public transportation mainly came from countries throughout Europe and had many similarities to the findings in this study and the results were therefore supported by these previous researches. The recommendations of the authors to providers of public transport were limited to countries of the European Union.

Research design: With the guidance of the research design used in this thesis (Maxwell 2005) the authors were constantly thinking about validity regarding the forthcoming results. Every reviewed research material and gathered data was read by at least two authors to support validity.

User-centered approach to increase the usage of public transportation: Regarding the recommendation to draw inspiration or use the concept of PSS in public transportation in order fulfil user needs, it is important to highlight that in this thesis the data collection was inspired from this need fulfilment approach and the findings in this thesis might differ throughout different regions or countries within the European Union. It is suggested to providers of public transportation to assess the users’ needs of their region. However, the findings in this thesis were supported by literature review from researches in various parts of Europe and there seems to be many similarities amongst users throughout Europe.

Survey: Based on research in the field of user satisfaction within public transportation the survey was created to find preferences of importance for users and non-users of public transportation, which gave the authors a basis on how to conduct further research. Furthermore, a segmentation strategy was used in the survey to assess if there were differences between car drivers and users of PTs’ preferences. However, the survey had very similar results as previous research in the field of customer satisfaction. There were many advantages in conducting an online survey (e.g. wider geographical coverage, high number of respondents, strong methodical control, rapid data collection and associated costs) but also many disadvantages (e.g. perceived as junk mail, up scaled male respondents and respondents that lack of internet experience) (Evans and Mathur 2005).

User interviews: Based on previous research and the survey, the user interviews were created. It gave the authors deeper insights of what are the users' wants and needs while using the service of a bus. It enabled the authors to capture the direct satisfaction and not the remembered satisfaction (Pedersen et al. 2011). The interviews were recorded and transcribed to capture everything the interviewee said (Morgan 1997). The sample of nine user interviews could have been extended to more interviews if the time period was greater.

Providers’ interviews: Interviewing providers of public transportation helped the authors to understand more deeply their perspective on how to attract more users, the decision making process with their stakeholders and their view on broader systems perspective. Again, the interviews were recorded and transcribed to capture everything the interviewee said (Morgan 1997). The aim was to interview several providers of public transportation from smaller cities to metropolitans. Two providers were interviewed. From a validity standpoint it would have been more rigorous to interview more providers but due to access and time constraints it did not occur.
All along the process of gathering data the authors had a critical view of the results and did not alone take decisions and draw conclusions. Conclusions were drawn together and under the guidance of our supervisor to strengthen the validity of the research.
5 Conclusion

Today’s societal development is not sustainable and the transportation system has the potential to be a significant lever to bring Society towards sustainability. This Master's thesis focused on the contribution to the public transport system to that shift, through dematerialization and substitutions that could occur by increasing the public transportation use rate.

However, despite the potential role of public transport to bring the transportation system towards sustainability, its use rate has remained steady while in the same time private land passenger travels have increased.

The Framework for Strategic Sustainable Development allowed the authors to have a strategic approach of the topic by providing a holistic perspective of the systems interconnected to the public transport system. Besides, planning in complex systems requires a “bird’s eye” perspective to understand and account for the connections between these networks of systems. Additionally, a backcasting planning process was used to deepen this strategic approach by defining a desirable future for public transportation providers, which is to maximize the number of people commuting with public transport, while providers comply with the four sustainability principles.

With the vision in mind, assessing the current public transport system reality seemed to be the next natural step to identify the gaps that currently prevent providers from reaching the vision. Studying peoples’ travelling needs through a User Journey Map (inspired by a Product-Service System), led the authors to deepen the understanding of peoples' travel behaviours which revealed the complexity of this field of research. Indeed, this complexity can also be illustrated by the personal relationship people have with transport, especially when it comes to the relation that people have with cars, which is often referred to as a cultural phenomenon in the literature and which appeared to be the biggest competitor for the current public transport system.

Despite these clear and personal relationships with transport, it appeared that car drivers and public transportation users had a very close travel preference which was a sign that these preferences were not enough to explain the choice of using either a private or a public mode of transport. Furthermore, it was highlighted that users of public transportation were overall satisfied before, during and after their travelling journey, which was not in line with their expected needs satisfaction. Supported by other studies on public transportation, it seemed that the expected needs satisfaction of people when using public transport was underestimated, while the expected needs satisfaction of driving a car was overestimated, which highlighted a major gap linked to potential misjudgements that would bias the choice of the mode of transport.

Hence, car was mostly associated to the strong preferences of freedom and independence, whereas public transport was valued with what appeared to be less attractive preferences such as environmental friendly and affordable. These results were identified as a potential reason for the misjudgements that people often have when considering their mode of transport, and consequently as a significant barrier for people to shift to public transportation.
Moreover, by assessing the current reality of two public transportation providers, one from the city of Copenhagen and the other one from the city of Växjö, it appeared that the satisfaction of users’ needs was one of their top priorities and that they were trying to follow up the actual level of satisfaction through surveys and interviews with users. However, it has been emphasized that the decision making process lacked of reactivity and of a broader system perspective to efficiently attract more users. Furthermore, even though their visions of success incorporated an environmental dimension, it was clear that these were incomplete to reach sustainability and thus, the vision of success for public transportation set by the authors.

Through literature review regarding the field of public transport, and a users’ needs oriented approach, it was possible to brainstorm recommendations that would be likely to address those gaps and therefore increase the use rate of the public transport system. These recommendations were proposed while taking into account their potential to maintain and/or increase the use rate of public transportation. The authors emphasized on the recommendations that would address the functional preferences where the main gaps were identified between car drivers and public transport users, as well as the recommendations that would address the gaps identified in the sociological and cultural motives when choosing the mode of transport.

In the same way that the authors drew inspiration from the Product-Service system in order to more efficiently assess the users’ needs, the recommendation is that public transportation providers would have a similar approach in order to best address those needs in their specific system.

For the public transportation system to reach strategically its vision of success while bringing the whole transportation system towards sustainability, it is recommended that public transportation providers implement and prioritize future actions by defining a criterion that would emphasize that the users’ needs of importance highlighted in the study are fulfilled. Providers are also advised to apply the strategic guidelines presented at the Strategic level of the FSSD. The actions implemented to bridge the gaps should be flexible enough to allow further improvements towards the same goal of success, and prioritized through a step-wise approach in a way that expensive but impactful actions would be built upon previous actions that would bring early return on investment.

By scoping down to the drill hole of public transportation, the authors have understood the large potential role of public transport to shift the transportation system towards sustainability by reaching its own vision of success. Moreover, the holistic and strategic approach used in this study allowed them to identify the required collaborations between all subsystems involved in the socio-ecological system to bring Society as a whole towards sustainability.
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Steg L. 2003. Can public transport compete with a private car?. Department of psychology. 27 (2).


Thompson, Anthony. 2013. Consultation with Anthony Thompson, 10 h. Blekinge Institute of Technology, Karlskrona.


Appendices

Appendix A - Bus routes in Curitiba (Brasil 2013)

Appendix B - Table for analysis of qualitative data

<table>
<thead>
<tr>
<th>Provider</th>
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I. Assessing the preferences

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II. Assessing the costs

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III. Assessing the revenues

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IV. Assessing the system

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V. Assessing the quality

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VI. Assessing the efficiency

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VII. Assessing the sustainability

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8. Assessing the strategic

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Analysing qualitative data
Appendix C - Link between the user satisfaction and quality of the service

The authors believe that any public transport system would benefit from a reinforced loop between the use rate and the overall quality of the service by improving the users’ experience.

Appendix D - Example of a public transportation provider's stakeholders

Appendix E - Tentative sustainability characteristics of different PSS Types. (Tukker 2004)
Appendix F - Interview with the public transportation providers

Interviews with Movia/Länstrafiken Kronoberg

Interview information:

The purpose of the interview is to understand the providers perspective on public transportation and compare it to the users experience regarding that same service, in order to find the existing gaps.

The answers will be recorded and may be quoted and used in a thesis written by Thibaut Driffort, Oscar Ogenblad and Luis Sousa Lara.

The interviewers will ask some questions which the provider is free to answer or not answer.

The estimated time for the interview is two hour.

To contact the interviewers after the interview, please send an e-mail to dos.msls@gmail.com or call 0737-823225.

Do you have any questions before starting the interview?

Provider’s strategy + User Journey Map

1. Why are the following criteria important or not to Movia/Länstrafiken Kronoberg?

  - Distance to mean of transportation:
  - Price:
  - Comfort:
  - Route information:
  - Time information:
- Easy payment:
- Travelling time:
- Waiting time:
- Safety:
- Arrival in time:
- Cleanness in vehicle:
- Flexibility:
- Environmental concern:

2. What are the current actions being taken by Movia/ Länstrafiken Kronoberg to address the user's needs and preferences?

Pre-use:

Considering various means of transportation? Go to mean of transport?

Waiting time?

Use-phase:

Payment

Seat availability?

Travelling?

Complementary mean of transport?

Post-use:

First feeling? Further reflections?

3. Are there any future actions that Movia/ Länstrafiken Kronoberg could take to address user’s needs and preferences?
Pre-use:
Considering various means of transportation? Go to mean of transport?
Waiting time?
Use-phase:
Payment
Seat availability?
Travelling?
Complementary mean of transport?
Post-use:
First feeling? Further reflections?

4. Who are the stakeholders of Movia/Länstrafiken Kronoberg and how do they influence the planning and decision making processes?

5. How are you currently planning regarding the intermodal mobility within Movia’s/Länstrafiken Kronoberg’s services?

Public Transportation / Cars: Positive and Negative Associations

Public transportation, associations:

1. Environmental friendly, affordable and useful time are some positive associations with public transportation. What are the opportunities and hinders for Movia to enhance these associations in order to attract more users?

2. Lack of freedom, dependence, lack of social status, lack of privacy and lack of control are some negative associations with public transportation. What are the opportunities and hinders for Movia to address these negative associations?

Car, associations:

Freedom, Independence, privacy and control are some positive associations with cars. What are the opportunities and hinders for Movia to use these positive associations with cars as a leverage point for public transportation?
4. Expensive and pollution are two negative associations with cars. What are the opportunities and hinders for Movia/ Länstrafiken Kronoberg to use these negative associations in order to attract more users to public transportation?

5. How does Movia/ Länstrafiken Kronoberg interact with the following subsystems of public transportation?

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<tr>
<td>Oilfields</td>
<td>Gasoline, Electricity, natural gas, ethanol...</td>
<td>Otto engine, diesel engines, stirling engines, hybrids....</td>
<td>Physical infrastructures, space available, spatial planning, soft infrastructures (education system, culture...)</td>
<td>decision making, values, preferences, needs, political organization..</td>
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<td>Coal mines</td>
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<td>Uranium mines</td>
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<td>Natural gas fields</td>
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<td>Bioalcohols from corn fields</td>
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6. To what extent each of this subsystems is taken into account during the decision and planning process?

Appendix G - Interviews with users of public transportation

Interview with users of public transportation based on the customized User Journey Map

Do you consider yourself to be mostly a car driver or a user of public transportation?

A; You drive a car for every travel you do and you enjoy driving it for so many reasons. You don’t think that any public mean of transport would provide as much quality as cars.

B; You drive a car for every travel you do and you enjoy driving it for so many reasons. 2; However you could consider using an alternative mean of transportation even if it was public.
C: You drive a car for most of your travels mostly because you believe that it is better than any other alternative but for you a car is just a way to move from A to B.

D: You always use public transports, bike or walk. But perhaps you are not entirely satisfied of your current public transport system.

E: You usually use a public mean of transport, bike or walk because it is the fastest and the cheapest way to move around. You would use a car if it was more convenient.

F: You use a public mean of transport, bike or walk because you don’t have a car and cannot really afford it.

Need of mobility (starting point).

PRE-USE PHASE

Considering means of transportation

1. You obviously chose to use bus as a mean of transportation, what were the reasons for choosing the bus?

2. Would you or do you use another mode of transport for this travel? Why?

3. How important is for you the cost of travelling?

4. Are there any enablers and/or hinders for you when going to the bus stop?

Waiting time

6. How do you feel when waiting for the bus?

7. How satisfied are you with the information regarding the bus arrival time?

8. How satisfied are you with the route information?
USE PHASE

Payment
9. How do you feel about the current payment system?

10. How does the driver behaviour influence the way you will feel when travelling with bus?

Seat availability
11. Is having a seat available in the bus a decisive criteria when it comes to choosing the mode of transport for you? Why?

12. How satisfied are you with the seat availability inside the bus?

Travelling
13. How do you feel when you are travelling by bus?

14. What is important to you when commuting in urban areas?

End of use
15. How do you feel about the way the route information is presented?

16. Does the current number of bus stops satisfy your travelling needs? Why?

17. Was there anything you worried about when getting off the bus?

Or multimodal?
18. Do you sometimes use a complementary public mode of transport to get closer to your final destination?

19. How would having a complementary mode of transport satisfy your overall travel experience?

POST-USE PHASE

20. What is your first feeling after your travel?

21. How satisfied are you overall with the travel made?

22. Taking into account the travel experience, what would have made it better?

Appendix H - Survey

Moving around: Survey on urban mobility!

Your input is very important as a user or potential user to improve public transportation!

This survey is part of a Master’s thesis at Blekinge Institute of Technology (Sweden) made by three students.

We would very much appreciate if you would fill in the survey.

Estimate time for completion: 5 minutes.

Thank you!

Thibaut Driffort, Oscar Ogenblad and Luís Sousa Lara

SURVEY:

1. Gender

Male / Female
2. Age
Under 18 / 18-24 / 25-34 / 35-44 / 45-54 / 55-64 / 65-84 / 85 or older

3. What type of area do you live in?
Urban area / Suburban area / Countryside / Other

4. Distance to public transportation
Less than 200 meters / Between 200-500 meters / Between 500 meters and 1 km / More than 1 km

5. Choose the option that suits you the most
A; You drive a car for every travel you do and you enjoy driving it for so many reasons. You don’t think that any public mean of transport would provide as much quality as cars.

B; You drive a car for every travel you do and you enjoy driving it for so many reasons. 2; However you could consider using an alternative mean of transportation even if it was public.

C; You drive a car for most of your travels mostly because you believe that it is better than any other alternative but for you a car is just a way to move from A to B.

D; You always use public transports, bike or walk. But perhaps you are not entirely satisfied of your current public transport system.

E; You usually use a public mean of transport, bike or walk because it is the fastest and the cheapest way to move around. You would use a car if it was more convenient.

F; You use a public mean of transport, bike or walk because you don’t have a car and cannot really afford it.

6. Who do you live with?
By myself / Partner / Friend(s) / Shared accommodation / Other

7. What is your average daily travel distance?
Less than 1 km / Between 1 and 4 km / Between 5 to 10 km / Between 11 and 20 km / More than 20 km / Other

8. Do you have children under the age of 12?
9. Do you use a smartphone or tablet when moving around in your daily life?
Yes / No / Other

10. Do you have daily access to a car?
Yes / No / Other

11. Do you have a driving license for car?
Yes / No / Other

12. Number of cars in household?
0 / 1 / 2 / 3 / 4 or more

13. How often do you use public transportation?
I don't use public transportation / 1-4 trips per week / 5-8 trips per week / 9-12 trips per week / 13 or more trips per week / Other

14. What means of transportation do you currently use the most?
Bicycle / Car / Bus / Metro / Train / Tram / Boat / Other

15. What are the criteria of high and low importance to you when using transportation?

- Distance to mean of transportation
  5: Very high importance, 4: High importance, 3: Neutral, 2: Low importance, 1: Very low importance

- Price
  5: Very high importance, 4: High importance, 3: Neutral, 2: Low importance, 1: Very low importance
<table>
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<tr>
<td>Route information</td>
<td>5: Very high</td>
</tr>
<tr>
<td>Time information</td>
<td>5: Very high</td>
</tr>
<tr>
<td>Easy payment</td>
<td>5: Very high</td>
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<tr>
<td>Travelling time</td>
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• Flexibility

5: Very high importance, 4: High importance, 3: Neutral, 2: Low importance, 1: Very low importance

• Environmental concern

5: Very high importance, 4: High importance, 3: Neutral, 2: Low importance, 1: Very low importance

Pick maximum 3 positive associations with PUBLIC TRANSPORTATION

1 Freedom
2 Independence
3 Social status
4 Pleasant
5 Control
6 Privacy
7 Environmental friendly
8 Sexy
9 Useful time (not wasted time)
10 Social interaction
11 Healthy
12 Affordable

Pick maximum 3 positive associations with CARS
1 Freedom
2 Independence
3 Social status
4 Pleasant
5 Control
6 Privacy
7 Environmental friendly
8 Sexy
9 Useful time (not wasted time)
10 Social interaction
11 Healthy
12 Affordable

**Pick maximum 3 negative associations with CARS**

1 Lack of freedom
2 Dependence
3 Lack of social status
4 Unpleasant
5 Lack of control
6 Lack of privacy
7 Pollution
8 Unsexy
9 Wasted time
10 Lack of social interaction
11 Unhealthy
12 Expensive
Pick maximum 3 negative associations with PUBLIC TRANSPORTATION

1 Lack of freedom
2 Dependence
3 Lack of social status
4 Unpleasant
5 Lack of control
6 Lack of privacy
7 Pollution
8 Unsexy
9 Wasted time
10 Lack of social interaction
11 Unhealthy
12 Expensive

How did you come across did survey?

Facebook / E-mail / Database / Twitter / Other

Lastly, please name one thing that would lead you to use public transportation more often?