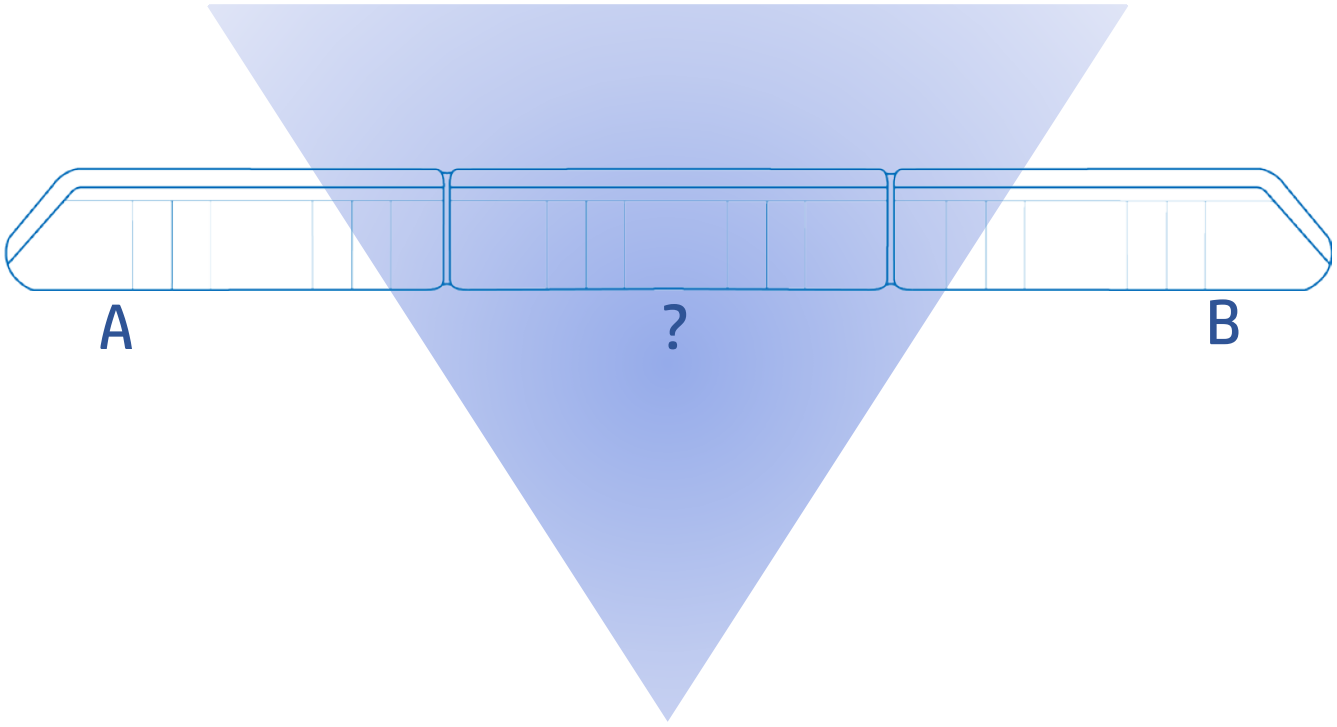
Light rails more than from A to B?



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Preface

This master thesis is the final project and part of the master program 'Mobilities and Urban Studies' at Aalborg University.

I would like to thank all who participated in interviews for their time and knowledge, as this project would not have been possible without their contribution. Also, thanks to my Supervisor Claus Lassen for the support. I would furthermore like to thank my colleagues during my internship at Metroselskabet & Hovedstadens Letbane, who have been a significant inspiration for me in this project. Lastly, I would like to thank my family for the great support throughout the process of this project.

For the project is used Harvard style reference system and the reference list can be found at the end of the report. Here, is also the appendix including a CD containing interview recordings.

Abstract

Sustainable transport development relies on addressing all three dimensions of sustainability; economic, environmental and social. But transport appraisals seem to be mostly focused on the addressing aspects related to the economic and environmental dimensions, while the social dimension receives little attention. It is from this general conception that the objective of the project is to identify how the social aspect is understood and operationalised in relation to the planning process for two Danish light rail cases.

The cases are analysed through a qualitative study design with a theoretical framework focusing on the concept of sustainability, the sustainable mobilities paradigm and definition of social impacts. The purpose of the qualitative study design is to identify how the social dimension have been operationalised and to gain an understanding of how practitioners perceive and understand sustainability, the social dimension and potential social impacts of light rail systems.

The findings show that the two light rail cases have had different approaches to how sustainability have been used in the planning process, but that both cases can be considered as a part of a sustainable mobility approach. The findings furthermore show that there is a bottom-up acknowledged of the importance of evaluating social aspects, but that social aspects are yet to be acknowledged from a top-down perspective.

Resumé

Dette projekt bygger på to grundlæggende forståelser, hvor den først forståelse er at bæredygtig transportudvikling er afhængig af at løse alle tre dimensioner af bæredygtighed den økonomiske, miljømæssige og sociale. Men transportvurderinger synes for det meste at være fokuseret på de adresserende aspekter i forbindelse med de økonomiske og miljømæssige dimensioner, mens den sociale dimension får mindre opmærksomhed. Der har imidlertid i de senere år været en stigende anerkendelse inden for transport forskning af betydningen af transportens sociale aspekter, især med den voksende litteratur inden for mobilitetsparadigmet. Den anden forståelse handler om, hvordan letbaner har fået en form for genfødsel i mange europæiske byer inden for de sidste 20 år, da der er en voksende anerkendelse af forbindelsen mellem letbaner og byudvikling. Rationalerne for bygning af letbaner er ikke kun at etablere et højklasset transportmiddel, der kan bringe folk fra A til B, men fremmes i stedet for at tjene et bredere formål som en del af større byfornyelsesprojekter. Dette har også været blandt de vigtigste rationaler for letbanerne i Aarhus og Odense og som er de cases der er undersøgt i dette projekt. Det er ud fra disse ovenstående forståelser, at projektets formål er at identificere, hvordan det sociale aspekt forstås og har været operationaliseret i forhold til planlægningsprocessen for to danske letbaner.

Letbane projekterne analyseres gennem et kvalitativt undersøgelsesdesign med en teoretisk ramme med fokus på begrebet bæredygtighed, paradigmet for bæredygtig mobilitet og definition af sociale påvirkninger. Hvor fokus er er at identificere, hvordan den sociale dimension er blevet operationaliseret og at få en forståelse for, hvordan praktikere opfatter og forstår bæredygtighed, den sociale dimension og potentielle sociale påvirkninger fra letbaner.

Resultaterne viser, at de to letbaner har haft forskellige tilgange til, hvordan bæredygtighed er brugt i planlægningsprocessen, men at etableringen af letbanerne kan betragtes som en del af en bæredygtig mobilitetstilgang. Resultaterne viser desuden, at der er en bottom-up anerkendelse af vigtigheden af at evaluere sociale aspekter, og at en passende tilgang til evaluering af sociale påvirkninger bør være i et kvalitativt vurderingsformat som for eksempel multi-kriterie analyse (MCA). Men det blev også identificeret, at en sådan tilgang er udfordret i dansk planlægningskontekst, fordi sociale aspekter endnu ikke anerkendes fra et top-down perspektiv.

Content

1. Discussion of the problem

This chapter function as an introduction by setting the scene of the problem with a discussion of the social dimension within planning of light rail systems. The first part focuses on the growing sustainability challenges of automobility and the pressure it has on urban areas and society. The discussion then continues with an attention on light rail systems as a possible alternative for urban mobility, which can and is being, used as an urban development tool and not just a transportation mode. The focus then narrows in on a discussion of how the social dimension is underrepresented in transport planning and how this project can contribute with knowledge that can enlighten future planning practice. Lastly will the research question and structure of the report be presented.

1.1 Issues and challenges of automobility

The amount of transport is continually increasing all over the world, and Denmark is not exception to this. The largest Danish roads are expected to experience a growth of traffic of almost 70 percent towards 2030 and the rail services are also expected to experience an increase, although much lower than roads.
The amount of time an average Dane spends on transport is greater than the amount of time it takes to finish their primary education. Furthermore, an average Danish household spend more money on transport than they spend on food (Infrastrukturkommissionen, 2008). This shows that transportation is an essential part of our daily lives and that it is important that transport planning reflects this importance in a sustainable direction.

For many years, transport planning has had a functionalistic approach with attention on creating a transport system favouring automobility (Urry, 2007). This approach is still having a central role in contemporary transport planning, as it represents a freedom to move at both short and great distance with limited restrictions. With automobility, timetables for public transport became irrelevant, as the car introduced an independence that public transport could not provide (Urry, 2007). This is also the reason that the car is essential for many people, especially those living in rural areas, where alternatives to the car can be very

QUOTE
"*The narrow focus on solving congestion tends to mostly benefit high-income private vehicle users. More thoughtful and holistic solutions are thus needed to bring benefits to a wider population.*"
UN-Habitat (2013) p. 110

limited, due to poor public transport options and great distances. In urban areas, however, the car has more restrictions, as issues of congestion and parking represent severe challenges. With an increase in traffic, such issues will only become greater in time, without alternative initiatives being implemented. One initiative has been to increase road capacity, although this can be difficult in urban areas where the built structure limits the possibilities for expanding current roads and build new ones. Furthermore, it is well documented that increasing road capacity inevitable leads to more cars on the roads in form of induced traffic (Litman, 2017).

Motorised traffic is in many ways an unsustainable transport mode from an environmental perspective, as the use and emissions of non-renewable fossil fuels are among the major contributes to global warming. Furthermore, air and noise pollution from motorised traffic is a serious health concern that affects all social groups. But evidence shows that low income groups tend to be affected more than other groups (UN-Habitat, 2013). These issues of motorised traffic are known and have received political attention in European countries. European cities have introduced road user charging schemes for the central part of the cities (May *et al.*, 2010). Such schemes have in most cases had a positive effect in reducing CO_2 emission and air pollution within the cities. But implementing road user charging schemes, while it can be effective, is also subject to political controversy of priorities (May *et al.*, 2010).

QUOTE

"Streets that were once a place where people stopped for conversation and children played are transformed into the exclusive domain of cars. Furthermore, the quality of the local environment is vastly reduced with noise and air pollution."

UN-Habitat (2013) p. 110

Another factor for cars dominance can be identified as the phenomenon of 'car-fixation', proposed by Matthies and Klöckner (2015). They argue for psychological approach of understanding how the car has been predominant and this can be caused by 'car-focused socialisation'. Different environmental factors influence choice patterns, which, for instance, can be traced to childhood experiences of parents' car ownership and use (Matthies and Klöckner 2015). These factors create habits which can be difficult to change and provide an equal alternative to the car will in many cases not result in a modal shift.

One aspect of car traffic has received less attention within transport planning, but has gained some attention within transport studies. The sociological perspective, specifically social interaction and production of social capital have been argued to be

suffering from the increase of car driving (Bauman 2000; Putnam 2000). Especially solitary car driving, which represents the vast majority of car driving, has this encapsulating ability where the driver is isolated from others by the windscreen of the car (Brömmelstroet *et al*., 2017; Sheller and Urry, 2000). Interaction and exposure to strangers is very limited to non-existent, which has negative effect on social capital.

1.2 Rebirth of the modern tram

The challenges and issues presented above highlight the imperative importance of viable alternatives for urban mobility and here public transport plays a significant part in sustainable urban mobility. One of the public transport modes which in the last 20 years have experienced a rebirth is the modern tram, also known as a light rail transit[1] (MVG, 2008). Many European countries have built and many plan to build light rail systems to improve urban mobility in their cities (Bottoms, 2003). Light rail systems are much cheaper than metro systems, which is one of the reasons that cities down to a population of 100,000 inhabitants find light rail attractive for their city (Olesen and Lassen, 2016). But if the purpose is to provide a relatively low cost public transport mode that efficiently transport people from A to B, then a bus rapid transit system would be the favourable choice. This is, however, not the case for many European countries, as they have chosen light rail systems over bus rapid transit systems, despite light rail systems often show a poor socio-economic return (Olesen and Lassen, 2016). The reason for this, at first sight, irrational economic choice, is based on an acknowledgement that light rail systems can provide multiple benefits that makes it more than just a transport mode bringing people from A to B.

1.3 Abilities of a light rail

Light rail systems are considered as a sustainable mobility mode, which is a more affective people mover, as it has a large capacity and if segregated from other traffic in its own trace, have faster travel speeds than traditional busses and bus-rapid transit. Furthermore, does light rails primary run on electricity, which results in no local emissions and air pollution and have a lower noise level than busses that run on fossil fuels (MVG, 2008; Atkins and Grontmij, 2011).

Another argument used for light rail systems and rail based systems in general is that the factor of comfort level for such systems is perceived to be greater than bus-based alternatives (MVG, 2008). This comfort factor can be one important incentive for creating a modal shift, especially for car drivers where comfort is important. Although some studies on this topic have shown mixed outcomes over the existents of such a

[1] This report does not distinguish between tram, streetcar or light rail.

factor and it seems to be depended on the context and method of the study (Olesen, 2014, p. 39).
Contrary to traditional busses and BRT systems, which are very flexible in terms of routes choice, light rails have fixed tracks which make it expensive and difficult to change routes after some years. This can on one side be considered as a disadvantage if there start to be changes in residential patterns that call for a change of route. On the other hand, it is seen as an advantage by being fixated to a specific corridor, the light rail can then act as an important encouragement for attracting investors and developers to invest and develop along light rail corridor (Olesen, 2014). In this relation investigation of rise in property values in proximity to a newly established light rail corridor have been the topic of several studies. The studies reviewed by Nielsen *et al*. (2016) havs shown different results, as some light rail systems have had no effect on property values and others have shown an increase in up to 32 percent.
An important notice for these studies concerning rise in property values is that there is no generic and well established method for calculating these values (Nielsen *et al*. 2016). For this reason, large variations in the percentage of how much property values have increased can occur, as it can be difficult to determine such values because of the context of each study, where a lot of different factors can have an influence on property values.

As light rail is a public transport system where one purpose is to be a viable alternative to automobility, then it is important to investigate whether or not implementation of a light rail system has contributed to a modal shift from car to public transport. Several studies have investigated how implementation of light rails has had influence on modal shift and car ownership. The results have been slightly mixed, e.g. the paper by Lee and Senior (2013) shows by using English Census data, that four English light rails build between 1991 and 2001 have not contributed to discouraging car ownership. This is, despite that building light rails are often justified for its ability to create a modal shift of car users to public transport. Other studies have shown that implementation of new urban rail based systems have resulted in a modal shift (e.g. Hass-Klau and Crampton, 2005; Nielsen *et al*., 2016) and decrease of car ownership (Mulalic *et al*., 2015).

1.4 Light rail as an urban development tool

The rationales for building light rail systems can be different from country to country and from city to city, although there seems to be a consistent link between light rail and urban development, and spatial planning. This trend is especially seen in European cities (Olesen, 2014) and within cities in the United States (Cervero, 1984; King and Fisher, 2016). The motivation behind this rationale is the acknowledgement that light

rails have certain impacts on its surrounding area in form of direct and indirect effect. It is especially the indirect effects that some decision-makers promote as the mechanism for urban development (Olesen, 2014). Among these indirect effects are enhanced city image, which can attract businesses to settle along the corridor. Another indirect effect can be, the already mentioned, increase in property values. As Olesen (2014 p. 37) conclude '(...) the dedicated light rail infrastructure has the potential to attract businesses and facilitate urban regeneration and urban development.'

Rather than being promoted primary as a new sustainable public transport system, which provide better accessibility and travel time savings, light rail systems are promoted as urban development projects. Although, it is important to mention that there is still an emphasis on the sustainability aspect of light rail systems, with focus on the environmental factors, such as no direct emissions.

Nevertheless, when promoted as urban regeneration and development, it has to be supported through policies or it can otherwise lead to unwanted gentrification and social exclusion of low income groups along the light rail corridor. It is therefore, important that decision-makers are informed, as best as possible, of both potential benefits and potential consequences of establishing a light rail.

1.5 Social dimension

In relation to light rail systems it has been shown above that light rails are considered as a sustainable public transport system, which has the potential to be used as an urban development tool. Although, when promoted as a sustainable public transport system, it seems to be from a perspective of environmental concerns, rather than all three dimensions of sustainability. Furthermore, when promoted as an urban development tool, it seems to be from an economic perspective with focus on economic impacts. Such an interpretation, although it might be forthright, leaves the question of where the social perspective fits into the light rail equation. The question of the social dimension of transport has in recent years within transport studies emerged an interest and a call for attention towards understanding and evaluating social impacts of transport (Guers *et al*. 2009; Markovich and Lucas, 2011; Jones and Lucas, 2012). This has especially been in regard to preliminary planning phases, more specifically in appraisals of transport projects. Jones and Lucas (2012) highlight that social impacts of transport have been historically

QUOTE

"*Integrating social dimensions throughout the lifecycle of transport projects enhances their potential to bring life-changing benefits to the end users, while reducing the risk of negative social outcomes."*

UN-Habitat (2013) p. 108

underrepresented within transport decision-making and that this has led to a marginalised focus on well-being and quality of life in transport projects.
The attention on the social dimension and the relation to travel and movement has also been argued for by sociologist John Urry in his ground-breaking book *Sociology Beyond Societies* (2000). This has led to the still evolving and interdisciplinary field of the 'mobilities paradigm', which will be further elaborated in Chapter 2.

A UN-Habitat report on sustainable urban mobility also points to the missing application of social impacts within transport projects, as shown below:

> "*In recent years, transport policy has begun to focus more intently on new assessment and evaluation regimes, to better articulate the impacts of transport investments. Whereas transport projects undergo environmental and economic impact assessments, the application of social impact assessments is relatively less advanced.*" (UN-Habitat, 2013 p. 108)

It is this topic that is at the centre of attention of this report and it will be investigated within a Danish context of planning of two light rail systems.

1.6 Light rails in Denmark

As mentioned in earlier sections in this chapter, light rail systems have experienced a rebirth in European cities and this includes Danish cities. Many potential light rail systems have been on the drawing board, especially in the Greater Copenhagen region. But it is in the second and third largest cities in Denmark that construction is currently in progress, Aarhus and Odense respectively. Aarhus light rail is planned to be open in the summer of 2017 and Odense light rail is planned to open in late 2020 (Aarhus Letbane, n.d.; Odense Letbane, n.d.a). It is the planning phase of these two light rail projects which is used as case study for this project.

1.7 The study objective

For transport planning, there exist different forms of appraisals, which all can be related to one or more of the central dimensions of sustainability. Here the simple interpretation of economic and environmental perspectives used above, will be transferred to appraisals. Where the interpretation can be that the cost-benefit analysis (CBA) represents the economic impacts on society. While, environmental impacts are

analysed in environmental impact assessments (EIA)[2]. This leaves the question of where social impacts fit into appraisal of light rail projects. Therefore, the purpose of this study is to identify the role social dimension have appraisals and planning of the two Danish light rail projects. This is done through a review and analysis of the relevant planning and appraisal documents and through qualitative interviews with relevant professionals who have either been involved with the planning of the two Danish light rail projects or have essential knowledge about light rails and planning. The purpose of the qualitative interviews is to gain an understanding of how they perceive and understand sustainability, the social dimension and potential social impacts of light rail systems.

QUOTE

"(...) *it is important to consider the elements of social sustainability in any evaluation of mobility modes, since these social implications affect behavioural choices, which are ultimately responsible for the success or failure of any urban mobility system."*

UN-Habitat (2013) p. 108

[2] In a Danish context: VVM-redegørelse and Miljørapport

1.8 Research question

What role does the social dimension of sustainability have in planning of Aarhus and Odense light rail and how can evaluations of social impacts improve planning of light rails towards sustainable mobility?

This project is a case study that focus on the planning practice of Aarhus and Odense light rail. The purpose of the project is two-folded, where the first aim is to identify how the social dimension and social impacts of transport is understood and perceived among practitioners in transport planning. The second aim is to identify the role in which these two concepts have had in the planning process of the two Danish light rail systems.

Structure of the report

This first chapter has set the scene of the project within a common understanding of sustainability and the role of the social dimension transport and presented the research question. Chapter 2 will present the theoretical perspectives central to the project and establish a theoretical framework with definitions of the central concepts from the research question, that will function as the structure for the main analysis. Chapter 3 will place the projects position within theories of science and unfold a methodological discussion concerning the project study and the methods used. Chapter 4 is a short presentation of the planning process for both Aarhus and Odense light. Chapter 5 will further unfold the literature concerning social impacts and relational elements within the social dimension sphere of transport planning. Chapter 6 is the main analysis of the empirical finding for the project and is structured into three themes based on the theoretical framework. Lastly Chapter 7 will present the conclusion of the project.

2. Theoretical approach

This chapter presents the theoretical perspectives central to the project, as to provide a theoretical framework, which functions as the basis of the analytical approach of the project. First the theoretical foundation of the project takes its point of departure from the emerging socio-technical approaches within the 'mobilities turn'. Second the growing concept of sustainability and the associated dimensions will be presented from a transport oriented perspective. Following the concept of sustainability, the third section will present David Banisters 'sustainable mobilities paradigm' as an alternative approach to conventional transport planning. The fourth section will focus on impacts of establishing transport infrastructures, more specifically social impacts and how these can be defined. The conclusion of this chapter will describe the theoretical framework and how each of the theories is applied analytically, both individually and in combination.

2.1 Mobilities Turn

The theoretical standpoint of this project takes its departure within the growing study of mobilities, more specifically within 'the mobilities paradigm' or 'mobilities turn' as it is also known as. Mobility studies have its origin in sociology and social sciences with the sociologist John Urry introducing a new theoretical way of studying society. In his book, *Sociology Beyond Societies* (2000), Urry argue that society should be studied through mobilities. Here referring to mobilities as not to be confined by physical mobility, but to include other forms mobility e.g. virtual, imagined and experienced mobility.

The study of mobilities has opened for an interdisciplinary approach, where different fields (e.g. anthropology, geography, transport studies, and sociology) have contributed to the growing literature within the mobilities paradigm (Sheller and Urry, 2006). It is important to emphasise that mobilities in its various forms serve as an important part of our daily lives, and new forms of mobilities are rapidly growing.

The theoretical approach represented within the mobilities paradigm presented by Urry (2000) have led to a wide range of scholars to further develop the understanding of mobilities and its sociocultural significands (Cresswell, 2006; Jensen, 2013; Kaufmann, 2002; Urry, 2007; Vannini, 2010).

Merging approaches

Sheller and Urry (2006) argue that social science has been focussed on a 'sedentary' view of society and neglected how technologies, e.g. automobility have influenced and

transformed the way we perceive and live in time and space. Social science has mainly been focused on the interactions between 'human subjects', without acknowledging the influence that physical and material infrastructure have on everyday lives (Urry, 2007). This is despite the fact, that the world over the years is increasingly more and more on the move, with help from technologies such as, cars, trains and airplanes.

Traditional transportation research has from an analytical approach perceived transport of simply getting from A to B, in the most effective way. This have led to transport planning focusing on cost-effectiveness and utility maximisation, by increasing capacity and reducing distance, travel time and cost (Jensen, 2015). This approach has mainly paid attention to quantitative measures that neglect the social dimension of travel, as it identifies every person to always make rational decisions with the purpose of maximising one's utility.
The mobilities paradigm seeks to combine the social science and transportation approach into a mobilities approach, which is not to substitute the quantitative and rational approach, but rather to open for the possibilities of the 'irrational mobile person' (Jensen, 2015). This mobilities approach opens for an interdisciplinary understanding of what produces travel from a sociocultural perspective and with the basic idea that movement is more than from A to B.

The mobilities turn present a wide interdisciplinary approach to mobility, which reaches further than the scope of this project. This project sees the elements of the mobilities turn in relation to how it can help further explore and develop transportation systems that goes beyond traditional transport planning, specifically in terms of light rails.

2.2 Sustainability and transport

The report *Our Common future* was the result of the *World Commision on Environment and Development*, which were asked by the General Assembly of the United Nations to formulate 'a global agenda for change' (UN 1987). This publication, which is also known as 'Brundtland report', presented a definition of the concept of sustainable development, which since then has been adopted around the world. The report defined sustainable development as:

"*Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs."* (UN, 1987 p. 54)

This definition and the purpose of the report has not been to create a certain 'blueprint for action', but instead to act a 'pathway' from which to follow (UN, 1987 p. 18). There is, therefore, not presented any guidance for how to make the concept operational.

In her PhD thesis on sustainable transport planning, Jeppesen (2009) finds that this lack of guidance has let to cases where the concept has been reduced 'to a word, or merely a term'. In such cases, sustainability is used as a form of label that is meant to bring positive associations and does not reflect either a process or an end goal. When sustainability is used as merely a term, it then relies on the user's perception of the term. Jeppesen (2009), argue for two ways of using the concept of sustainability, which is either 'implicit' use or 'explicit' use. With implicit use of the concept of sustainability, it is used as a term, which can be used in many different situations, without there is given a defined way for how it is used or how it should be understood. When used in an explicit way, there is developed clear guidance for how to understand, operationalise, and evaluate the concept of sustainability.

Another aspect in the use of sustainability is whether it is used as 'process' or 'results'. 'Process' refers to using the concept of sustainability and the three dimensions as an active part of the actual transport planning and decision-making process. It refers to the process which leads towards a result and that the measure to reach the result is carried out on the basis of sustainability considerations and actions. Although the process can be sustainable, it does not necessary mean that the result is sustainable (Jeppesen, 2009 p. 26-27).

When the concept of sustainability is used in regard to 'results', then it refers to outcome of the planning and decision-making process. Here, sustainability is concerned with the actual results of the transport project and is evaluated based on a set of predetermined indicators. A sustainable result can be more manageable to achieve with a sustainable process, but it can also be achieved without a sustainable process, although it might be more difficult (Jeppesen, 2009 p. 27).

To further understand what sustainability entails, the Brundtland report does present a set of requirements for achieving sustainable development (UN, 1987 p. 74):

"the pursuit of sustainable development requires:

- *a political system that secures effective citizen participation in decision making.*
- *an economic system that is able to generate surpluses and technical knowledge on a self-reliant and sustained basis*
- *a social system that provides for solutions for the tensions arising from disharmonious development.*
- *a production system that respects the obligation to preserve the ecological base for development,*
- *a technological system that can search continuously for new solutions,*
- *an international system that fosters sustainable patterns of trade and finance, and*
- *an administrative system that is flexible and has the capacity for self-correction."*

Among these requirements, Jeppesen (2009), identify the main dimensions of sustainability, regarding 'sustainable transport planning". These dimensions are what is also perceived as the foundation of sustainability, namely economic, social, and environmental dimension.

In a later report from UN-Habitat (2013), each dimension of the concept of sustainability is presented in their relation to sustainable urban mobility. Here, the economic dimension is concerned with securing that 'resources are efficiently used and distributed to maximize the benefits and minimize the external costs of mobility' (UN-Habitat, 2013 p. 12). The environmental dimension is concerned with many environmental challenges of urban mobility, such as dependency on non-renewable fossil fuels, as well as air and noise pollution (UN-Habitat, 2013 p. 11-12). The social dimension in relation to urban mobility is described as:

> "*Urban transport is socially sustainable when mobility benefits are equally and fairly distributed, with few if any inequalities in access to transport infrastructure and services based on income, social and physical differences (including gender, ethnicity, age or disabilities)*" (UN-Habitat p. 10)

In the UN-Habitat (2013) report, an additional dimension has been added in relation to sustainable mobility. This is the 'Institutional and governance dimension', which is concerned with the framework where from urban mobility is constituted, referring to

transparent and participatory processes of planning and governing. This is, however, a bigger issue in developing countries and is already fairly strong represented in many developed countries.

The UN-Habitat (2013) report on sustainable urban mobility is an example of the relevance of developing the concept of sustainability within the field of transport planning and it shows that the subject of sustainable urban mobility is complex and comprehensive.

2.3 The sustainable mobility paradigm

Sustainability and transport is an increasing field of study both in research and in practice. As presented above with Jeppesens (2009) PhD thesis, there is different approaches for how to use the concept of sustainability in transport planning. In this relation, Banister (2008) presents a planning approach, which he terms 'the sustainable mobility paradigm', as an alternative approach to conventional transport planning. Banister writes:

> *"Sustainable mobility provides an alternative paradigm within which to investigate the complexity of cities, and to strengthen the link between land use and transport."* (Banister, 2008 p. 73)

Banisters (2008) approach is a critique of conventional transport planning and its failing ability to find sustainable mobility solutions in cities, which have seen an increase in car dependence. This increase in car dependence is a result that stems from a lack of attractive alternatives, such as public transport, cycling and walking. This is despite the fact, that cities provide the best opportunities for a 'sustainable urban form'. Cities with a population over 50,000 generally have the potential to support mixed land use and a transport system with minimised need for a car (see also Jespersen (2014) for thoughts on the paradigm in a Danish context).

Banister (2008) identifies two key challenges in the approach used in conventional transport planning. The first challenge is that transport is thought of as a derived demand, where travel is always seen as a cost. This approach always sees travel as something that is needed and where travel time is wasted time. There are, however, more and more people that use travel as a form of activity and in such cases travel time is valued time. It is important to recognise that transport is considered as derived demand as well as a valued activity (Banister, 2008).

The second challenge is the subject of time minimisation of travel, especially in cities. More and more cities have used efforts to slow down traffic, mainly for safety and

environmental reasons. There is, nevertheless, the issue of unwanted slow traffic in the form of congestion. Congestion is a serious issue in many cities and is a topic that is never ending as it seems unrealistic to believe in traffic without congestion in some form of way. The aim should be to work towards a planning that consider reasonable travel time, instead of time minimisation. Although, it can be difficult to have an exactly defined parameter of what can be considered reasonable travel time, which is why sustainable transport policy is important.

In order to develop sustainable mobility in cities these two above mentioned challenges have to be managed. But the current methods that are represented in conventional transport planning, is not equipped to handle these new approaches. New methods have to be developed to create the transition to the sustainable mobility approach.

In Table 1, is shown the difference in traditional transport planning and sustainable mobility as Banister (2008) envision it. Banister highlights four kinds of actions that are needed for achieving sustainable mobility (Banister, 2008 p. 75 with underlining added):

> "*The sustainable mobility approach requires actions to reduce the need to travel (less trips), to encourage modal shift, to reduce trip lengths and to encourage greater efficiency in the transport system.*"

Making these actions possible does not only require an ideological change of transport policy, which is primary based on rationality and economic arguments, but it is an important step towards sustainable mobility planning. Another important step requires that the public is involved and support such change. If the public, which includes both the inhabitant and stakeholders, does not support a change of perspective, then it will not happen.

Table 1 Conventional approach vs. Sustainable mobility approach

The conventional approach – transport planning and engineering (Marshall 2001)	An alternative approach - sustainable mobility (Banister 2008)
Physical dimensions	Social dimensions
Mobility	Accessibility
Traffic/car focus	People focus, either in (or on) a vehicle or on foot
Large scale	Local scale
Street as road	Street as a space
Motorised traffic	All modes of transport often in a hierarchy with pedestrian and cyclist
Forecasting traffic	Visioning on cities
Modelling approaches	Scenario development and modelling
Economic evaluation	Multicriteria analysis to take account of environmental and social concerns
Travel as a derived demand	Travel as a valued activity as well as a derived demand
Demand based	Management based
Speeding up traffic	Slowing movement down
Travel time minimisation	Reasonable travel times and travel time reliability
Segregation of people and traffic	Integration of people and traffic

Source: Adapted from Banister (2008) (Table 1)

2.4 Social effects and impacts of transport

It is important for a preliminary analysis of light rail project to investigate the different kinds of impacts that the light rail can have on the surrounding area. These impacts can generally be considered to be within the same three dimensions as the concept of sustainability; economic, environmental and social. While economic and environmental impacts are generally well defined, the same cannot be said for social impacts. Social impact is a term that is difficult to define and this has led to a conceptual confusion of how the term should be understood (Jones and Lucas, 2012). There exist various understandings of the term, although there have been few attempt to create a clear definition. The term has in early mentions been used with the purpose of identifying social consequences ahead of time (Burdges, 1987). It has been used in social impact assessments of planning in general and has not specifically been focused on transport projects. The use of the term has in this relation been dedicated to identifying a social impact as an adverse impact. This approach focus solely on social impact in a negative way and ignore that social impacts also can be positive and seen as a benefit. Stanley and Vella-Brodrick (2009) argue that in cases where social impacts have been mention

in relation to transport project, it has also been considered within a negative context (e.g. accidents and people with disabilities).

This focus on social impacts as something that is of a negative nature is insufficient if the social dimension should be equally explored in appraisal, as the economic and environmental dimension are. There is, therefore a need for a definition that captures both positive and negative effects and such a definition is presented by Geurs *et al.* (2009 p. 71):

> *"…social impacts of transport are defined as changes in transport sources [vehicles, infrastructure and/or movement] that (might) positively or negatively influence the preferences, well-being, behaviour or perception of individuals, groups, social categories and society in general (in the future).*"

This definition shows how social impacts of transport can be difficult to define and it can be necessary to have a very broad definition in order to capture the complexity of the term. This broad definition does create certain methodological challenges, as it recognises all groups of society from all of society in general and down to subjective individual. Another challenge, identified by Geurs *et al*. (2009 p. 71), is that it implicates an overlap with impacts which can be considered as a part of the definitions within the economic or environmental dimensions. The scholars have deliberately chosen to do this, as to not avoid the possibility of impacts, which can be seen as part of all three dimensions. An impact can be understood in a way which suggests that it has an influence on all three dimensions. In such cases, it is important to only have it represented once in an analysis, to avoid the possibility of double counting impacts (Geurs *et al*., 2009 p. 71). The understanding of when something can be considered to be a social impact can vary from individual to individual. Here Geurs *et al.* (2009) distinguish between social impacts and social effects, as they identify a certain physical change in transport source leads to a series of effects, e.g. air pollution, physical barrier, or better accessibility. These effects cannot necessarily be considered as a social impact, as it depends on the sensitivity level of each individual. A social effect becomes a social impact when the sensitivity level is surpassed and it leads to any form of change in behaviour. This shows that social impacts of transport are a very complex and comprehensive matter and that there is a need for methodologies and categorisation in order to incorporate social impacts in analysis for transport projects. This will be will be further elaborated in Chapter 5.

2.5 Theoretical framework

This chapter have presented the theories which will act as the theoretical framework for answering the research question. The following conclusion for this chapter will explain how the theories are operationalised throughout the analysis of the thesis. Each of the theories is used in the analysis, both individually and in a form of combination, as they all share a common element in regard to the social dimension.

This project takes its theoretical point of departure in the sociological approach of the mobilities turn, which seeks to highlight the need for an understanding of both how and why we move. The mobilities turn seeks to go beyond the traditional understanding of people as always rationale agents and explore the underlying social aspects of movement. Through the mobilities turn perspective, a light rail is recognised to have a material, physical, psychological and cultural effect, rather than just being a transportation system, which brings people from A to B.

The concept of sustainability is for the analysis used in two different ways. The first is that the concept of sustainability encompasses a focus on the three dimension; economical, environmental and social. While these dimensions are complex and mutually correlated with each other, they are in this project used as simplified terms to divide the otherwise complex aspects of transport planning. The second approach of sustainability refer to analysing how the concept is understood and used in relation to planning of light rail systems. This is done through qualitative interviews and analysis of planning documents. The emphasis will be on how the concept of sustainability has been implemented in the planning of the two light rails (e.g. implicit or explicit use of the concept).

The sustainable mobility approach shares many similarities with the 'mobilities turn' and sustainability. While the mobilities turn, have a very broad focus on all the different forms of mobility, the sustainable mobility approach narrows in on the actual planning perspectives. The sustainability aspect of this approach, more or less explores all three dimensions, but one of the key notions is the emphasis on moving away from having economical dimension as the main focus. This theoretical approach is in the analysis used to get an understanding of how planning of the two light rails fit into the traditional transport planning approach and the sustainable mobility paradigm approach (Table 1).

The definition of social impacts provided above, presents a foundation from which it is possible to investigate how social impacts have been implemented in planning of the

two light rails. In this relation, the analysis focus on the understanding of what can be constituted as a social impact, through qualitative interviews and review of the planning documents. It is important to gain knowledge about how the social dimension and social impacts are understood and used in order to identify potential challenges and possibilities of how investigation of social impacts can improve planning practices.

The theoretical framework is presented in Figure 2.1, and shows how the 'mobilities turn' act as the common frame for this project. Each of the three theories are presented with small arrows illustrating how these are mutually connected through the social dimension. The thick arrows represent how the theories be used to gain an understanding of the planning process of Aarhus and Odense light rail, and furthermore how this knowledge can reflect back to improve the understanding of the theories.

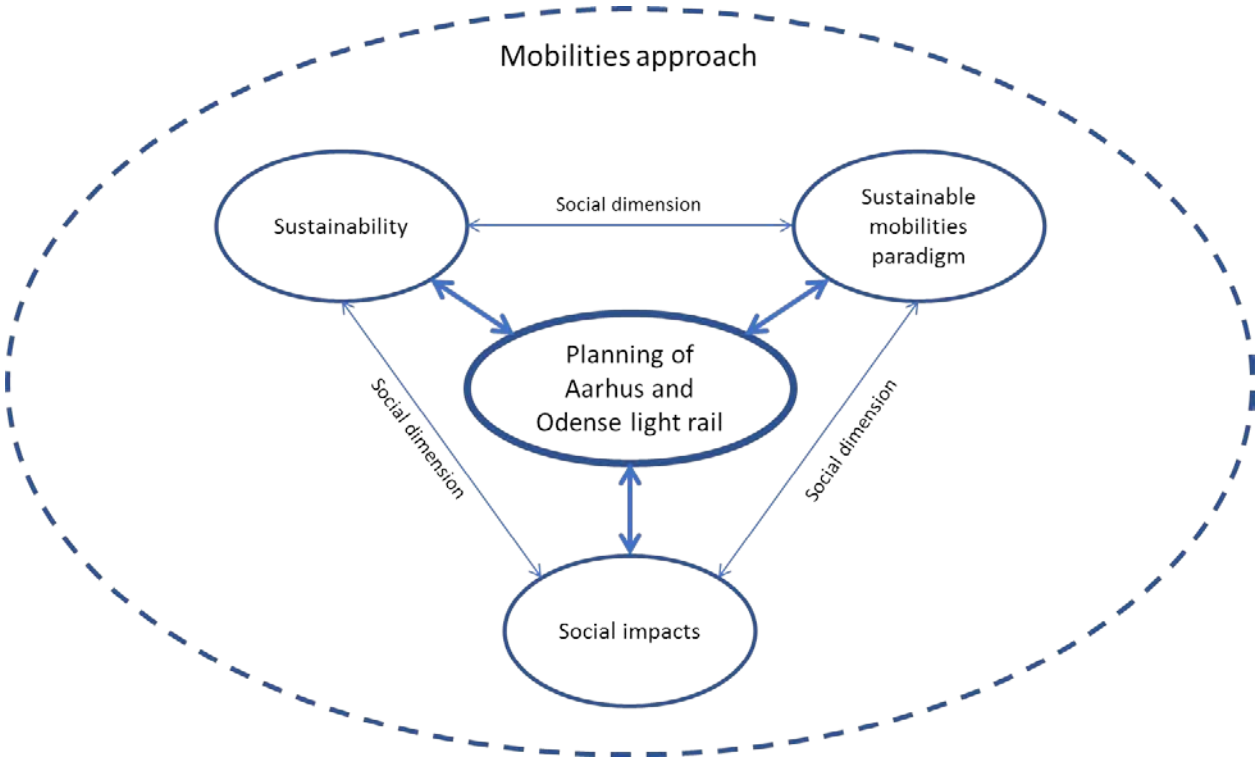

Figure 2.1 Theoretical framework (Own illustration)

3. Theories of science and methodology

In this chapter I will direct the attention towards the projects position within theories of science and the methodological discussion concerning the project study and the methods used. First, I argue for the use of a pragmatic approach that takes hold of a problem by using experience and knowledge from practice as an approach for solving the problem. Furthermore, is argued for pragmatic pluralism, which opens for the opportunity and urge for the use of multiple theoretical approaches and in this case, the hermeneutics and phenomenology open for an interpretation of the literature and experiences through interviews.
The practical methods will be described individually and it will be argued for use of a qualitative research design to answer the research questions.

3.1 Theories of science

The purpose for the project is two-folded, as the first aim is to identify how the social dimension and social impacts of transport is understood and perceived among practitioners in transport planning of Danish light rails. The second aim is to identify how this understanding is represented and operationalised within the actual planning process of Danish light rail systems. It is therefore, argued for a pragmatic approach to this project, as this approach have an emphasis on experience and knowledge through practice and human action. The knowledge derived through practice is represented by different disciplines, which each has different experiences and realities of practice (Olesen, 2014).

Pragmatism in its classical sense started around 1860 with Charles Sanders Peirce as the founder and with William James and John Dewey as the main contributors of the classical pragmatic tradition (Gimmler, 2005). The epistemology of pragmatism is that knowledge is gained through practice, action and experience. In this relation knowledge is also derived from our everyday lives and not only something that can be derived in a laboratory (Brinkmann, 2013a). Theories are therefore, seen as useful tools that can help us understand and analyse processes of the world. Although, theories are helpful tools, they do not present absolute truth.

The way in which we gain knowledge is dependent of a lot of factors and can be both contextual and situational. Knowledge is somewhat shaped by experience and in regard to experience and normativity, the pragmatic approach does from Dewey's perspective not limit itself to scientific cognition, instead the line between scientific cognition and

human cognition is somewhat blurred as the human in any case cannot by seen as a passive bystander (Brinkmann, 2013a p. 63). The planner, architect, researcher, student etc. all gain experience through practice and action, and some of this experience can be described as tacit knowledge. Here, 'tacit knowledge is implicit knowledge and therefore we know more than we can tell. But sometimes telling is necessary, this is when controlled experience starts.' (Gimmler, 2013 p. 19). It is in this relation important to understand that all actors bring 'tacit practical knowledge' (Olesen, 2014 p. 87) which will always have a value-laden perspective, to a certain degree. It is therefore, important to the best of our ability 'to acknowledge and compensate for the influence of our perspective' (Hildeband, 2008 p. 225) when performing research or other forms of inquiry.

Another aspect within the pragmatic approach is the notion of abductive reasoning, which differs from the more traditional ways of reasoning, induction and deduction. Inductive reasoning can be described as the process of generalising based on previous experience or observations and deductive reasoning can be described as way to prove that something must be (Brinkmann, 2013a). While induction only provide a likely conclusion, deduction provide definite conclusion. Abductive reasoning is way of working with possible explanation to uncertain situations through hypothesises (Gimmler, 2005). In this sense abduction is way to describe an explanation to a problem through a logical interpretation of the problem. Abduction therefore, offer a way in which to describe mechanism social impacts of light rail systems. Mette Olesen describes in her PhD thesis how abductive reasoning can is applied in her research of light rails:

> "*Abductive reasoning about light rail projects could suggest that it would be likely that the light rail would be considered as more of an 'urban project' than an 'infrastructure project'. However, there would be no claim that all light rail projects are then 'urban projects'. Being an urban project may be a reasonable fact in some cases, where this reasoning proves to be true. This reasoning then has implications for how we should interpret the outcome of such systems and how we should assess success in reaching these objectives*." (Olesen, 2014 p. 87)

This abductive reasoning has also been relevant to consider for this project, but furthermore could an abductive reasoning for this project suggest that the 'social dimension' and 'social impacts' is not considered as part of the planning processes of Danish light systems.

> **QUOTE**
> *"In the analyses of interview material the acknowledgement of the fact that affective expressions are already interpreted expressions could function as a necessary precaution against the naïve longing for authenticity. The interviewed person certainly meant what she or he said, but the expression nevertheless reflects individual and social values and evaluations – and the same goes for the observation or analysis of the researcher."*
> Gimmler (2005) p. 19

The ontology of pragmatism opens for multiple interpretation of what can be perceived as reality and therefore, the pragmatic approach does not represent a way to seek and find an absolute truth nor is not relevant or even doable to achieve. The pragmatic approach give the opportunity to use different ontologies as it would be foolish to limit oneself to one ontology, as if to limit a carpenter to only use one tool (Brinkmann, 2013a p. 56). Pragmatism therefore, allow and urge for the use of an open view, which sees the world from different perspectives, which can be referred to as pragmatic pluralism (Brinkmann, 2013a). Here, hermeneutics and phenomenology describe how interpretation play a significant role in analysing meaning and significance of text and speech (Brinkmann, 2013a; Brinkmann, 2013b). Part of the aim of this project has been to find meaning and understanding through a qualitative approach of reading relevant literature and planning documents. Both in terms of a historic perspective and in a contextual perspective. An important aspect within hermeneutics is that it takes a starting point in the researcher's or any interpreter's prejudice of the studied subject or phenomena, which is used to access a deeper interpretation (Egholm, 2014 p. 100-101 in Lange, 2016).

3.2 Practical methods

In order to identify the role of the social dimension and social impacts in Danish light rail planning, it has been necessary to firstly establish how these concepts are defined and understood in terms of this project. Following that, it is necessary to investigate how practitioners understand and perceive the two main concepts of this project, namely the social dimension and social impacts. Here, the methodological approach is important to gather the necessary knowledge. This following section will describe the practical methods and methodological considerations for the study design of the project.

The first part will shortly argue for a qualitative study design and the following will describe the choice for the use of case studies. Next will the methods used for gathering empirical data be described and discussed, these methods include document analysis and interviews.

Qualitative study design

A qualitative study design is chosen, because it for this project is found central to the purpose of collecting an understanding of how the social dimension has been operated within analyses and planning of Danish light rail projects. Quantitative elements could have been implemented, if the study objective had been different (e.g. focussed on inhabitants' perception of potential social impacts of a light rail). However, since the purpose is to gain an understanding of the planning process and practitioners' perception and understanding of the concepts of social dimension and social impacts, it is found relevant with a qualitative study design that will focus on experience and tacit practical knowledge as argued above.

Case studies

Case studies is a common study design, which is used by many different disciplines, as it provides an opportunity to focus on a specific phenomenon, which can entail a wide range of possibilities such as, an organisation, a city, an individual (Andersen, 2014). For this project, the particular cases are the planning of two light rail system. The purpose of two cases instead of one is to explore the planning of light rails in a wider Danish context, as major infrastructure projects in two different cities are two very different projects.

There is at this time of writing no functioning light rail system in Denmark, but both of the two cases are currently in development with Aarhus Letbane planned to open late

summer this year and Odense Letbane planned to open in 2020. However, both of these cases have gone through years of planning processes and it is specifically this process, which is the field of research for this project. This is also the among reasons for choosing these two specific cases, as they are the two out of three light rail projects currently in development in Denmark. The two cases have similarities, but also present clear differences both from a physical perspective, as well as in their narrative (see Chapter 4 for an introduction to the cases). And this makes these two cases interesting in relation to how they have been envisioned and planned. The third light rail project in Denmark is the Ring 3 light rail in Greater Copenhagen, which also have gone through years of planning and is currently in tendering. But this light rail project has not been included in this project primary due to time restrictions and lack of resources.

Document analysis

An important part of gathering empirical knowledge of the planning process of the light rails in Aarhus and Odense, have been to conduct document analyses of a range of different document. The document analysis consists of two part with the first being with a focus on planning documents for the Aarhus and Odense light rails. The second part consists of a form of literature review within transport studies and social sciences that focus on the social aspects of transport, which will include scientific articles, reports and official guidance's (see Chapter 5). This has provided a valuable foundation for the preparation of interviews, and the analysis of planning documents and interviews.

The analysis of planning documents has been used to identify rationales, visions, agendas and practices, which is presented to public. This can help build a narrative of the historical perspective of the long planning process and identify key events. Furthermore, have the document analysis focussed on identifying how social aspects have been presented, as this is a central part of answering the research question.

QUOTE

"*Document analysis is perhaps the most widely used method in social sciences.*"

Lynggaard 2010 p. 137 in Lange, 2016 p. 57 Own translation

It is not only the written word that is relevant in document analyses, visual representation in documents can also give meaning which can be interpreted. This has, however, received less attention in the analysis for this project.

The planning documents analysed have been different kinds of planning documents in form of preliminary analysis, CBA, EIA and explanatory report.

The intention of the analysis of planning documents has been, besides from a narrative perspective, to identify aspects related to sustainability, the social dimension and social impacts. Here, concepts and theories from the theoretical framework and literature review have been used as a necessary guidance for the direction of the search in the different planning documents, as many of these planning documents are long and comprehensive.

The planning documents reviewed for Aarhus light rail are listed below:

- *Sporvogne i Århus,* 2000
- *Vision om letbane i Århus-området*, 2005
- *Letbaner i Århus-området*, 2006
- *VVM-redegørelse og miljørapport for Letbane i Århus-området – etape 1*, 2010
- *Vurdering af eksisterende stationer på etape 1*, 2013
- *Forundersøgelse Letbaneetape Brabrand – Aarhus Ø*, 2014

The planning documents reviewed for Odense light rail are listed below:

- *Bypotentialet for Odense Letbane: Foranalyse – En bystrategisk udviklingsproces: Fra vision og proces til konkretisering*, 2010
- *Foranalyse af letbane: Teknisk baggrundsrapport*, 2011
- *Odense Letbane: Udredningsrapport*, 2013
- *Odense Letbane: Udredningsrapport – Resume*, 2013
- *Odense Letbane: VVM og miljøvurdering*, 2013
- *VVM for Odense Letbane: Baggrundsrapport om landskab og byæstetik*, 2013
- *VVM for Odense Letbane: Sammenfattende redegørelse*, 2013

As mentioned, the purpose of the document analysis of scientific articles have been to develop an understanding of the contemporary research within transport studies and social sciences concerned with social aspects of transportation. Some international reports and guidance have also been included in the review. The reasoning to include these has been to gain a broader conceptual understanding between the relations of the social aspects within transport planning. And furthermore, serve the purpose of drawing on international practice and experiences, which are used to analyses the Danish cases.

Interviews

Besides document analysis, another important part of collecting empirical data have been done through qualitative interviews. The aim of a qualitative interview is to gather a deeper understanding of a certain topic. An interview is a dialog between the interviewer and the interviewee, where the form of the interview can be structured depended on the practical opportunities, purpose of the study and resources available (Andersen, 2014). Generally, face to face interviews can be divided into three structures, with the fully structured interview, the fully unstructured interview and the semi-structured interview, with the latter being in the middle of the other two approaches (Brinkmann, 2013b). Besides the overall structure, an interview can be analytically performed in different forms. Here, Brinkmann (2013b p. 43) identify two broad analytical approaches:

> "*On the one side, experience focused interviewing seeking to elicit accurate reports of what interviewees have experienced (in broad terms the phenomenological positions), and on the other side, language and interaction-focused interviewing (discourse-oriented positions) that focus on the nature of interview interaction in its own right.*" (Brinkmann, 2013b p. 43)

Neither of these approaches can be said to be better than the other, as they depend on the purpose of the interview. The interviews for this project have been inspired with elements from both approaches. The interviews provide an insight to the cases which would not be possible for the document analysis and it gives the possibility to get new viewpoints which has not been presented in the written documents.

Preparation of interviews

Semi-structured interviews are, as it is implicit in the name, neither fully structured nor fully unstructured interview, but instead lies somewhere in the middle and is regarded as 'the standard approach for qualitative interviewing' (Brinkmann, 2013b p. 19). A semi-structured interview gives the opportunity to adapt the interview according to the answers given by the interviewee. Instead of a strict structure of questions, the semi-structured interview is performed with an interview guide, which is only a guiding tool for the interview.

Before the first interview, a general interview guide was constructed and acted as the overall structure for all the interviews. For each interview, the interview guide was revised with minor changes to fit the profession and work of each interviewee, but the general structure of the interview guide remained unchanged. The general interview guide can be found in the Appendix 1.

A lot of thought and time has gone into aiming the questions of the interviews, regarding the social dimension and social impact, to not direct the answers of the interviewees, but instead to encourage them to give an answer solely based on their professional opinion. This 'Rogerian nondirective approach' (Brinkmann, 2013b p. 9) have guided the main part of the interviews. Although, as Brinkmann (2013b p. 19) state *'(...) there are no such thing as non-leading questions.'*. Even telling the interviewees the topic of the project, have already guided the direction of the interview and can somewhat influence interviewees and therefore the possibility of it being reflected in their answers. Therefore, the questions have been aimed to be as open as possible without suggesting what the social dimension and social impacts represents and whether it is needed in planning and appraisals of transport of light rails. As the quote to the right states it is preferable not to talk about specific opinions, however, this project have partly been aimed towards the interviewees professional opinion, as well as talk about the general theme, as it has been found relevant to answer the research question.

> **QUOTE**
> *"All questions lead the interviewee in certain directions, but it is generally preferable to lead participants only to talk about certain themes, rather than to specific opinions about these themes."*

All interviewees were asked permission to use the interview actively in the analysis of the project and agreed provided a review. An important notion in relation to the interviews, is that quotes used in the analysis to emphasise certain meaning, is based on my own interpretation.

Interviewees

Finding relevant people to interview about their knowledge and experiences of planning of Danish light rail systems.

Recruitment of interviewees was based on the criteria to have representatives from three different professions, namely planners, consultants and researchers, and that these either had been involved with planning of light rails and/or have knowledge of such planning process. Furthermore, was a criterion to have representatives from each of the two light rail cases.

Each of the interviewees were contacted by mail and it was necessary to provide a brief introduction to the topic of the project, as to get their interest to participate in the interview. But this introduction to the topic can unintentionally have influenced the interviewees perception and opinion of the topic, even though it was attempted to be written objectively.

The interviewees are listed below:

- Christopher Holland: Project manager and consultant for transport planning at COWI, have worked together with Aarhus Letbanesekretariat on future stages of Aarhus light rail and have worked on the environmental impact assessment for the first stage of Aarhus light rail. Have also been involved with a preliminary analysis of the second stage of the Odense light rail.
- Morten Skou Nicolaisen: Urban Mobility Planner at Aarhus Municipality, previously Assistant Professor at Aalborg University with a PhD in transport project evaluation.
- Søren Sloth Lave: Planner at Aarhus Municipality, have worked on the environmental impact assessment and the municipal plan supplement for the Aarhus light rail.
- Paw Gadgaard: Manager of local planning at Odense Municipality, worked as project manager for the environmental impact assessment and the local plan for the Odense light rail.
- Carsten Henriksen: Specialist consultant, Tramway technical leader at Odense Municipality, has been project manager for a preliminary analysis, and has furthermore been involved with the explanatory report[3] and the environmental impact assessment for the Odense light rail.
- Mette Olesen: Project manager at Nordjyllands Trafikselskab. Have a PhD in European light rail mobilities with special focus on light rails as a strategic development tool and have also been involved in planning processes of Danish light rails from her work at COWI.

Five of the six interviews were conducted as face to face interview, with the last interview with Mette Olesen being the only telephone interview.

[3] *Odense Letbane: Udredningsrapport* (Odense Kommune, 2013)

Own practice and experience

I have during this project used my own experience and knowledge concerning preliminary planning of light rail systems, as I during my internship at Metroselskabet & Hovedstadens Letbane have been involved with a preliminary analysis of a possible light rail between Gladsaxe and Nørrebro along Frederikssundsvej in Copenhagen. The preliminary analysis was divided into four groups, each with different objectives. The group I was a part of, were tasked with developing a generic method for strategic analysis and mapping to identify potentials along the light rail corridor. This group consisted of Metroselskabet & Hovedstadens Letbane, Copenhagen and Gladsaxe municipality and external consultants.

Most of my work, were concerned with processing socio-demographic data and searching for research and international examples that could be used in the analysis. It was during this process that the curiosity for the social dimension and social impacts of light rail systems were evoked.

4. Introduction to Danish light rails

The purpose of the chapter is to give an introduction to the two case studies of this project, by giving a short historic picture of the process for the two light rail cases.

4.1 Light rail in Aarhus

The first tram in Aarhus opened in 1904, but with the increase of automobility and after almost 70 years the tram was closed in 1971 like many other trams around Europe (COWI, 2010). But in 1999, Aarhus city council and the Ministry of Transport launched the first inquiries of the possibility of reintroducing the tram in Aarhus and the rationale behind this inquiry was that the traffic in and around the city of Aarhus increase every year, while the share of public transport steadily declined (Århus Kommune, 2000). But it was not until 2005 that the light rail system in Aarhus gained momentum and a new, but similar, vision evolved. This main idea was that the two already existing regional railways to Grenaa and Odder should be used as the foundation for the new light rail system and should be connected with a 12-km track between the two regional railways (COWI, 2010). The rationale behind this upgrade was that Aarhus in recent years had experienced an increase in commuters from the neighbouring municipalities (COWI, 2010) and the growth of inhabitants in the Aarhus area turned out to be higher than expected back in 2000, especially in the northern part of Aarhus with Lisbjerg as a major development area (COWI, 2005). This growth in commuters and inhabitants highlighted the need for an upgrade of the public transport system and connecting the two regional railways and later upgrading to a light rail systems posed an opportunity that could tackle these challenges.

Facts of Aarhus Letbane (stage 1)

- 110 km of track
- 49 stations
- Have two types of light rail systems. One to Odder with a max. speed of 80km/h. and one to Grenaa with a max. speed of 100km/h.

(Aarhus Letbane, n.d.; Midttrafik, n.d.)

In 2010, the EIA[4] was sent in hearing, which later resulted in the Aarhus City Council passing the municipal supplement for stage one of Aarhus Letbane. Two years later in May 2012, the Act of Aarhus Letbane was passed by the Danish parliament and construction of the light rail started in 2013, with Aarhus Letbane scheduled to open in the late summer of 2017. This is, however, only stage one of vision of creating a light

[4] *VVM-redegørelse og miljørapport for Letbane i Århus-området – etape 1* (COWI, 2010)

rail network in the Aarhus area. Three extensions of network are part of the vision for the light rail network and the second stage which goes between Aarhus East and Brabrand was investigated in 2014 with a preliminary analysis of this alignment (Letbanesamarbejdet, 2013; COWI, 2014a).

With 110 km of track the stage one of Aarhus light rail is not just an urban light rail, but it also acts as regional train with connections to Odder and Grenaa. Several areas along the alignment, mainly in the northern part of Aarhus, have been identified as areas with potential for development. Among the towns can be mentioned Lisbjerg, Nye and Elev. These new development areas will with the light rail have direct access to the city centre of Aarhus. Other noteworthy facilities along the corridor is Skejby hospital, Aarhus University campus and the new library and citizen service center at Dokk 1 down at the harbour front.

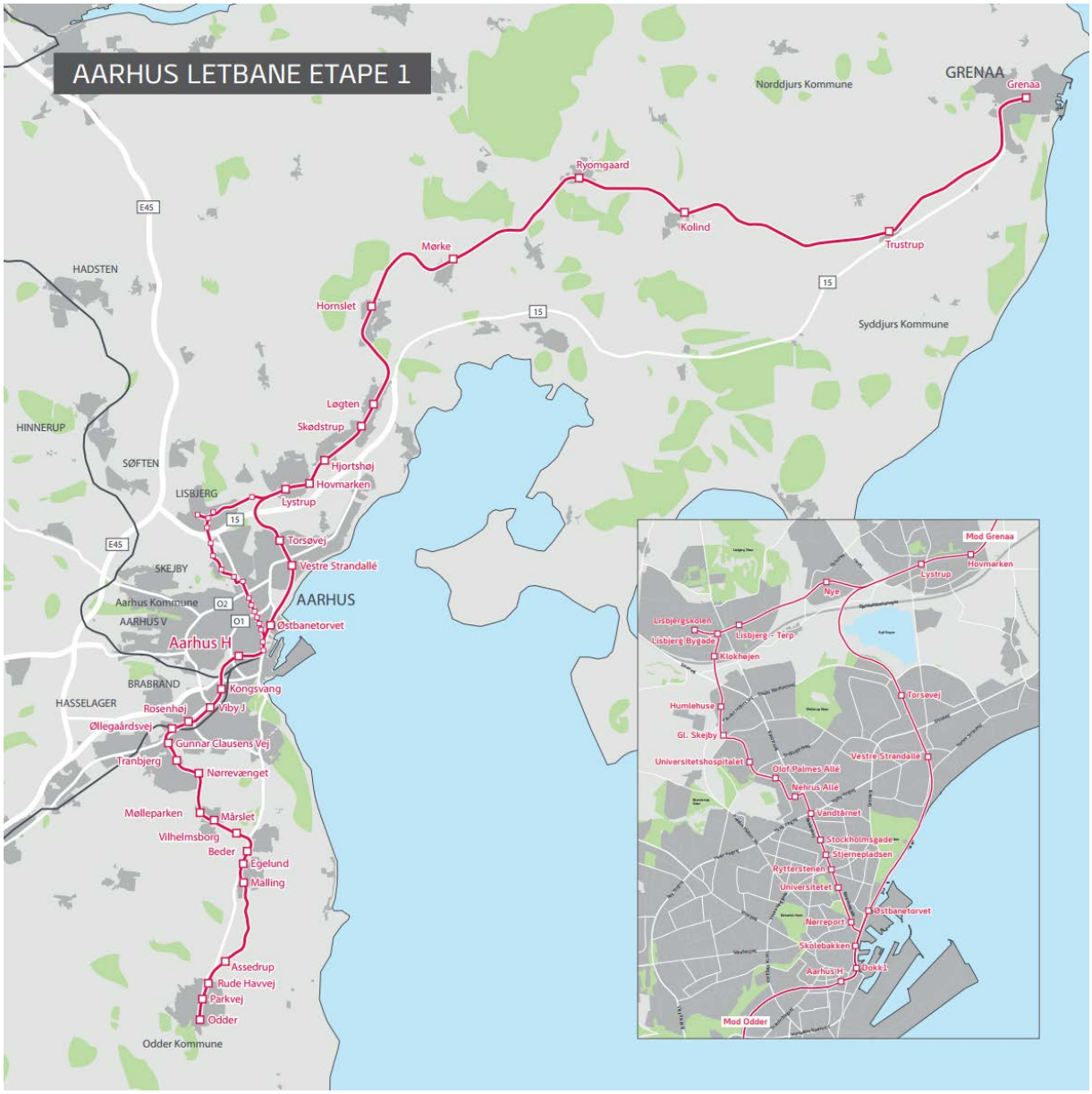

Figure 4.1 Map of stage one of Aarhus Letbane (Source: Aarhus Letbane, n.d.)

4.2 Light rail in Odense

Odense is the third largest city in Denmark with over 200000 inhabitants in Odense Municipality (Odense Kommune, 2016). The city of Odense aspires to transform itself from 'a large Danish town to a great Danish city' and a large step of being able to achieve this is by implementing a light rail system as the 'backbone' of the general transport system and urban development to accommodate the continuing growth of the city (Odense Letbane, n.d.c).
Odense is scheduled to be the second city in the Denmark to have a new and modern light rail system. Odense has, like Aarhus and Copenhagen, previously had a tram system. In 1911, the first tram line opened in Odense and it was the third and latest of the three largest cities in Denmark to introduce a tram system (Odense Letbane, n.d.b). Although, being the latest addition of tram systems in Denmark at the time, it became the first to close down. The tram was perceived as old-fashioned and uncomfortable. Furthermore, with the increase in automobility, the tram was seen as the problem, which caused congestions issues. This led to the closure of the Odense trams system in 1952 (Odense Letbane, n.d.b).

In 2009 Odense Municipality decides to conduct a preliminary analysis of a light rail system for the city of Odense, with Grontmij Carl Bro as the main consultant and along with this analysis Juul Frost Arkitekter complete an analysis with a focus on the urban potential of building a light rail in Odense (Odense Kommune, 2011). Another purpose of the analysis by Juul Frost Arkitekter was to investigate potentials of different alignments and other transport modes from a perspective of added value. Here, added value is not expressed in monetary terms, but is instead based on qualitative assessment on a range of parameters (Juul Frost Arkitekter, 2010).

Facts of Odense Letbane (stage 1)

- 14,7 km of track
- 26 stations
- Departures every 10 minutes.
- 35,000 passengers expected on weekdays and one million estimated per month.
- Total travel time from North to South is approximately 42 minutes including stops.

(Odense Letbane, n.d.c)

These two analyses were among the first steps toward the decision of building a light rail in Odense and in February 2011 Odense City Council decide on the definitive alignment for stage one of the light rail project. As a next step the City Council decide to proceed with the planning of Odense light rail and two additional analyses is needed before the Danish Parliament could decide if they would grant funding for the

construction of the light rail. These analyses are the EIA[5] and an explanatory report[6], the latter with the purpose of forming the foundation for a political agreement and passing of the construction act of the light rail (Odense Kommune, 2013b). The act of Odense Letbane was passed in February 2015 by the Danish Parliament, which meant the physical construction phase could begin, starting with utilities works (e.g moving and installing cables and pipes) and with the actual construction of the light rail planned to start in late 2017 (Odense Letbane, n.d.c).

The alignment of the stage one of Odense light rail is chosen based on the development strategies and to connect important destination together. The alignment goes between Tarup in the north and Hjallese in the south. This alignment will establish a connection to a wide range of attractions, which are cultural, commercial, business, educational and health related. Of the cultural attractions can be mentioned Odense Idrætspark and the new Odense Music and Theatre House, ODEON. Commercially the alignment goes through the city centre and the new shopping centre VIVA. It also has a stop at Odense central station which will be an important transit hub for many passengers. Along the alignment, Odense Municipality have many major development projects for both housing and businesses and here it is the hope that the light rail will act as a catalyst for attracting investments along the corridor. In the south-eastern part of the alignment is the University of Southern Denmark (SDU) its campus area. North of SDU will be the new science and business park, Cortex park, and to the south of SDU will be the new university hospital, 'Nyt OUH', which is scheduled to open in 2022. This area is in the future estimated to host more than 60000 people, studying, working and living (Odense Letbane, n.d.c). In Hjallese at the southern end of the alignment the light rail will have a station near Svendborgbanen and Hjallese station, that will make transfers between the regional railway and the light rail easy. Another important element is the creation of a park and ride facility in the southern part of the alignment, close to the E20 motorway (Odense Kommune, 2013a). The station in Hjallese and the park and ride facility will as transit hubs create opportunities for commuters to switch to the light rail towards the city centre.

[5] *Odense Letbane: VVM og miljøvurdering* (Odense Kommune, 2013c)
[6] *Odense Letbane: Udredningsrapport* (Odense Kommune, 2013a)

Figure 4.2 Map of stage 1 and 2 of Odense light rail (Source: Odense Letbane, 2015)

5. Social aspect in transport planning

This chapter aims to further explore the literature concerning social impacts and relational elements within the social dimension sphere of transport planning. Furthermore, will be described some of the challenges of investigating social impacts of transport. Although the field of social impacts transport is both underexplore in transport studies and underrepresented in transport planning, as argued in Chapter 1, there is some literature that is concerned with the topic. Here, the attention will have a generalised focus on mobility systems, as the literature on social impacts extends beyond light rail planning.

5.1 Categorisation

The definition of a social impact, presented in Chapter 2, showed that it is a comprehensive and complex subject. However, a definition this broad can in itself be considered as insufficient for implementing investigations of social impacts into planning and appraisals of transport. It would be impossible to implement without narrowing the focus of both what is necessary and possible to investigate. Here, Geurs *et al.* (2009), besides presenting the definition of a social impact, also present a form of categorisation of social impacts of transport (Table 2). The social impacts are in this categorisation divided into different themes, which represent the sources of the impacts, and sub themes for further specification of the nature of the impacts. This categorisation shows that social impacts can take many forms and furthermore that impacts can be spread out over different time periods. Some impacts are caused by a direct effect, while others are caused by indirect effects. In this relation, there are also cumulative effects that can take years before it can be considered a social impact (Jones and Lucas, 2012). Analysing cumulative and indirect effects is filled with an uncertainty, which makes it difficult to make valid prediction of the social impacts it would create in the future. The drivers behind such effect requires further exploration and research in order to get a better understanding of how to analyse social impacts of transport (Markovich and Lucas, 2011; Lucas, 2012; Jones and Lucas, 2012).

Another important aspect in relation to social impacts is matter of scale. Small scale policy interventions or design changes (e.g. changes in an intersection) might have little effect in behaviour for most people and therefore might not lead to a social impact. However, such changes can be small part of a bigger infrastructural change, as the construction of a light rail system would be, and in such cases many small changes might lead to behavioural changes and social impacts. Geurs *et al.* (2009) argue that social impacts, when analysed, tend to focus on an individual micro scale, whereas

environmental and economic impacts is generally analysed on a meso or macro scale. This individual scale is true for certain social impacts (e.g. journey quality and visual quality), but other social impacts can be necessary to explore from a perspective of a collective of actors (e.g. cultural diversity or social movements). As to what is necessary to analyse therefore depends on the scope of the given project.

Table 2. Categorisation of social impacts of transport by source

Theme	**Sub-themes**	**Impact**
Presence of infrastructure	Structurally	Visual quality Historical/cultural resources Severance/social cohesion
	Temporarily (Construction)	Noise nuisance Barriers and diversions Uncertainty of construction Forced relocation
Presence of park vehicles		Visual quality Use of space
Presence of transport facilities, services and activities	Transport facilities	Availability and physical access Level of service provided Transportation choice/option values Cultural diversity
	Land use	Access to spatially distributed services and activities
Traffic (movements of vehicles)	Safety	Accidents Averting behaviour Safety perceptions Public safety (dangerous cargo)
	Environment	Noise levels, nuisance Soil, air and water quality
Travel (movement of people)		Intrinsic value, journey quality Physical fitness Security

(Adapted from: Geurs *et al*. 2009, p. 75)

5.2 Evaluating social impacts

Another key challenge regarding analysing social impacts in transport appraisals, is concerned with the method of which the social impacts is evaluated. The primary appraisal method for transport projects are cost-benefit analyses (CBA). A CBA is solely concerned with impacts that can be monetarised and is therefore an effective method for communicative purposes. Because it with this method is possible to provide a result that determine if a transport project have either a negative or positive economic effect on society. Thereby, it is possible to compare different alternative to identify the most economical affective project. Although, an important notion for a CBA is that all non-monetarised impacts are not evaluated by this method. This means that soft and intangible impacts, both negative and positive, which in many cases are difficult or even impossible to monetarised, is left out of the appraisal (Beria *et al*., 2012). This weakness makes CBA inappropriate to evaluate several social impacts (e.g. those listed above) as they can be recognised as intangible.

> **QUOTE**
> *"If MCA is an acknowledged technique for the assessment of sustainability at neighbourhood level, CBA is mainly used for infrastructure and large transformation projects."*
> Beria *et al*. (2012)

Another appraisal method is multicriteria analysis (MCA), which is more appropriation for evaluating soft and intangible impacts. A MCA can take many different forms, but the general idea is to specify the objective at hand, by identifying appropriate indicators. The indicators can be both qualitative and quantitative and are applied a form of weighting or ranking based on a set of criteria (Beria *et al.*, 2012).

Beria *et al.* (2012) have in their paper focussed on these two methods and have investigated how appropriate they are in analysing sustainable mobility on a neighbourhood scale. Their results show that each of the two methodologies have their strengths and weaknesses, but when used in a combination can complement each other well by overcoming each other's weaknesses.

5.3 Theories and concepts

The social dimension within transport studies have over the years seen a growing literature with ties to social sociology and social science as mentioned in earlier chapters. This have led to the adaptation of different theories and concept, with the purpose of expanding and exploring the conceptual framework of the social dimension, in transport studies. This section will focus on two of the different concepts, namely social exclusion and social capital.

Social exclusion has its origin in social policy, with a specific focus poverty. It is only in recent years that the connection between social policy and transportation has been explored, more specifically in terms of transport disadvantage (Stanley and Vella-Brodrick, 2009). Social exclusion is a complex and comprehensive concept, which can take various forms and is not limited to a single explanation. Although, a simple explanation narrows the concept down to two outcomes, which suggest that an individual is either socially excluded or socially included. With this approach, the aim and end goal is to achieve social inclusion. To determine whether or not an individual is socially included can rely on a variety of criteria, which tend to be measured through economic factors (Stanley and Vella-Brodrick, 2009).

Stanley and Vella-Brodrick (2009) acknowledge that social inclusion should be pursued, but they also argue that social inclusion as an end goal scenario is not an appropriate approach. Instead they argue for a broader understanding of the concept with a continuing process of improving quality of life, with elements as 'well-being and community connectiveness' (Stanley and Vella-Brodrick, 2009).

Another notion worth mentioning regarding social exclusion and its relation to transport is that exclusion can be divided into categorise, as exclusion can be depended on a variety of factors. Some of these categorisations are listed below[7]:

- The built environment can in many ways act as a physical barrier and have different effects for different social and demographic groups (physical exclusion).
- The geographical location of home, transport options and services can be isolated and result in inaccessibility (geographical exclusion).
- Low income or unemployment, or other monetary constraints can prevent people from travelling to destinations relatively close to home (economic exclusion).
- Certain groups, such as lone mothers, can suffer from a lack of possible travel time, which put restrictions on their ability to travel (time-based exclusion).
- Crime or insecurity can have a discouraging effect on peoples will to travel with certain transportation mode or to certain destinations (fear-based exclusion).
- Gated communities, semi-public spaces or surveillance are examples of exclusionary measures that can discourage people from certain spaces or transport systems (space exclusion).

[7] The list is from Mogensen *et al.*, (submitted), but inspired by the categorisation of Church *et al.* (2000).

This list shows that there can be many reasons for why an individual is socially excluded, and at the same that exclusion cannot only be expressed based on economic factor, such as income.

Social capital is another concept that has been affiliated with transport, with the purpose of understanding the relation between transport and the ability to establish or maintain social networks. The concept is adopted from sociology, where there have been presented different perspectives on what is encompassed within the term social capital, but in general social capital is concerned with building trust and social networks (Currie and Stanley, 2008). In this relation, have Stone *et al.* (2003) identified three types of social capital which is described below[8]:

- *Bonding* social capital revolves mainly around family or other connections that can be considered as close and strong ties. This form can have a significant meaning for an individual, but can also function as exclusionary for individuals outside this inner network.
- *Bridging* social capital goes beyond the closed networks to establish links between other networks. It helps build a bridge of diversity with connections between individuals and networks that is not necessary of the same social position.
- *Linking* social capital is established between an individual and authority or institution. It has similarities with bridging, however is more focussed on the connection between an individual and a form of power.

All three types of social capital have elements of participation, networking and trust, and these elements can be said to be the foundation for increasing a person's social capital. Here, according to Urry (2002) being able to be mobile is central for facilitating social networks through face to face interaction and co-presence. Although, Putnam (2000) argues that not all forms of travel are desirable, as he refers to the car dependence and solitary driving to be the cause of decline of social capital. Urrys (2002) notion between being mobile and social network, seems in this case not to be focussed on movement in itself, but more towards

QUOTE

"*Mobility in general is central to glueing social networks together, while physical travel is especially important in facilitating those face-to-face co-present conversations, to the making of links and social connections, albeit unequal, that endure over time.*"
Urry (2002)

[8] The list is from Mogensen *et al.*, (submitted), but inspired by Stone *et al.* (2003).

securing that all social groups can establish and maintain social connections without limiting mobility. But exposure to diversity might also have a positive effect on a person's social capital, as argued by Brömmelstroet et al. (2017), exposure to diversity can be related to all forms of mobility, as different mobility modes evoke different situations and emotions. There is no guaranty that moving with and around other people is contributing to build relations and social cohesion, it however creates an opportunity for this to happen. Moving alone or not moving at all, can on the other hand act as a form of cocoon, which isolates one from others and decreases one's social capital.

5.4 National and international examples

This section will present three examples related to the themes that have been presented in this chapter, which shows different approaches to explore the social dimension of transport. The purpose is not to give a detailed description of these approaches, but rather to provide a short overview of different approaches related to the social dimension of transport planning.

Monetisation

The first example is a study from a Danish context related to the challenge of applying monetary values to soft and intangible elements related to transport, which can otherwise be difficult to monetarise. The study by Lundehede *et al.* (2013) is based on a review of how certain urban qualities have a potential influence on increasing land values in Aarhus and Copenhagen. The urban qualities that is the potential cause of the increase is represented from parameters such as proximity to commercial and service functions, proximity to recreational areas, and proximity to public transport. By studying these parameters in relation to their influence on land value, they are able to apply a distance depended monetary value for the parameters. These monetary values are, however, expressed with some level of uncertainty and cannot be considered as generic representation that can be applied to all cities.

The intent of trying to determine the monetary values is to present a method that can be used to give a qualified estimate of economic benefits of these parameters on a neighbourhood scale. An important notion from the study is that using this method in relation to large infrastructure projects can be difficult as such projects often are spread out over a wide area (Lundehede *et al.*, 2013). Although it is a step towards acknowledging the value of soft and intangible elements, which is important in relation to the social dimension of transport projects.

Social capital

The second example is from Sweden and is related to analysing social capital to evaluate future metro lines in Stockholm. In a report, Modin (2013) analyse the connections between social capital and investments in metro lines in Stockholm. In the report, social capital is understood through the same three types of social capital, as was described earlier (bonding, bridging and linking) (Modin, 2013). It is here recognised that a 'well-functioning democratic society' depends on a high amount of social capital among the inhabitants. The aim of the report is to evaluate four different metro lines and their ability to enhance social capital in proximity to the stations along the line. In order to evaluate the four metro lines, four factors are identified to have a significant influence on increasing social capital. These four factors explained and underlined below:

> "(…) *subway investment can contribute in several ways to strengthening the bridging and linking of social capital. One way is through the investment as such that sends signals of commitment, which creates new and high-quality public transport. Another way is to ensure that the subway's functionality and safety are good and well-functioning. The third is that a metro creates opportunities for bridging meetings by linking different meeting places. In addition, investments in public transport create increased regional accessibility with labour and growth effects*" (Modin, 2013 p. 3, Own translation and underlining)

Each of the four investigated metro lines is roughly evaluated for their ability to either positively or negatively affect each of the four underlined factors. Each line has also been given a score concerning social capital. Although, the actual calculation to determine whether a metro line has a positive or negative social capital score is not fully described, but only that it is based on survey data concerning elements of trust, security, participation in elections and association participation (Modin, 2013). This example has shown how the concept of social capital have been actively used for evaluating of transport projects, but it also shows that it is difficult, as it requires a massive amount of survey data.

Impact evaluation

This last example is from the United Kingdom, more specific the Department for Transport, and is related to categorising and evaluating social impacts of transport projects. The Department for Transport in the UK has developed a Web-based Transport Analysis Guidance (WebTAG), which is a toolkit that consists of range of transport modelling tools and appraisal methods. The WebTAG guidance is require for all transport project, which rely on government approval and act as guide for best

practice for all other transport related projects (Department for Transport, 2014a). WebTAG provides guidance for not only CBA appraisal methods, as is the case with Danish guidance[9], but is divided into different categorises of guidance's needed for appraisal. Each of the categories is listed below (Department for Transport, 2017):

- Cost-benefit analysis
- Economic impacts
- Environmental impacts
- Social and distributional impacts
- Uni-modal appraisal

As it is evident from the list above social impacts and distributional impact is in the same category, as they are closely related. Although, they both have their own guidance as the approaches for the appraisal of each, differs from each other. The appraisal guidance for social impacts focus on eight social impacts with the main purpose of quantifying and monetarising each of these social impact. There is, however, some of the eight social impacts, which require a qualitative assessment, as it is not possible to monetarise all of them. The eight social impacts are listed below (Department for Transport, 2014b):

> **QUOTE**
> "*Some other impacts are simply too difficult to derive a reliable monetary value for in current practice. However, the fact that some impacts are not expressible as monetary values should not lead to the conclusion that they are neglected by the decision-maker.*"
> Department for Transport (2014a)

- Accidents
- Physical Activity
- Security
- Severance
- Journey Quality
- Option and non-Use Values
- Accessibility
- Personal Affordability

The appraisal of distributional impacts has the purpose of assessing impacts on different social groups, through quantitative and qualitative assessment of impacts

[9] Referering to *Manual for samfundsøkonomisk analyse på transportområdet* Transportministeriet (2015a)

based on eight indicators, being: user benefits, noise, air quality, accidents, security, severance, accessibility and personal affordability (Department for Transport, 2014c). Some of these indicators are similar to those in the social impacts appraisal (see above), but in this case the approach is to apply an assessment based on seven-scaled scoring to determine if impacts of the indicators are beneficial or adverse for each social group (Department for Transport, 2014c). This process can be resource and time intensive, but can provide a valuable view of how a transport project affects different social groups.

6. Analysis of findings

This chapter presents the main analysis of the project, with the purpose of analysing the empirical data gathered through the qualitative study design presented in Chapter 3. The structure of the analysis is divided into the three main themes of the theoretical framework presented in Chapter 2, namely *Sustainability*, *Sustainable mobility* and *Social impacts*.

6.1 Sustainability

The concept of sustainability is comprehensive and the understanding of what the concept encompass can differ from person to person. This is also what makes the concept challenging to operationalise in relation to transport planning and planning in general. It can be easy to label something as sustainable with the fairly common understanding that sustainability is about not compromising future generation's needs. Although, how this is achieved, is where the real challenges start to arise, as there is not a specific guideline for achieving sustainability (see Chapter 2). The purpose of the following sections is therefore to analyse how the concept of sustainability is understood and operationalised in relation to the planning of Aarhus and Odense light rails. Furthermore, this part of the analysis will focus on the understanding of the three dimensions, and specifically in terms of the social dimension.

Aarhus light rail

The Aarhus light rail project is special and different from the other light rails in Denmark, in terms of planning process. The reason for this is probably the fact that it was the first light rail project in Denmark, and therefore such a process had never been done before. The Aarhus light rail project can therefore have set a precedent for the other light rail projects (Research interview, Morten Skou Nicolaisen).

The light rail in Aarhus, which is planned to open in 2017, has had a long planning process, where the first thoughts about upgrading the public transport system in the Aarhus area started in 2000 (see Chapter 4). One of the main rationales for the Aarhus light rail has from the start, and still is, to provide an effective transport system for commuters in the Aarhus region by connecting the two pre-existing regional railways (Research interview, Mette Olesen and Søren Sloth Lave). Another rationale, that emerged with inspiration from European cases, and which helped build a narrative for the light rail, was about the light rail as an urban development tool and 'investment magnet' (Research interview Morten Skou Nicolaisen). These two central rationales are

also reflected in the different planning documents, which describe the vision for the light rail (COWI, 2005; 2006; 2010). While, these two rationales can form a narrative related to sustainability, it has not been the case, at least not within the planning documents. The few times sustainability is mentioned in the planning documents, it is used implicitly, without any direction for how it should be understood. This suggests that sustainability as a concept has not been an implemented part of the planning process and the general narrative for Aarhus light rail. A possible reason for this is argued by Morten Skou Nicolaisen:

> "*It is not something that sells many tickets, either at political or official level. (...) You can have many sustainability gains, but if it does not have some form of accessibility value or is a part of an overall urban transformation process, then there's no one who really worries about it.* " (Research interview Morten Skou Nicolaisen)

What Morten Skou Nicolaisen is referring to here is that light rail projects in general must be considered in a wider context, that offer more than just an environmental friendly transport mode.

The absence of the term sustainability in planning documents for Aarhus light rail does not necessary mean that sustainability has not been part of the planning process. It instead suggests that whether sustainability has been part of the planning process, rely on individuals' perception of how they understand the concept of sustainability and the three dimensions.

Odense light rail

The Odense light rail shares many similarities with Aarhus light rail, but there is also a lot of differences, as does the planning process. The planning process of Odense light rail started many years after Aarhus. Therefore, both the municipality and the state have had the opportunity to learn from some of the experiences of the Aarhus project. This has resulted in differences in the planning approach noticeable with the addition of an explanatory report, which was not required for Aarhus light rail (Research interview Morten Skou Nicolaisen).

The rationales for Odense light rail can be divided into three themes, with the first being about upgrading the transport system to a high-class and sustainable public transport mode that apply to a broad number of social groups.

The second rationale is about image and perception of the city. The light rail is a form of prestige project, which can support the story of Odense's transformation from a large Danish town, to a great Danish city (Research interview, Paw Gadgaard and Carsten Henriksen). The last rationale is about urban development and that the light rail has a specific quality, as Paw Gadgaard explain:

> "*We read a lot of readers' letters in the newspaper, which states that the light rail is inflexible. That is funnily enough the quality, that it's inflexible, because it gives investors and developers an investment security that a high-class public transport mode continues to be just outside the front door. The bus could disappear tomorrow. While, the light rail does not.*" (Research interview Paw Gadgaard)

The fact that the light rail is fixed is an important factor for providing a security for attracting investments along the corridor. This last rationale is especially important in connection to how the concept of sustainability is applied in planning of Odense. This can be seen in the plan strategy from 2011, which describe how Odense is to become a sustainable city through a focus on urban densification (Odense Kommune, 2011 p. 18-19). The plan strategy's focus on sustainability has also been guiding for the planning document for the light rail, both in the synopsis for the EIA and in the explanatory report (Odense Kommune, 2013a; 2013e).

The approach to the planning process indicate that the concept of sustainability has been used in terms of a sustainable 'process' and to a lesser degree in terms of sustainable 'result'. For instance, in the early phase of the project in 2010 Odense Municipality got Juul Frost Arkitekter to analyse the potentials of different alignments and compare bus prioritisation, BRT (Bus Rapid Transit) and light rail on 15 parameters divided among five themes presented in a value compass (see Juul Frost Arkitekter 2010). These parameters and themes are also some of the characteristics of sustainable urban mobility, as described in the report from UN-Habitat (2013).

QUOTE

"*The light rail also has a completely different appeal to some social groups that could never find themselves in a bus, but who sees no problem getting into a light rail. That is psychology, but how it is.*"
Research interview, Paw Gadgaard

While, the concept of sustainability is a central part of the narrative and has been used in the early phase for the light rail, it seems that sustainability in the later phases of the project has been on a more general level without having set a clear and detailed concretisation of how the concept should be operationalised and evaluated. It is in this sense used 'implicitly', rather than 'explicitly', as it was in the early planning phases.

The three dimension

The planning process for the two cases has had very different approaches to the concept of sustainability. Sustainability might not have been an implemented part of planning and narrative for Aarhus light rail project, while it has been and still is important for the narrative of Odense light rail. However, regarding the three dimensions within the concept of sustainability, all interviewees agreed, that it can be argued that the CBA and the EIA can be categorised to represent the economic and environmental dimension. Although, not necessary as a part of a sustainability agenda, but in the understanding that these two of analyses fall into the themes of the economic and environmental dimension. But where the social dimension is reflected is unclear, as it is not directly described or analysed in neither the CBA or the EIA. As Morten Skou Nicolaisen explain:

> "*It (ed. social dimension) is rarely an anchored part of the formal analysis tool. So, I would dare to say, that we in principle do not have any good tools to explore the social aspect of mobility. And it also depends a lot on what the social part is, when speaking about sustainability aspects. Because what is social or economic in terms of distributional aspects of investment.*" (Research interview Morten Skou Nicolaisen)

Here Morten Skou Nicolaisen raises two related points, the first being about what is encompassed within the social dimension and the second being about the difficulty establishing a clear distinction between what is part of the social dimension and what is part of the other dimensions, the latter being further analysed later in this chapter.
The fact that there is no dedicated analysis for the social dimension, also means that the social dimension can be described in different ways, as it is presented below with my interpretation based on some of interviewees description of what the social dimension can encompass:

- Carsten Henriksen identify the social dimension as elements of socio-economy, segregation and non-segregation, and that it also is about image, perception and reputation of the city. He furthermore describes that it in the socio-economic sense is about creating connection between the different services and facilities of a city (e.g. the university, hospital, malls and sport facilities) and that a light rail can help revitalise the neighbourhoods along the light rail corridor (Research interview Carsten Henriksen).

- Mette Olesen identify the social dimension as all the things you do in urban planning and how this affects the people you plan for and the changes that planning have in relation to urban life and quality of life. She furthermore describes how the social dimension is also about equal accessibility for different social groups (Research interview Mette Olesen).
- Christopher Holland identifies the social dimension in relation to a light rail project to be about how a light rail potentially can change travel patterns, availability of shops and service, and furthermore change the composition of people living in neighbourhoods in proximity to the light rail (Research interview Christopher Holland)

It has from the descriptions above and the other three interviews been possible to identify two recurring themes, that seem to be central for the understanding of the social dimension. The first is in relation to the rationale of both cases as the light rail can be a form of urban development tool that has the potential to support a revitalisation of deprived neighbourhoods. The second theme is related to the other rationale that were evident from both cases and is about creating access to services for a broad number of social groups. In that sense, the latter theme complements the central part of social dimension of sustainable urban mobility described in the UN-Habitat report (see Chapter 2).

6.2 Sustainable mobilities

This section of the analysis will focus on the sustainable mobilities paradigm and how light rail projects as the two cases can be seen to be part of this alternative approach to the conventional transport planning approach.

Light rails as sustainable mobility planning

The conventional approach to transport planning with focus on time savings and cost minimisation has been the dominant approach for many. While, this alternative sustainable mobility approach formulated by Banister (2008) has gained attention in recent year, together with other examples of social aspects of transport in both literature and planning practice (see Chapter 5). Here, the planning of the light rails can be seen as a step towards the alternative approach and away from the conventional approach. As Banister writes:

> *"Transport policy measures can reduce levels of car use through the promotion of walk and cycle and the development of the new transport hierarchy. This can be achieved through slowing down urban traffic and reallocating space to public transport, through parking controls and road pricing, and through making it easier to use public transport."* (Banister, 2008 p. 75)

What Banister writes here about 'slowing down urban traffic and reallocating space to public transport' has especially been necessary for the Odense case, compared to the Aarhus case. As Mette Olesen describe the difference:

> *"(...) Aarhus, at least their stage one and the light rail at Ring 3, are a bit more like some 'commuter lanes'. It can also be said about Aalborg and Odense, but in Aalborg and Odense the light rails touch a lot of the central parts of the city, more than they do in Aarhus and at Ring 3."* (Research interview Mette Olesen)

She continues how this affect the speed of the light rails:

> "*It does not work with an average speed of 20 km/h on a 'commute lane', as it will be too slow to get from a to b over long distances as is the case with Aarhus and Ring 3. Where one of the main purposes in Odense and Aalborg was to enter central parts of the inner city, which does not warrant the same speeds."* (Research interview Mette Olesen)

One of the main rationales for Aarhus light rail is to create an attractive alternative for commuters who use the car. This requires certain speeds so that the light rail can get

fast from a to b. While, Odense light rail is also meant for commuters, it is not possible or perhaps necessary to have the same kind of speed.

Another notion related to what Banister writes, which both municipalities recognise, is that there is a limitation to the capacity of cars in the inner city and that it is necessary with a high-class public transport system if they want to change the current trends for the car. As Mette Olesen explain: *"(...) there has been some planning tendency/trends in giving the cities back to the people and not the cars*." This has especially been the case in Odense, as is also illustrated with the closure of Thomas B. Triges Gade in 2014, which previously was a thoroughfare through the inner city. The closure of the thoroughfare was important for the municipality to create another alternative and here the light rail play that role (Research interview Mette Olesen). This is also what Banister mentions as an important part of transport policy:

> *"Demand management is effective in restricting access and reallocating space, and making more effective use of the available capacity. A much wider notion of the street is being created, as it is no longer only being considered as a road but also as a space for people, green modes and public transport. Creative use of this space at different times of the day or day of the week means also that new uses can be encouraged (e.g. street markets or play zones)."* (Banister, 2008 p. 75)

A similar situation is found for the harbour front in Aarhus where a four-lane road have been reduced to a two-lane. Here, the role of the light rail is two folded, with the first being to provide a mobility flow to the harbour area, because of the reducing in car lanes. The second role is to reduce the barrier effect down towards the new public spaces and development areas at the harbour front (Research interview Morten Skou Nicolaisen).

Reducing the capacity for cars in cities is always a controversial subject, but also because there for many years has been a rationale of planning for cars (Research interview Mette Olesen). This new approach of limiting road capacity can be seen as a clash between the conventional approach and the sustainable mobility, which is also very divided among the public and politicians.

Paw Gadgaard explains how this has created a double focus in planning:

> *"Of course, there have been some political disagreements about the consequences of this light rail. Where some would like to be a more sustainable city and have more cyclists and people using the light rail, and there are also some parties who like the cars as well. And we can say that there was a schism here that we focus on both. Both cars and this (ed. Light rail). It can be said that it basically does not make much sense."* (Research interview Paw Gadgaard)

This focus on both cars and light rail creates challenges in relation to prioritisation of planning approaches, which is also evident for economic appraisal of such light rail projects.

Conventional approach vs. sustainable mobilities approach

One of the difference between the conventional approach and the sustainable mobilities approach is the focus on different appraisal methods. The conventional approach has generally been focus on economic aspects with the aim of monetarising different impacts in order to implement it in a CBA. However, is it very difficult, if not impossible, to monetarise soft and intangible impact, which many environmental and social impacts are (see Chapter 5). The sustainable mobilities approach, therefore, highlight MCA, which is better suited to handle evaluations of the soft and intangible impacts. MCA has, however, not been used in planning process of the two light rail cases. It has instead been the conventional approach with a focus on economic perspectives. As Christopher Holland describes the different studies and reports he has been involved in for light rails:

> *"(…) when you think about what some of the studies and reports encompass, then it shows that they are very connected to things you can monetarise for a project*." (Research interview Christopher Holland)

The focus on the economical perspective in terms of feasibility of the projects, is an important part of the planning process, where the role of CBA can be seen as a milestone to determine whether or not the projects are feasible: "*It typically has the role of bringing the project past a milestone that can close the economic debate."* (Research interview Morten Skou Nicolaisen). Although, it is not always easy to close the economic debate, because the economical milestone can differ over time and be depended on the current government and what project kind of project it is. So, to figure out what is the acceptable rentability in terms of decision-making, can be difficult to know for certain (Research interview Morten Skou Nicolaisen).

An example of this unclear determination of the economic requirements for light rail projects can be illustrated by Søren Sloth Laves notion on the importance of CBA in terms of decision-making:

> "*It is very crucial (…) You can see Aalborg, they did not receive state co-financing because the socio-economic profitability was too poor*." (Research interview Søren Sloth Lave)

The Aalborg light rail project showed a negative internal rate of return[10], which was the key argument for why the Aalborg light rail project did not receive state co-financing (Transportministeriet, 2015). The Aalborg light project, therefore, seems to have suffered from the changing economic milestone, which Morten Skou Nicolaisen refers to, as it has also been a challenge for all the other light rail projects where all the stage one light rail projects in Denmark have showed a negative internal rate of return (Lohmann-Hansen, 2014). So, to determine how important the internal rate of return is for such projects can differ, but: "*The rhetoric says it is very important. What happens behind closed doors can sometimes be difficult to follow.*" (Research interview Morten Skou Nicolaisen).
One of the reasons why light rail projects show a poor socio-economic return can be that the model used is not designed to public transport projects as light rails:

> "*On the socio-economic side has it in general been common for all, both for Aalborg, Aarhus and Odense. That they have struggled with the requirement of following a government model for socio-economic analysis. Which, roughly speaking, has been developed for road projects.*" (Research interview Christopher Holland)

The CBA model is structured with a focus on time savings, where reducing capacity for cars leads to longer travel time, which results in a negative economic impact. This can however, negate the ambitions of the light rail, where the light rail can be part of the municipalities transport policy to reduce cars in inner parts of the city.
Another challenge with the CBA model is, as mentioned earlier, its inability to monetarise intangible impacts and other potential economic effects in terms of urban development, investments and increase in land value along the light rail corridor. The city councils want the project despite the results show a poor socio-economic return. The challenge is articulating the importance of the additional economic effects and added social values to the Transport Ministry, which is the key to help fund the project (Research interview Mette Olesen). Odense municipality has, for instance in their

[10] COWI (2014b)

explanatory report[11], calculated the additional economic effects of the light rail based on the conclusion of the study by Lundehede *et al.* (2013) (see Chapter 5 for more on this study). Mette Olesen note how the Transport Ministry prefer 'facts' and numbers, because that's the frame from which they work. It has, therefore, been difficult for the municipalities to explain that such projects bring other values, which cannot be describe through the socio-economic analysis. So, even though the projects show a poor socio-economic return, they can still be good projects (Research interview Mette Olesen).

This focus on the economic requirements in the current CBA model can, as seen with the Aalborg case, set limitation for the possibility of implementing new sustainable mobility technologies:

> *"The requirements for the CBA set by the government, with internal rate of return, provisions for unforeseen expenses, and additional contributions to some pool, makes it very difficult to change technology. (...) When switching from an environmentally harmful to a more sustainable technology, even though one can say light rails are an old technology, it is still cleaner and more sustainable technology in some areas. Then the change is very difficult because there are those requirements to the socio-economic profitability."* (Research interview Søren Sloth Lave)

There is a need to see light rail projects and other transport projects in a broader perspective. It is of cause necessary to have the economic appraisal of transport project and not just build blindly, but it is also necessary to ascribe the aspect which cannot be measured a form of value in relation a strategic development of a city (Research interview Mette Olesen). It is in this relation that the role of CBA should be more flexible and more situated to the transport mode and project it is used for, or it will otherwise be easy to misuse:

> "*Where it (red. CBA) plays too big a role is when there are some politicians who are either too rigid in their use of it or deliberately misuse the CBA, for example, to compare investment in highways and light rail. Based purely on profitability."* (Research interview Morten Skou Nicolaisen)

When the CBA is used as in the example above, it is like comparing apples and oranges. It might be possible to analyse 90-95 % of all the economic effects of highway projects on the countryside, but that is simply not possible to do with a light

[11] *Odense Letbane: Udredningsrapport* (Odense Kommune, 2013)

rail that goes through a city. It might only be possible to analyse 15-20 % of all economic effects of a light rail project in a city, which is a part of a large urban development initiative (Research interview Morten Skou Nicolaisen). It is essential to acknowledge that light rail projects have a wide range of economic effects, which cannot be capture in an economical appraisal.

6.3 Social impacts

This part of the analysis will focus on notion of social impacts in relation to how such impacts can be understood and how social impacts might be represented in the different analyses for the two light rail cases. It will furthermore focus on how social impacts can and should be evaluated.

Understanding social impacts

The notion of social impacts and how this term is understood among practitioners is a central part of this project. All the interviewees were asked about how they understand social impacts and below is presented some of the elements they identify based on my interpretation of their answers:

- Carsten Henriksen mentions that social impacts could be about the combination of residents, as this might change for areas in proximity to the light rail. Some people might move away from the light rail because it becomes difficult to have and/or use a car, and others might move closer to the light rail because it might be easier without a car. It depends on preferences. (Research interview Carsten Henriksen)
- Morten Skou Nicolaisen identifies social impacts as elements of how different social groups can be affected differently. He also mentions how a light rail can have an indirect effect on people's perception and travel behaviour, and in this relation, refer to US studies on how people commuting by active transport have a lot higher satisfaction, higher energy level, less likely to be stressed. This is higher than people using public transport, but a lot higher than people commuting in car. An impact could furthermore, be on family structures and their preferences in terms of having one or two cars as the light rail creates better accessibility. Some families might choose to have one car instead of two because of the better accessibility. Such impact might not be a short-term impact, but a long-term impact, which is very difficult to predict. (Research interview Morten Skou Nicolaisen)
- Søren Sloth Lave identify on one side barrier effects and accessibility to a public transport system, in terms of giving commuters the opportunity to commute in and out of the city by the light rail. He identifies this as the direct effects upon the inhabitants. On the other side, he mentions the environmental derived socio-economic circumstances. Here, can noise be one of the indirect effects, which can have an impact on inhabitants (Research interview Søren Sloth Lave)

A common theme, that is identified throughout the interviews, shows that the interviewees understand social impacts as elements that can cause a change in preferences and behaviour. This illustrates, that how practitioners understand social impacts, is similar to the definition of social impacts presented in Chapter 2. But it also illustrates that social impacts are a comprehensive subject that touch upon many diffuse elements. A categorisation of social impacts is therefore necessary in order to narrow the potential impacts to something that is not too complex. An example of such a categorisation is provided by Geurs *et al.* (2009) and was presented in Chapter 5.
After the interviewees were asked about how they understand social impacts, the interviewees were presented to both the definition and categorisation of social impacts in order for them to identify if these impacts have been examined in the analyses for the two light rail cases. Here, many of the interviewees identify several of the social impacts listed in the categorisation, as impacts that are already part of the EIA. However, the impacts, that are already part of EIA, are analysed with a more technical approach with a lesser focus on how these impacts can affect behaviour among different social groups, which can be difficult to quantify. In that sense, the current analyses methods both CBA and EIA lack the socio-economic and sociological perspectives, that potentially can have a big influence on people in the city where a light rail is built.

Evaluating social impacts
It is difficult to evaluate the value of the social aspects, which is important for this kind of project, when there is no tool in Danish planning practice for evaluating such impacts (Research interview Mette Olesen). In this relation, the interviewees were asked about which approach that would be appropriate for evaluating social impacts that could be used in the decision-making process. Should the focus, for instance, be qualitative assessments, quantitative investigations or would the appropriate approach be if social impacts could be monetarised. Here, some interviewees mention how things that can be quantified is sometime seen as the truth, but that this not always holds true:

> "*There is a tendency to say that if you can monetarise, put a value on something, then it's correct. But all assumptions you make, are also taken from a normative perspective. That means, that the socio-economic model we have in Denmark is made by someone, who has determined which parameter to evaluate, and that does not necessarily make it objective. It is extremely subjective. Because you could have chosen any other parameter and then any other projects would look better."* (Research interview Mette Olesen)

> "*There is such an urge, that when things can be quantified and used in a calculation, then it shows the truth. But that is just not always the case*." (Research interview Paw Gadgaard)

That is also a discussion, which can depend on the school you are from. Some want to quantify as much as possible. But that can also create issues, as some impacts can be associated with a high level of uncertainty and can therefore when quantified act as a form of false truth (Research interview Mette Olesen).

> *"Politicians generally like to have some numbers where they can see that: okay, this project is better than this project. (...) Conversely, can that also reduce complexity so much that you do not understand how the numbers they emerged."* (Research interview Mette Olesen)

Instead of quantifying and monetarising, which are the primary go to methods for the conventional transport planning approach, could a possible method, as mentioned earlier in this chapter, be MCA:

> *"If you can live with something like multi-criteria analysis of some kind, where you say: there are some aspects here, which we cannot quantify and we cannot at all add an economic value to it, but we can say something about whether it's low, medium or high. Or build some different scenarios for how the development will be. That could work."* (Research interview Morten Skou Nicolaisen)

It can in this relation be relevant to look towards methods used in other countries, which could serve as inspiration or maybe even be adopted to fit into a Danish planning context. Instead of trying to develop a new methods or tool from scratch (Research interview Mette Olesen). But here the challenge will be to figure out how the methods can be applied in Danish planning practice:

> "(…) th*e difficult thing will be to figure out where to draw the line. Because, how robust should the system be. Because socio-economy has the same problems. When we speak about socio-economics, it is very much presented as there is two lines under the result. But you can order socio-economic analyses from five different consultants and you will probably get five different results of the same project. There is also a big debate about what to include and how to monetarise it.* " (Research interview Morten Skou Nicolaisen)

An example could be the UK guidance methods from WebTAG presented in Chapter 5, that could serve as an inspiration for how to use MCA to analyse distributional impacts across different social groups.

But here it is relevant to ask where in the Danish planning context it makes sense to adopt methods from other countries:

> "*The question is where it makes sense. Because there is no reason to do the analyses locally if everyone thinks: 'Yes, we are aware of it. We already know that without getting the analyses, and we all agree on it.' Unless the analyses are used to validate what we all agree on, when we walk and clap each other on their backs. So, you can say maybe there is not much interest in it locally. But it could be used externally like the socio-economic analyses, as a ticket for state funding. Although, the Transport Ministry does not care about this.*" (Research interview Morten Skou Nicolaisen)

All the interviewee mention that if there was to be developed a set of guidelines for analysing social impacts, like the UK example, then the Transport Ministry might not be the most appropriate to develop it. As the Transport Ministry's practice is still very connected to the conventional transport planning approach with a top-down focus on socio-economical perspective. While, there from a bottom-up perspective already seem to be an acknowledgement of the importance of analysing the social aspect of transport (Research interview Mette Olesen). It can therefore be up to the municipalities to develop such tools. But it can be problematic for them to use such tools in negotiation with the Transport Ministry, as long as it is not an acknowledged method or tool (Research interview Mette Olesen). Hence, it is essential that there are acknowledged methods that can rank qualitative assessment alongside monetarised appraisals in terms of decision-making. But it can be difficult to use a 30-page report or analysis which describe somewhat diffuse aspects, as social impacts can be, and put that up against a few numbers, that determine whether a project is profitable (Research interview Mette Olesen).

QUOTE

"It could be exciting to make some decisions that, for example, are based on social aspects, but I do not know if it could ever become a reality." (Research interview Christopher Holland)

7. Conclusion

The objective of this chapter is to answer the research question:

> What role does the social dimension of sustainability have in planning of Aarhus and Odense light rail and how can evaluation of social impacts improve planning of light rails towards sustainable mobility?

To answer the question, it has been necessary to establish a basic understanding of each of the concepts within the research question. This was done through the initial chapters, which highlighted two points necessary to answer the research question. The first point being how transport appraisals mainly focus on economic and environmental perspective, while the social dimension of sustainability has generally been underrepresented in transport appraisals. There has however in recent years been an increasing acknowledgement within transport studies of the importance of the social aspects of transport, especially with the growing literature within the mobilities paradigm. The second point is about how light rail systems have received a form of rebirth in many European cities within the last 20 years, as there is a growing recognition of the link between light rails and urban development. The rationales for building light rail systems are not just to provide a transport mode that bring people from A to B, but is instead promoted as to serve a wider purpose of urban regeneration. This have also been among the main rationales for the two light rail projects that have been investigated in this project.
It is through these two points that the project has sought to answer the first part of the research question 'What role does the social dimension of sustainability have in planning of Aarhus and Odense light rail?'.
Here, it is evident that there has been a clear difference in how the social dimension and the concept of sustainability have been applied in the planning process between the two light rail projects, especially in terms of the different planning documents. The concept of sustainability has not been an active part in planning of Aarhus light rail, while the concept has played a more active role in the narrative and preliminary planning of Odense light rail. While, the concept of sustainability might not have been an implemented part of the planning process of Aarhus light rail, there are still aspects of the project that present elements towards a sustainable mobility planning approach. The fact that a light rail in both cases are being built as to upgrade the public transport system and that the light rail is planned to contribute to urban development is a clear step towards sustainable mobility.

To answer the second part of the research question 'how can evaluation of social impacts improve planning of light rails towards sustainable mobility?' it has been necessary to establish a definition for what constitutes as social impact of transport. Here was presented a broad definition that encompass both positive and negative effects that can influence people preferences, well-being, behaviour etc. Such a broad definition entails aspect that can also be considered as economic and/or environmental impacts and it can be necessary to categorised social impacts. Such a categorisation was presented in Chapter 5 and was also used during the interviews as to identify how these impacts might already be part of the analyses, such as the EIA and CBA for the two light rail cases. Here, the interviewees identified several impacts as to already be part of the EIA. These impacts were analysed with a more technical approach with a lesser focus on how these impacts can affect behaviour among different social groups, which can be difficult to quantify. In that sense, the current analyses methods both CBA and EIA lack the socio-economic and sociological perspectives that are encompassed within the definition of social impacts.

The findings show that there is a bottom-up acknowledgement of the importance of evaluating social aspects and that an appropriate approach for evaluating social impacts was identified to be in a qualitative appraisal format as MCA. But it was also identified that such an approach is challenged in Danish planning context, because social aspects are yet to be acknowledged from a top-down perspective.

References

Aarhus Letbane, (n.d.) *Status*. Aarhus Letbane. Available from: http://www.letbanen.dk/nyheder/2017/28-status-anlaegsarbejde/ [Accessed 5th April 2017]

Aarhus Letbane. (n.d.) *Om Letbanen*. Aarhus Letbane. Available from: http://www.letbanen.dk/om-letbanen/ [Accessed 12th April 2017]

Århus Kommune. (2000) *Sporvogne i Århus*. Århus Kommune and Transportministeriet. May 2000.

Århus Kommune. (2010) *Forslag til Letbane i Århus-området – etape 1: Tillæg nr. 1 til Kommuneplan 2009*. Århus Kommune, Teknik og Miljø. February 2010

Andersen, I. (2014) Den skinbarlige virkelighed: Vidensproduktion i samfundsvidenskaberne, 5th edition, Samfundslitteratur, Frederiksberg.

Andrea Caragliu , Chiara Del Bo & Peter Nijkamp (2011) Smart Cities in Europe. *Journal of Urban Technology*. 18:2, 65-82.

Atkins and Grontmij, (2011) *Letbaner i Danmark – Fakta og fremtidsudsigter*

Banister, D. (2008) The sustainable mobility paradigm. *Transport Policy*. 15, 73-80.

Bauman, Z. (2000) *Liquid modernity*. Cambridge: Polity Polity.

Beria, P., Maltese, I., Mariotti, I., (2012) Multicriteria versus Cost Benefit Analysis: a comparative perspective in the assessment of sustainable mobility, European Transport Research Review, Volume 4, Issue 3, 137–152

Bottoms, G. D. (2003) *Continuing Development in Light Rail Transit in Western Europe: United Kingdom, France, Spain, Portugal and Italy*. Federal Transit Administration. 9th National Light Rail Transit Conference. November 16-18.

Brinkmann, S. (2013a) Kvalitativ udforskning af hverdagslivet. Copenhagen: Hans Reitzels Forlag.

Brinkmann, S. (2013b) *Qualitative Interviewing: Understanding qualitative research.* Oxford: Oxford University Press. [Published to Oxford Scholarship Online: March 2015]

Brömmelstroet, M., Nikolaeva A., Glaser, M., Nicolaisen, M. S., & Chan, C., (2017) Travelling together alone and alone together: mobility and potential exposure to diversity. *Applied Mobilities*. 2 (1), 1-15.

Burdge, R. J., (1987) The social impact assessment model and the planning process. *Environmental Impact Assessment Review.* 7, 141-150

Cervero, R., (1984) Journal Report: Light Rail Transit and Urban Development. *Journal of the American Planning Association*. 50:2, 133-147.

Cresswell, T. (2006) *On the Move: Mobility in the Western World*. New York: Routledge.

Church, A., Frost M., Sullivan, K., (2000) Transport and social exclusion in London. Transport policy 7, (3), 195-205

COWI. (2005) *Vision om letbane i Århus-området*. COWI A/S. April 2005

COWI. (2006) *Letbaner i Århus-området*. COWI A/S. August 2006.

COWI. (2010) *VVM-redegørelse og miljørapport for Letbane i Århus-området – etape 1*. COWI A/S, Århus Kommune.

COWI. (2014a) *Forundersøgelse Letbaneetape Brabrand – Aarhus Ø*. COWI A/S, Aarhus Kommune, Aarhus C.

COWI (2014b) *Aalborg letbane / BRT Samfundsøkonomi: Teknisk notat.* COWI A/S, Aalborg

Department for Transport. (2014a) Transport Analysis Guidance: An Overview of Transport Appraisal. UK Department of Transport. January 2014

Department for Transport. (2014b) TAG Unit A4.1: Social Impact Appraisal. UK Department of Transport. November 2014

Department for Transport. (2014c) TAG Unit A4.2: Distributional Impact Appraisal. UK Department of Transport. November 2014

Department for Transport. (2017) *Transport analysis guidance: WebTAG*. Available from: https://www.gov.uk/guidance/transport-analysis-guidance-webtag [Accessed 1st May 2017]

Geurs, K.T., Boon, W., Van Wee, B., (2009) Social impacts of transport: literature review and the state of practice of transport appraisal in the Netherland and United Kingdom. *Transport Reviews.* 29 (1), 69-90.

Gimmler, A. (2005). American Pragmatism: Creativity in Everyday Life. In J. a. Kristiansen, Hverdagslivssociologi. Copenhagen: Hans Reitzels Forlag.

Hass-Klau, C., and Crampton, G., (2005) Economic Impacts of Light Rail Investments: The results of 15 Urban areas in France, Germany, UK and North America., Chapter 16

in *Urban Transport Development – A Complex Issue*, 245-255, Berlin Heidelberg: Springer.

Hildeband, D. l. (2008). Public Administration as Pragmatic, Democratic and Objective. Public Administration Review, March/April, 222-229.

Infrastrukturkommissionen, (2008) *Danmarks transportinfrastruktur 2030: Betænkning fra Infrastrukturkommissionen*, January 2008.

Jensen, O. B., (2013) *Staging Mobilities*. Aalborg: Routledge

Jensen, O. B., (2015) More than A to B: cultures of mobilities and travel. In *Handbook on Transport and Development,* [eBook] Cheltenham, UK: Edward Elgar Publishing, 479-490

Jeppesen, S. L. (2009). (PhD Thesis) - *Sustainable Transport Planning – A Multi-Methodology Approach to Decision Making*. Period October 2006 - November 2009. Kgs. Lyngby: DTU Transport

Jones, P., Lucas, K., (2012) The social consequences of transport decision-making: clarifying concepts, synthesising knowledge and assessing implications. *Journal of Transport Geography* 21, 4-16.

Juul Frost Arkitekter. (2010) *Bypotentialet for Odense Letbane: Foranalyse – En bystrategisk udviklingsproces: Fra vision og proces til konkretisering*. Juul & Frost Arkitekter.

Kaufmann, V., (2002) Re-Thinking Mobility. London: Ashgate.

Lange, I. S. G (2016) (Ph.d. Thesis) Transit- eller leveby? – Et casestudie af Hirtshals som et stærkt mobilitetspåvirket sted I Gennemfartsdanmark February 2016. Aalborg: Aalborg University.

Lee, S. S., Senior, M. L., (2013) Do light rail services discourage car ownership and use? Evidence from Census data for four English cities. *Journal of Transport Geography* 29, 11-23.

Letbanesamarbejdet. (2013) *Samspil 2025*. Letbanesamarbejdet, Midttrafik.

Letbanesekretariatet. (2013) *Vurdering af eksisterende stationer på etape 1*. Letbanesekretariatet, Midttrafik. January 2013.

Litman, T. (2017) *Generated Traffic and Induced Travel. Implications for Transport Planning*. Victoria Transport Policy Institute, Victoria.

Lohmann-Hansen, A. (2014) Powerpoint presentation: Letbaner. Trafikdage Aalborg Universitet 2014. Available from: http://www.trafikdage.dk/papers_2014/Praesentationer_2014/Hoering.pdf [Accessed 13th May 2017]

Lucas, K., (2012) Social impacts and social equity issues in transport workshop series: Final Dissemination Event Report, University of Oxford, Transport Studies Unit.

Markovich, J., Lucas, K., (2011) *The Social and Distributional Impacts of Transport: A Literature Review*. Oxford University, TSU Working Paper, July 2011

Matthies, E., and Klöckner, C. A., (2015) Car-fixation, socialization, and opportunities for change. In *Handbook on Transport and Development,* [eBook] Cheltenham, UK: Edward Elgar Publishing, 491-501.

May, A.D., Koh, Andrew, Blackledge, D. and Fioretto, M. (2010) Overcoming the barriers to implementing urban road user charging schemes. *European Transport Research Review*, 2 (1), 53-68.

Modin, A. (2013) Tunnelbana som Investering i Socialt Kapital. 2013 Års Stockholmsförhandling.

Midttrafik. (n.d.) *Letbanen*. Midttrafik. Available from: https://www.midttrafik.dk/koreplaner/letbanen/ [Accessed 12th April 2017]

Mogensen, J., Lange, I, S. G. and Lassen, C. (submitted): Challenges of applying social impacts of transport in Transport appraisal. Journal of Transport Reviews. Summer 2017.

Mulalic, I., Pilegaard, N., Rouwendal, J., (2015) *Does improving Public Transport decrease Car Ownership? Evidence from the Copenhagen Metropolitan Area*. Tinbergen Institute Discussion paper, tinbern intitute, Amsterdam

MVG. (2008) *The Modern Tram In Europe*. München: Müncher Verkehrgesellschaft GmbH.

Nielsen, O. A., Anderson, M. K., Ingvardson, J. B., Andersen, J. L. E., Christiansen, H., Ketrín Halldórsdóttir, K., and Wibrand, J., (2016*) Internationale og nationale erfaringer for effekten af forskellige typer højklasset kollektiv transport og tæthed til stationer og standsningssteder*. DTU Transport. Kongens Lyngby.

Odense Kommune. (2011) *Foranalyse af letbane: Teknisk baggrundsrapport*. Odense Kommune, Bystrategisk Stab.

Odense Kommune. (2011) *Planstrategi 2011: Fra stor dansk by til dansk storby*. Odense Kommune. November 2011.

Odense Kommune. (2013a) *Odense Letbane: Udredningsrapport*. Odense Kommune, Odense Letbanesekretariat.

Odense Kommune. (2013b) *Odense Letbane: Udredningsrapport – Resume*. Odense Kommune, Odense Letbanesekretariat.

Odense Kommune. (2013c) *Odense Letbane: VVM og miljøvurdering.* COWI. Odense Kommune, Odense Letbane.

Odense Kommune. (2013d). VVM for Odense Letbane: Baggrundsrapport om landskab og byæstetik. Odense Kommune. Udarbejdet med bistand fra NIRAS A/S

Odense Kommune. (2013e). VVM for Odense Letbane: Sammenfattende redegørelse. Odense Kommune. Udarbejdet med bistand fra Orbicon A/S

Odense Letbane. (2015) *Generel folder om Odense Letbane*. Odense Letbane. Available from: https://www.odenseletbane.dk/media/1418/tender-launch-web.pdf [Accessed 10th April 2017]

Odense Kommune. (2016) *Odense runder 200.000 indbyggere*. Pressemeddelelse Odense Kommune Available from: http://www.odense.dk/presse/pressemeddelelser/pressemeddelelser-2016/odense-runder-200000-indbyggere [Accessed 10th April 2017]

Odense Letbane, (n.d.a) *Status på letbanen*. Available from: https://www.odenseletbane.dk/om-odense-letbane/status-pa-letbanen/ [Accessed 5th April 2017]

Odense Letbane. (n.d.b) *Historien om sporvognene i Odense*. Odense Letbane. Available from: https://www.odenseletbane.dk/byen-i-bevaegelse/historien-om-sporvognene-i-odense/ [Accessed 10th April 2017]

Odense Letbane. (n.d.c) *A City on the Move*. Booklet (English) Odense Letbane. Available from: https://www.odenseletbane.dk/media/1418/tender-launch-web.pdf [Accessed 10th April 2017]

Olesen, M. (2014) (Ph.d. Thesis) — Making Light Rail Mobilities. Period February 2011– February 2014. Aalborg: Aalborg University and COWI A/S.

Olesen, M., and Lassen, C., (2016) Rationalities and materialities of light rail scapes. *Journal of Transport Geography*. 54, 373–382.

Putnam, R.D. (2000) Bowling alone: The collapse and revival of American community. New York, NY: Simon and Schuster.

Sheller, M., Urry, J., (2000) The City and the Car. *International Journal of Urban and Regional Research*. 24 (4), 737-757.

Sheller, M. and J. Urry (2006) 'The New Mobilities Paradigm.' *Environment and Planning A* 38: 207–26.

Stanley, J., Vella-Brodrick, D., (2009) The usefulness of social exclusion to inform social policy in transport. *Tranport Policy*, 16, 90-96

Stone, W. (2001) Research Paper 24: Measuring Social Capital: Towards a Theoretically Informed Measurement Framework for Researching Social Capital in Family and Community Life (Melbourne: Australian Institute of Family Studies).

UN-Habitat, (2013) Planning and Design for Sustainable Urban Mobility – Global Report on Human Settlements 2013. United Nations Human Settlement Programme. Routledge.

United Nations (UN). (1987) *Development and International Economic Co-Operation: Environment, Report of the World Commission on Environment and Development* "Our Common Future" – note by the secretary general, Forty-second session, item 83 (e) of the provisional agenda, General Assembly, United Nations.

Transportministeriet, (2015a) *Manual for samfundsøkonomisk analyse på transportområdet – Anvendt metode of praksis i Transportministeriet*

Transportministeriet. (2015b) *FFL 2016: Regeringen tilpasser investeringer i kollektiv trafik efter den økonomiske virkelighed*. Available from: https://www.trm.dk/da/nyheder/2015/ffl-2016-regeringen-tilpasser-investeringer-i-kollektiv-trafik-efter-den-oekonomiske-virkelighed [Accessed 13th May 2017]

Urry, J., 2002. Mobility and proximity, Sociology, 36 (2), 255–274.

Urry, J. (2007) *Mobilities*. New York: Polity.

Urry, J. (2000) *Sociology Beyond Societies*. London: Routledge.

Vannini, P. (2010) Mobile Cultures: From the Sociology of Transportation to the Study of Mobilities, *Sociology Compass*. 4 (2), 111-121

Winter, K. (2015) Sociala nyttor i Sverigeförhandlingen. KTH. November 2015. Stockholm

Research interview list

- Paw Gadgaard: Odense Municipality, 15th of March.
- Christopher Holland: COWI Aalborg, 23rd of March.
- Morten Skou Nicolaisen: Aarhus Municipality, 28th of March.
- Søren Sloth Lave: Aarhus Municipality, 28th of March.
- Carsten Henriksen: Odense City Hall, 7th of April.
- Mette Olesen: Telephone, 27th of April.

Appendix

Appendix 1 – Interviewguide

General questions

- Can you start by telling a little about what you have been doing now?
    - How have you been involved in the work of Danish light rail projects?
- What do you think the main rationales are for establishing light rails in Denmark?
    - Are they different?
    - Do you think these rationales have changed during the process?
- Which planning documents is used as part of the decision-making process?

Sustainability

- Do you see that sustainability has been a part of the work with the Danish light railways?
    - If yes, how do you think there has been work on sustainability?
        - Do you think it has been clearly defined how the concept of sustainability should be used in the work of light railways?
- How do you personally establish a light rail as part of sustainable development?

Social dimension

I work in in my project with the three dimensions, the economic, environmental and social, and in this relation, an interpretation of these dimensions may be that the economic dimension is represented through the socio-economic analysis where the economic impacts on society are analysed. The environmental dimension is represented through the EIA, where the environmental impacts on society are analysed.

- What you think about such an interpretation? Is such an interpretation appropriate?
    - And where is the social dimension represented?
- How do you understand the social dimension? What can that encompass?
    - And where do you see that the social dimension fits in?

Social impacts

- What do you associate with social impacts and is it possible to talk about this in relation to a light rail projects?
    - Are there any specific parameters you would think could be defined as being of a social aspect?
- Is the social dimension e.g. already represented in the EIA and socioeconomic analysis in some form?
    - If so, is it sufficient or should the social dimension, for example, have its own analysis?

Show paper with definition and categorisation

Here is a definition of social impacts and a list where some researchers have identified and categorised such impacts.

- When you see them, do you recognie someone who you think is already illuminated in the socio-economic analysis, the EIA / Environmental Report or another analysis?
- Is it even possible or necessary to investigate the social dimension and how can it really be understood and done?
- Is there a dimension that is more important to illuminate than someone else in terms of being able to use for a decision basis?
- What would be the optimal approach to analyse social impacts when it is to be used as the basis for decision-making of a light rail?
    - Qualitatively or quantitatively
    - Descriptive or evaluative
    - Monetarised or not
- Is there a need for guidelines from e.g. the Transport Ministry of how to analyse social impacts of transport projects? E.g. In how it can be used for decision-making?
    - Mention UK guidance WebTAG

Socio-economy / CBA

- What role does the CBA play in relation to the basis for decision-making?
    - Does it have to big a role?
- Is there a need for methods that rank a qualitative assessment alongside with the valued effects found in a CBA?

Appendix 2 – Paper used during the interviews

This page with definition and categorisation was used during the interviews

Definition of social impacts:

"…social impacts of transport are defined as changes in transport sources [vehicles, infrastructure and/or movement] that (might) positively or negatively influence the preferences, well-being, behaviour or perception of individuals, groups, social categories and society in general (in the future)." (Geurs *et al*. 2009 p. 71)

Categorisation of social impacts of transport by source

Theme	**Sub-themes**	**Impact**
Presence of infrastructure	Structurally	Visual quality Historical/cultural resources Severance/social cohesion
	Temporarily (Construction)	Noise nuisance Barriers and diversions Uncertainty of construction Forced relocation
Presence of park vehicles		Visual quality Use of space
Presence of transport facilities, services and activities	Transport facilities	Availability and physical access Level of service provided Transportation choice/option values Cultural diversity
	Land use	Access to spatially distributed services and activities
Traffic (movements of vehicles)	Safety	Accidents Averting behaviour Safety perceptions Public safety (dangerous cargo)
	Environment	Noise levels, nuisance Soil, air and water quality
Travel (movement of people)		Intrinsic value, journey quality Physical fitness Security

(Adopted from: Geurs *et al*. 2009, p. 75)

Appendix 3 – CD with interview recordings