What if we no longer had private cars

A study of applying co-design to find solutions for the future of sustainable mobility in rural areas

AALBORG UNIVERSITY
DENMARK

Master thesis
MSc. Sustainable Design
Aalborg University Copenhagen
02-06-2023

Titel page

Titel of the project
What if we no longer had cars

Education
MSc in Sustainable Design

Semester
4th Semester

Educational institution
Aalborg University Copenhagen

Project period
03.02.2023 - 02.06.2023

No. Of standard pages
36

No. Of characters incl. gap
87.281

Supervisor
Andres Felipe Valderrama Pineda

Rune Lindenskov Mathiesen

Sustainable design MSc

Aalborg University Copenhagen

Study no. 20185526

02.06.2023

AALBORG UNIVERSITY
DENMARK

Picture 01 | Source: Own picture

Acknowledgment

The following thesis is the final project on the Master's programme from Aalborg University Copenhagen in Sustainable Design Engineering from 2021 to 2023 written by Rune Lindenskov Mathiesen.

As the author of this thesis, I am grateful for the collaborations and support experienced throughout the study.

First, I would like to express my gratitude to Anja Puggaard, Joe Jensen, and Anette Enemark from Movia, for setting aside resources to collaborate with me and taking an active role in participating in workshops as well as contributing with ongoing feedback. Also, thanks to the employees at Movia for taking the time to participate in a workshop.

Secondly, I would like to give a big thank you to all the actors who have been involved in this study, as they have had to prioritise time, to help me explore the field of sustainable rural mobility in Denmark. They did so by participating in interviews and for some participating in a workshop as well.

These actors are:

- Charlotte Amalie Frejlev Andersen | Concito
- Lars Wiinblad | Passagerpulsen
- Hans Ege-Møller | Faxe Kommune
- Morten Heile Hass | Region Hovedstaden
- Thorbjørn Sørensen |Fynbus
- Carsten Theede | Blaffernationen
- Jens Peter Hansen | Cyklistforbundet
- David Gaarsdal Rønnov | Sekretariatet for Supercykelstier

A final and special thank you to my supervisor Andres Felipe Valderrama Pineda, for ongoing valuable feedback and guidance in the field of sustainable mobility. The recommendations have supported the study greatly and allowed for a smoother process.

Thank you for the collaboration!

Abstract

Mobility in rural Denmark is struggling to maintain the same level of service and passengers, as more and more people buy private cars. This development is only strengthened as the dominant regime of private car ownership receives political support and initiatives for private electric cars in the future. A development that will have a negative effect on global sustainability goals such as the SDGs. However, academic literature reveals that rural mobility can be considered profitable when seen from a holistic perspective and that local actors should be included in the development of mobility solutions to avoid social exclusion and establish systems and solutions that will be long-lasting.

To challenge the dominant regime of private car ownership, this master thesis was conducted. It has done so by analyzing and investigating the field of rural mobility and the possibilities of developing adjustments to the regime. Based on the empirical data collected with desk research, interviewing practitioners in the field, and co-design through workshops, a conceptualization of a facilitation tool is proposed in SyncWorks. In conclusion, SyncWorks is developed to understand and include the actors as this is key in adjusting the dominant regime. With this, the intention is to equip Danish practitioners in rural mobility, in their work toward establishing valuable, inclusive, and sustainable mobility solutions in rural areas of Denmark.

Reading guide

This thesis is being presented using two different types of media. Partly as a written project and partly as a podcast. The media podcast has been used to record and present a large part of the empirical data collection, which is presented through an introduction episode and four episodes with participants. The time schedule of interviews and workshops can be seen in the podcast schedule. (Table 01). The podcasts should be heard during the analysis, where references have been made. The rest of the report have been written and the structure of this can be found on the next page. The podcast series and the written report are accompanied by relevant material attached as appendix. It will be referred to as 'Appendix #'. If you feel for it, then now would be a good time, to hear the first episode of the podcast called the introduction.

Podcast schedule

- Introduktion | 4:25
- Episode 1 | 41:22
  Charlotte Amalie Frejlev Andersen 00:00 - 12:30
  Lars Wiinblad 12:30 - 28:50
  Citizens 28:50 - 39:00
- Episode 2 | 30:02
  Hans Ege Møller 00:00 - 11:13
  Morten Heile Hass 11:13 - 17:06
  Thorbjørn Rævsbæk Sørensen 17:06 - 28:30
- Episode 3 | 52:08
  Carsten Theede 00:00 - 13:20
  Jens Peter Hansen 13:20 - 29:45
  David Gaarsdal Rønnov 29:45 - 50:17
- Episode 4 | 34:21
  1. Workshop 00:00 - 23:00
  2. Workshop 23:00 - 32:46

Table 01 | Source: Own illustration

Picture 02 | Source: Own picture

Report structure

The following section has been made to provide the reader with an overview of the thesis. The illustration at the bottom of the page has been created to give a visual presentation of the structure (see illustration 01) and to support the text. When going through the report, a cover page and a headline with a bold font will indicate a new section.

Scope

Introduction

With this first section, the aim is to address the challenges in the field of rural mobility. In doing so, some of the complexity is presented. Based on this information the approach of the study will be clear.

Research strategy

The goal of the second section is to develop an understanding of the chosen research questions as well as presenting it. To support this, a section has been written about how sustainability is being approached and why this study is made in a collaboration with Movia.

State of the art

In the third section, a deep dive into the literature of sustainable rural mobility has been made. This has provided an in-depth analysis of the newest literature within the field, thereby elaborating on the theme of sustainable rural mobility.

The project

Methods

The fifth section will present the methodology used in conducting the literature review, Interviews, transcription, and co-design process, which includes two different workshops.

Theories

This section will outline the theoretical framework applied in this thesis. Beginning with Design for Sustainable Transitions, which indicates how transition management will be used. This will be followed by the approach of applying the theory of Multi-Level Perspective, which will be used to identify the current regime, landscape, and niches.

Analysis

In this seventh section, the state of mobility in rural areas in Denmark is being analyzed. This is done through findings in academic literature, interviews, and workshops using the theoretical framework of the Multi-Level Perspective presented in the last section.

Cenceptualisation

This section is divided into three. First a presentation of how the concepts have been developed in this study, based on the empirical data and analytical findings. This will be followed by a description of the concept. Then a user guide is provided, which explains how to approach and use the concept. And the section looks at the business potential of the concept.

Ending

Discussion

A critical view of the project is being applied in this section. In doing so, learnings and future perspectives are being discussed, to improve the scientific approach in future studies within the field of sustainable rural mobility.

Conclusion

In the last section, it all comes together in the conclusion that highlights the outcome of using co-design and the theoretical framework of MLP and design for sustainable transitions in developing a new facilitation tool, to be used by practitioners in the field of sustainable rural mobility. All of this is done, to investigate whether the study has been able to answer the research question. (See page 9)

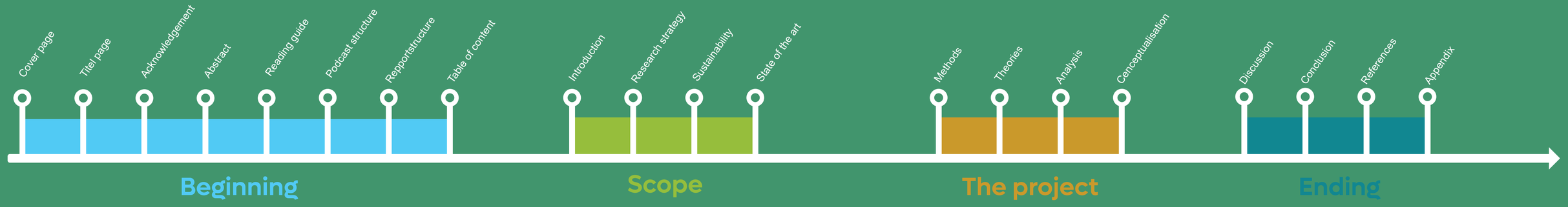


Illustration 01 | Source: Own illustration

Picture 03 | Source: Own picture

Table of contents

1. Introduction

1.1.The field of rural mobility

According to The United Nations Department of Economic and Social Affairs, 3,4 billion of the world's population is living in rural areas and around 80 percent of them are living below the international poverty line. Generally speaking, people living in rural areas have less access to education, hospital services, and other essential goods. (United Nations. Department of Economic and Social Affairs, 2021)

The definition of a rural area differs quite a lot depending on where in the world you are. As there has never been made a standard definition. In Japan the definition has been made, so that all settlements up to 50.000 are considered to be rural (MLIT, 2018). While the same definition is made for 15.000 people in Finland (Statistics Finland, n.d.). At the same time, the Danish definition is set to be less than 200 people living in the same area (Statistics Denmark, n.d.). This means that the conditions for a rural area differ quite a lot, making it difficult to transfer knowledge from country to country. For future reference the Danish definition will be used. An overview of danish municipalities classified as being rural can be seen in figure (01)

Access to mobility solutions is essential for those living in rural areas. It is the grid, that connects small communities and allows them to reach the bigger cities. It helps them survive and grow economically and it enables them to reach jobs, social activities, and other basic services. Despite all of this, rural mobility is often forgotten, as urban planners are focusing on the bigger cities resulting in a social gap (Transport Forum, 2021). It is not only the urban planners who decide the mobility conditions in rural areas, as political, social, and economical processes also have a big influence (Kühn, 2015). Considering the socioeconomic perspective is therefore important, when discussing the subject of mobility, as the lack of it, can influence global events and innovation in technical solutions, thereby changing the labor market resulting in areas being "left behind" (Hendrickson, Muro and Galston, 2018; Iammarino Rodriguez-Pose and Storper, 2019). A private form of mobility, such as having access to a private car, shifts the socio-economic circumstances as well when it provides those that can require one more access: "*Accessibility is at least as much about people as places. A place is not just 'more' or 'less' accessible, but accessible relative to people in all their different circumstances: people experience more, or less, access to places.*" - (Farrington, 2007). Another aspect to consider is the availability of highways, airports, and rail systems as these contribute greatly to the accessibility of basic services, such as hospitals, education, and food supplies (Lekakou, Remoundos and Stefanidaki, 2021).

Two big factors, that contribute to the problems in maintaining a sufficient mobility service level for the people living in rural areas, are urbanization and the rising age of the people living there. This is especially the case in Denmark, where most people living in regions far away from a metropolitan area are aged 65 or more (OECD Regional Statistics | OECD iLibrary, n.d.), (See appendix 01). This number is currently growing, as fewer children and young people are living there (*SMVdanmark*, 2021). This demographic development is just one of the difficulties that affect the demand for traditional public transportation in rural areas. This effect creates very difficult conditions for operating and maintaining a high standard in public transportation, resulting in less income from ticket sales and political support (Cowi, 2020). Such difficult conditions are part of the motivation for this thesis, as it has been written with the goal of trying to establish

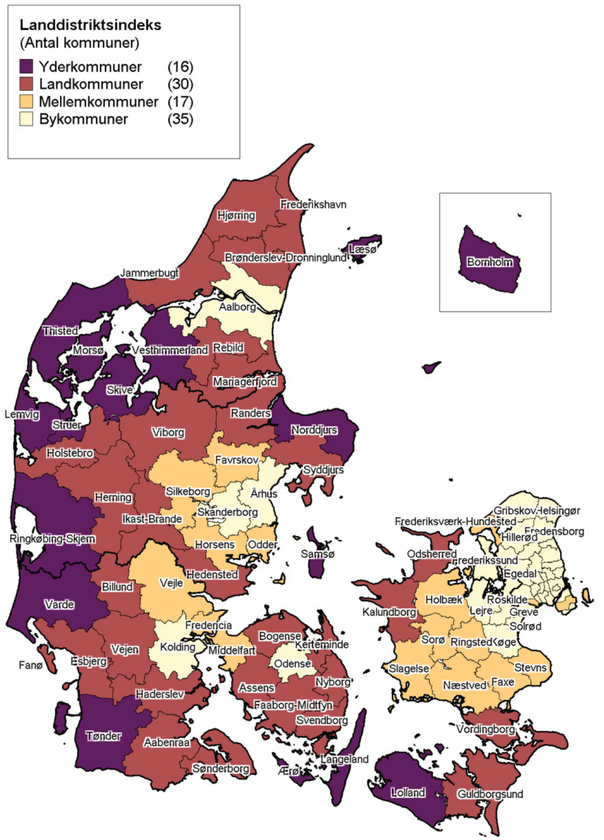


Figure 01 | National classification of municipalities. Source:(Kristensen et al. 2007)

Picture 04 | Source: Own picture

2. Research strategy

2.1. Narrowing the scope

a better connection between the stakeholders operating, maintaining and using the current system and thereby challenging the business-as-usual scenario. With the knowledge provided through my studies as a sustainable design engineer, a dissection of the complex system of mobility in rural areas has been made. This has helped to understand and contribute with insights and ideas to help the stakeholders who are trying to establish a better future for rural communities through better and more sustainable mobility solutions. In this specific study a collaboration with Movia was made, to help them explore and develop solutions on their own. Several relevant stakeholders, all working within the field of mobility solutions, were brought into the project, to contribute to a co-designerly process that would strengthen the exploration and reframing of the current approach to mobility in rural areas. Their contribution was made through interviews and workshops, to gain as much knowledge as possible.

The field of sustainable mobility solutions for rural areas is widespread, resulting in necessary steps toward narrowing the scope, to define a project, that is feasible within the timeframe of one semester. The world of sustainable mobility solutions is experiencing a drastic expansion as new solutions and equipment is being launched every year. This thesis has therefore deliberately limited the research to exclude specific solutions. A general overview of the solutions will however still be provided, to help understand the current situation. The scope of this thesis has also been limited to focus on the implementation and anchoring of sustainable mobility solutions in rural areas. Thereby saying that the focus is on actors, who can influence those processes. The aim of this study is to approach the current structure in a more holistic and sustainable way by incorporating a wider network of stakeholders to participate as well as challenge the structure for knowledge sharing and collaborations. With this aim in mind, the following research question has been made, to help fulfill just that.

Research question:

How can the use of co-design strengthen the future implementation of sustainable mobility solutions in rural areas of Denmark?

3. Sustainability

Sustainability is a central element in the future development of mobility in rural areas. In this study sustainability will be introduced through a holistic approach, inspired by the viewpoint from Kuhlman (2010). He highlights the original view on sustainability, which dates back to the development of the Brundtland Report (1987): "(…) to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs." - (WCED, 1987, p. 16)
Kuhlman argues that such a view on sustainability improves the world and sustain a system, which can support a desired level of well-being for future generations without compromising the well-being of planetary resources (Kuhlman & Farrington, 2010).

This holistic approach is also reviewed in the founding idea of the 17 UN Sustainable Development Goals (SDG´s) by the UN. This thesis is more specifically focusing on four of the goals: Number 8 (Decent work and economic growth), 9 (Industry, innovation and infrastructure), 10 (Reduce inequalities), 11
(Sustainable cities and communities), and 13 (Climate action). The combination of the 17 goals forms a framework for how to prioritize and work together to create a sustainable world in 2030 (United Nations Development Programme, n.d.). The strong combined forces behind the 17 SDGs also shows, that these areas are substantial to work with to create a better world.
Furthermore, the SDGs are addressing: "some of the systemic barriers to sustainable development and contain[ing] better coverage of, and balance between, the three dimensions of sustainable development – social, economic, and environmental – and their institutional/governance aspects."(Costanza et al., 2016, p. 350). Thereby the approach of interdisciplinarity is reflected in the SDGs.
This thesis brings in the theoretical framework of Multi-Level Perspective as well as
Design for Sustainable Transition by Gaziulusoy & Öztekin (2019). Together they help in establishing an overview of the field and locate some of the most profound challenges, in order to support the work of developing long-lasting and significant transitions. The use of the theories will be elaborated in the theoretical section.

Approaching this thesis from a sustainability perspective have resulted in a profound focus on incorporating interdisciplinarity with a socio-technical angle. This has led to co-design being a central element, an element which started out with the collaboration with Movia.

3.1. Collaboration with Movia

Throughout this thesis a collaboration with Movia has been made. Movia is a Danish public transportation company. They are located in Region Zealand and The Capital Region of Denmark, where they manage the daily operation of around 1.375 buses, 64 local trains, 1.400 demand responsive vehicles and several smaller micro-mobility projects. In total they transport around 200 million people around each year. In their strategy, they have three main focus areas: Develop mobility all over Zealand, create connectivity for all, and to prioritize sustainability and innovation(Movia som virksomhed | Movia, n.d.). With their collaboration in this project, they are hoping to strengthen their service and expertise within the field of developing new sustainable mobility solutions in rural areas of Denmark. They have contributed with knowledge and insights of the field and participated in two workshops which led to the outcome of this study.

Picture 05 | Moviabus in Westzealand , source: Own picture

3.2. Design process

This visualisation show the general design process of this study and highlight specific events, that have been essentiel. It gives an idea of the iterative nature of the process, as different interviews, workshops and research in general has effected the outcome and focus of the study. The timeline will in combination with the rest of this report create a more comprehensive picture of the process.

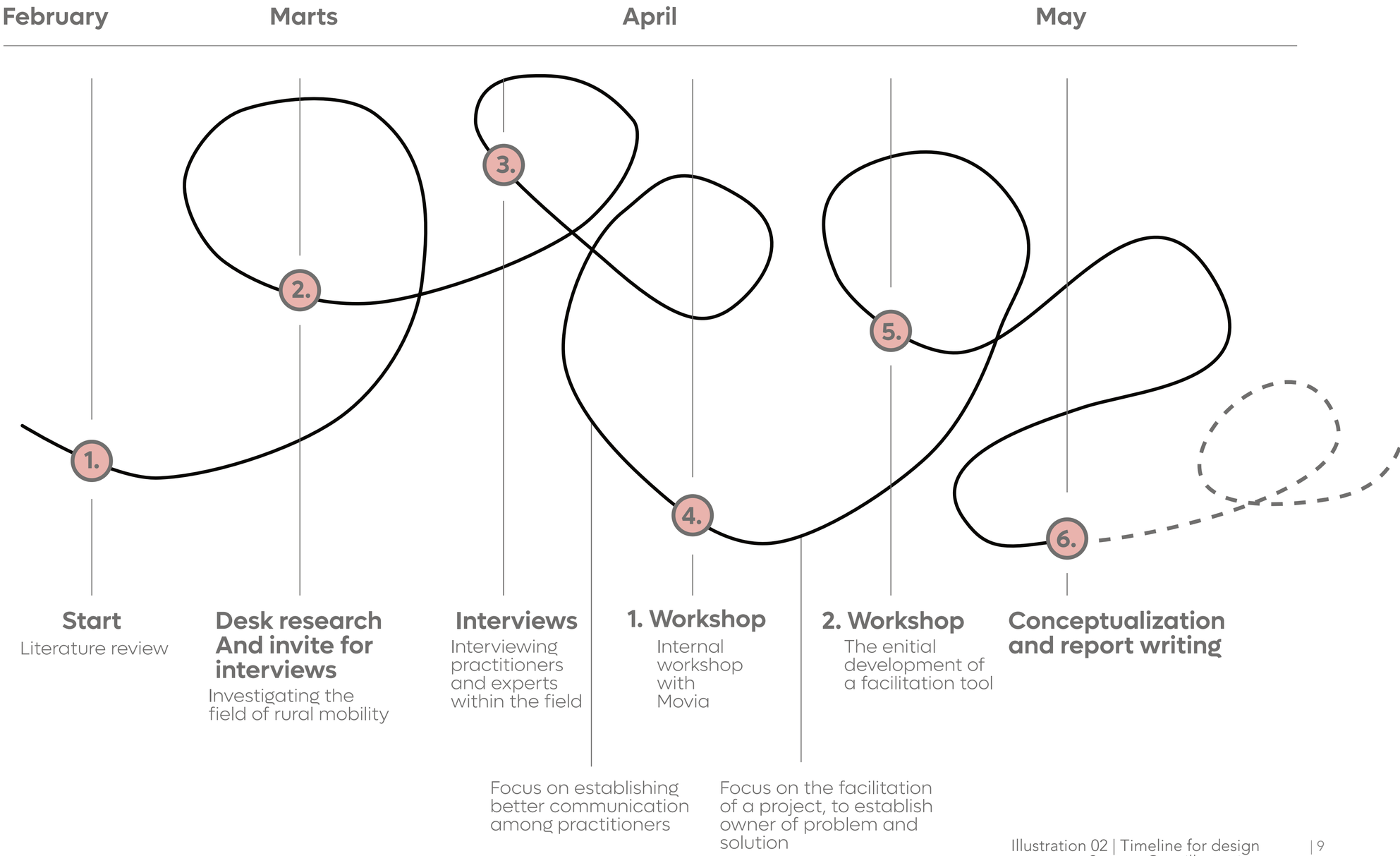


Illustration 02 | Timeline for design process Source: Own illustration

4. State of the art

Introduction

The aim of this literature review has been to explore the latest development within the research field of sustainable mobility solutions in rural areas. This review has identified the values that have contributed to a wider picture of the field of rural mobility solutions has been made visible. Furthermore, the literature review has enabled a better understanding of the stakeholders represented in the field, thereby contributing to the approach of the actors in this project.

For this literature review, the focus has been on researching literature that presents and discusses existing sustainable mobility solutions for rural areas, such as tools and frameworks. Collectively with the purpose of gaining an understanding of the field. For this report, the overall focus has been to understand the available approaches to use in the discussion of future solutions in rural areas of Denmark. The field has experienced ongoing development for several years, as tools and frameworks for rural development have been needed. To fully understand the state of the art only recent literature has been prioritized.

4.1. Literature review

When reviewing the literature, the majority of texts investigate the use of demand-responsive-transport (DRT) as it is one of the most commonly implemented solutions as well as being convertible with the traditional form of public transportation(Malnaca & Budilovich, 2022), (Knierim & Schlüter, 2021), (Poltimäe et al., 2022),(Bauchinger et al., 2021)(Fujisaki et al., 2022)(Psarra et al., 2021). Most of the DRT-systems mentioned, are based on a regular or smaller bus, which operate in a limited area, where it provides a mobility service to the citizens. The service is either fixed to a specific route or more flexible. Psarra (2021) elaborates by saying:

"DRT services are suitable to serve niche market customers such as those travelling in off-peak hours, low demand zones and making airport connections; users with mobility impairments (elderly, disabled); and in areas not accessible by conventional bus services."- (Psarra et al., 2021)

Bauchinger (2021) highlights that as the use of demand-responsive-transport is suitable for a niche market, the need for keeping a focus on the user is crucial for its implementation:

"Without fixed routes and obvious infrastructure, DRT services can be invisible to many residents, who may also believe that DRT is only for certain kinds of users" - (Bauchinger et al., 2021)

Another aspect of rural mobility represented in the literature is sharing. This can be divided into the sharing of assets like cars and bikes (Plazier, 2022)(Wellbrock et al., 2021)(Kwiatkowski, 2021) and the sharing of rides, like public transport, and carpooling (Carroll et al., 2021) they present an alternative solution to the more traditional public transportation and can be effective if implemented under the right condition (Verma & Taegen, 2019)(Bauchinger et al., 2021) which in these cases are based on a strong community.

Besides the solutions available for sustainable mobility in rural areas, the focus in the reviewed articles was clearly on the residents living in rural areas and to which extent they are able to transport themselves to their desired destination on their own, as part of this the majority states, that children, elderly, women, and people with mobility impairments are the ones in need of mobility solutions (Psarra et al., 2021), (Verma & Taegen, 2019), (Knierim & Schlüter, 2021) because a lack of public transportation is contributing to social exclusion, as the access to cities and thereby healthcare, education, and social and cultural

| Source: Chronotrains. (n.d.)

events are limited in rural areas (Psarra et al., 2021). Furthermore, it is stated that the absence of a car for emergency trips and the lack of access to a bigger city is significant factors, in the development of social sustainability for elderly people (Maretić & Abramović, 2020), (Verma & Taegen, 2019)

The absence of a car will however at the same time be beneficial for the implementation of more flexible solutions such as DRT (Knierim & Schlüter, 2021). Besides supporting the work toward a more socially equal society. The implementation of well-functioning mobility solutions could result in a reduction of CO2 emissions of up to 90% (Ciesla et al., 2022). For this reason, the study conducted by Poltimäe (2022) has the following conclusion, as it states that Demand responsive transportation (DRT), could be part of the solution to both social and environmental sustainability:

"This study has demonstrated that DRT and shared mobility solutions are promising from both environmental and social perspectives and could meet the needs of various user groups if designed properly. However, the willingness of rural user groups to adapt to novel mobility offers requires more scholarly attention as the current research has remained limited and fragmented in terms of spatial and sociodemographic coverage" - (Poltimäe et al., 2022)

On top of this, systems can under the right conditions even turn out to be profitable, when considering multiple factors, such as air pollution, noise reduction, reduced cost of climate change, fewer expenses associated with traffic accidents, lower cost of vehicles for the population, better opportunities for recruitment, reduction of travel time and an overall increase in economic development. (Šoštaric et al., 2022) (Bartle & Chatterjee, 2019) This is however a statement up for debate, as (Bauchinger et al., 2021) sees on-demand services as being more expensive to deploy in general. Part of the development towards establishing flexible systems in rural areas lies in new software such as Mobility as a Service (MaaS) (Akyol et al., 2017), (Nelson & Caulfield, 2022) It does however present another challenge, as digitalization also brings concerns.

"Digital solutions could make the services more responsive from a user perspective, although current rural DRT users are typically from demographics less likely to use digital technology."- (Bauchinger et al., 2021)

Through the literature reviewed the importance of engaging the local community and establishing commitment among local actors are clear, as they possess knowledge about the people living in the area (Flipo et al., 2021) thereby helping to shorten the rural gap. In general, an increasing number of people are globally moving out of rural areas and into the cities. This increases the difficulty of creating emission-free mobility solutions outside of the cities, as they will need to cover a wider and more complex variety of applications (Wellbrock et al., 2021).

Picture 06 | Source: Own picture

5. Methods

Introduction

This following section has been written to provide a comprehensive overview of the methods applied throughout the study. The empirical data was collected using these methods as semi-structured elements was central. The last method presented is co-design, here the combination of collected data and the outcome of the analysis was processed, leading to the development of the final concept. One of the first steps in this data collection was to compose the literature review.

5.1. Literature review

The literature review has been a central element in the collection of data during this thesis. The following section will elaborate on how it was done, by presenting the method applied.

The literature review was developed using the search database ´Scopus´ as it covers a wide range of scientific fields, which was expected to be needed for this search. The approach has been influenced by the book: Doing a literature review (Hart, 1998). With the use of the initial desk research, these words for the first search strategy were found.:

TITLE-ABS-KEY (mobility) AND TITLE-ABS-KEY (sustainable*) AND TITLE-ABS-KEY ("public transport*") AND TITLE-ABS-KEY ("Rural area*")

From this search a total of 49 results appeared. This was a manageable number of results, but in order to cover a bigger field the analytical tool at Scopus (Scopus Analysis) was used. This help clarify, that most of the articles had been published from the year 2015 and newer (See figure 02). As a result, the research strategy was limited to articles writing between 2015-2023. This was made with older relevant articles in mind, as they will be represented as references in the newer articles. With this new approach, the research strategy ended up like this:

TITLE-ABS-KEY (mobility) AND TITLE-ABS-KEY (sustainable*) AND TITLE-ABS-KEY ("public transport*") AND TITLE-ABS-KEY ("Rural area*")) AND (LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2015))

With this search strategy, 41 results appeared. Before a closer inspection of the articles was made, a final set of criteria was added, as they all had to be written in English as a journal, book, book series, peer-reviewed and be studying material that was conducted in a geographical relevant area. With the remaining 38 articles, the abstracts were read, as they fulfilled all of the criteria. With the 38 abstracts read, 19 were relevant to be part of the literature review. To analyze the 19 articles, an online whiteboard tool Miro-board (Miro.com) was used to create a map (See appendix 02). The map helped in developing an overview of the represented themes within the literature and in the selection of useful material. This helped clarify the individual and overlapping arguments used across the articles.

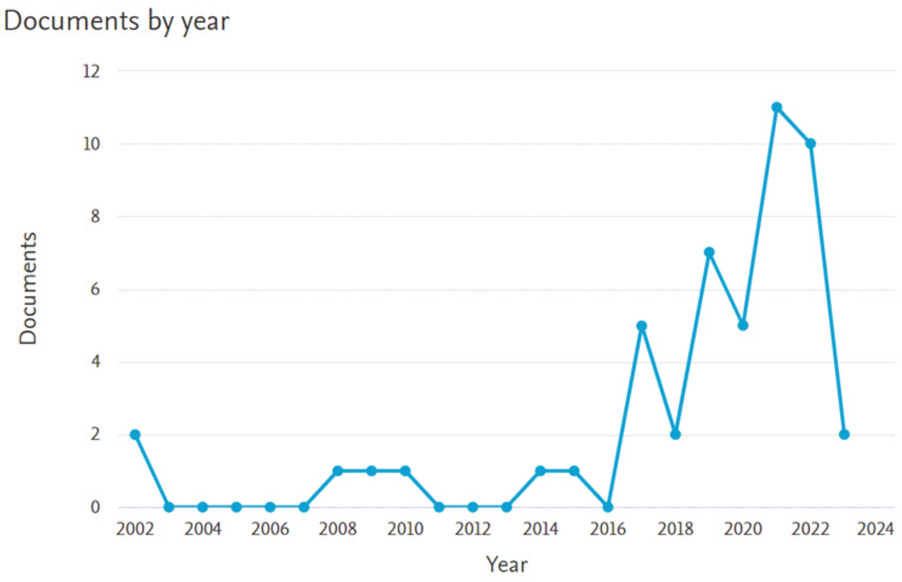


Figure 02 | Screenshot from Scopus |Source: Own picture

Table : Description of interviewees

Name and titel	Representing	Focus area
Charlotte Amalie Frejlev Andersen | Climate analyst	Concito	Future mobility
Lars Wiinblad | Project manager	Passagerpulsen	Looking out for wishes and concerns among the passangers
Hans-Ege Møller | Consultant	Faxe Municipality	Establishing and maintaining mobility solutions in Faxe Municipality
Morten Heile Hass | Consultant	The Capital Region of Denmark	Establishing and maintaining mobility solutions acros the region of greater Copenhagen
Thorbjørn Sørensen | Mobility planner	Fynbus	Developing and implementing mobility solutions on Fyn
Carsten Theede | Founder of Blaffernationen	Blaffernationen	Expanding the knowledge and use of hitchhiking in Denmark
Jens Peter Hansen | Chairman of Cyklistforbundet	Cyklistforbunder	Expanding the knowledge and use of riding bicycle in Denmark
David Gaarsdal Rønnov | Project manager	Sekretariatet for Supercykelstier	Expanding the knowledge and use of riding bicycle in Denmark as a tool for communting

Table 02 | Source: Own tabel

5.2. Semi-structured interviews

A central part of this study has been to interview a series of relevant spokespersons, most of whom are actors within the field of mobility in Denmark, in their daily work (See table 02). To gain the most from each interview, an effort to understand the interviewee was made, as they each represent different knowledge, concerns and interest. As part of this, each interview was prepared, by defining my role, as well as the approach for the interview by preparing questions and understanding the specific field. This was done to supplement the original questions resulting in a series of semi-structured interviews (Thagaard, 2007). All the conducted interviews were semi-structured, which were done by creating, an 'interview guide' (See appendix 03). This helped structure the interviews and maintain a direction while enabling the possibility of bringing new questions to the interview in order to elaborate on the answers and allowing the interviewee(s) to take a new relevant direction (Ayres, 2008). This was especially relevant, as they are experts within their respective fields and therefore would be change the direction of the interview, to what they felt would be interesting for the project.

The interviews were all conducted within familiar locations for the interviewees. The use of recording device was however shifting between a physical recorder and the use of Microsoft Teams, depending on whether the interview was online or not. This meant that the interviewees always felt comfortable and that they were able to find material if they needed to.

The interviews were all recorded and transcribed (See appendix 04), in order to process the gained information. This way the knowledge and statements could be divided into categories, which helped to understand their concerns as well as structure a plan for the podcast.

5.3. Transcription

For the transcription the tool developed by Zetland.dk called 'Good Tape' (Goodtape.com) was used. This supported the process and enabled that all the interviews could be transcribed in full length. 'Good Tape' creates the first draft for the transcription and is therefore not perfect. The draft was the edit, ending up with a useful result.

5.4. Co-design

In the early stages of the project a lot of knowledge were collected, through interviews and different literature. To activate all of this knowledge and establish new ideas with different stakeholders, co-design were applied as a method. These actors were all different people who had been involved in the project and participated at the workshops.

One way to describe co-design is"(…) the creativity of designers and people not trained in design working together in the design development process." (Sanders & Stappers, 2008, p. 6). For this specific project some of the stakeholder have a background in engineering, meaning that they have some degree of training in design. However, for most of the participants working with design is new. Despite one workshop being online and the other physical, a successful co-design process was staged, with two different scenario (David Bergman, 2013) and knowledge gathered as empirical data.

5.4.1. 1. workshop

This workshop was facilitated at Movia using of a presentation, that introduced the participants to the specific subject with quotes from the literature review and introductions to the methods that was used (See appendix 05). The following methods were conducted during the workshop 'thinkbox', 'scenarios' and 'dotting'. To facilitate, blank pieces of paper, post-it´s and writing tools were used.

The first aim of the workshop, was to detect and qualify the concerns, from each of the participants representing Movia as an organisation. The workshop also tried to generate a series of ideas and solutions for these concerns. This was specifically done by staging two different scenarios (See figure 03 and 04). The first scenario tried to frame a world, which is radically different than business as usual. Thereby enabling the participant to go in different directions and collectively develop solutions, that would support such a radical change in the current mobility structure. With the second scenario the framing was more specific to the profession which they possess, as the goal was to have them reflect on their current approach to implementation of new mobility solutions and the tools that they need to do so. Thereby creating a setting that would clarify such undeveloped tools. At the end of the workshop, dotting was used to locate the best ideas in order to build on the best ideas in the second workshop. (see figure 04)

Picture 07 | Source: Own picture

Figure 03 | Source: Own picture

Figure 04 | Source: Own picture

Figure 05 | Source: Own picture

5.4.2. 2. workshop

The second workshop was online. This is the case as some of the participants invited was located in Jutland and Fyn. Attending the second workshop was two project leaders representing Movia. Representing The Capital Region of Copenhagen was Morten Heile Hass, who is a consultant in the area of mobility, climate and education. The last actor attending the second workshop was Charlotte Amalie Frejlev Andersen who is a climate analytics in future mobility from Concito. Unfortunately, several cancellations were made shortly before the workshop, making it impossible to reschedule, as the chosen day, had been the most feasible day, for all of the invited actors.

For the online workshop two programs was used to facilitate. Microsoft Teams was used to create and stage a "room" in which the workshop could take place. The second program used was the online tool 'Miro-board'. It enables a plenum discussion and interaction across actors, as every participant had the ability to interact on the whiteboard. This became useful as the task at the workshop, was to create a mapping based on the actors who had been mentioned doing the interviews. This was done by connecting them using strings representing their relationships (See figure 06 and 07).

As the participants from the second workshop had all been interviewed or intended the first workshop, an investigation of individual concerns was not needed, as they had already been defined.

For this second workshop, the idea was to have the participant help with constructing a map, that can be used as a facilitation tool. A tool that will help define: Who is responsible for the problem in hand and who is responsible for the solution needed. Through several iterations the idea came, that a map that would show all the relevant actors, the connections between them, their relations to each other and the common disagreements came to life. To further improve the tool, relevant questions would also be added, so that an early discussion of potential problems can be established.

Part 1

Generating such a map was the goal for the second workshop. The participants started with a clean canvas and 21 boxes with all of the mentioned actors, from the previously conducted interviews. (See figure 06 and appendix 06) Extra boxes had been provided, to allow the participants to add extra actors, should they remember new ones. On the map, there are two types of line. The dotted lines indicates that a connection between two actors has not yet been fully established, however it would make sense for them to make such a connection. The participants could also choose to make a full line. This indicates a connection between the two connected actors. To this line, they could decide to add a red star, symbolising a problematic relationship (See figure 07 and appendix 07).

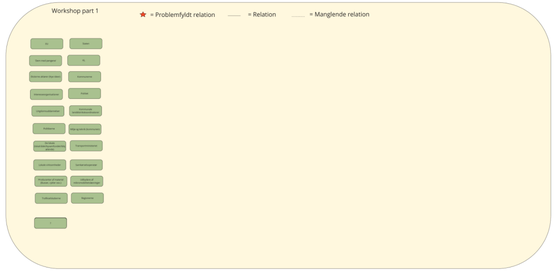


Figure 06 | Source: Own picture

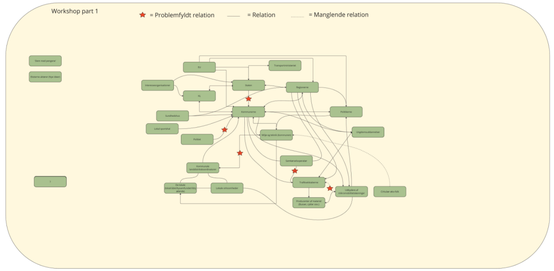


Figure 07 | Source: Own picture

Part 2

For the second exercise the participants were given the same map, that they had just created. (see figure 07 and appendix 07) Then they were given the task of adding blue boxes to the lines, in which they were asked to put relevant questions, that would be meaningful to ask. With the goal of connecting two actors, in order to establish, repair and strengthen their relationship, depending on their previous status. This map would thereby showcase all of the relationships within the field of sustainable mobility in rural areas of Denmark as well as the relevant questions to ask when starting a new project in the field, to help find the owner(s) of the problem(s) and the solution(s) (see figure 08 and appendix 08).

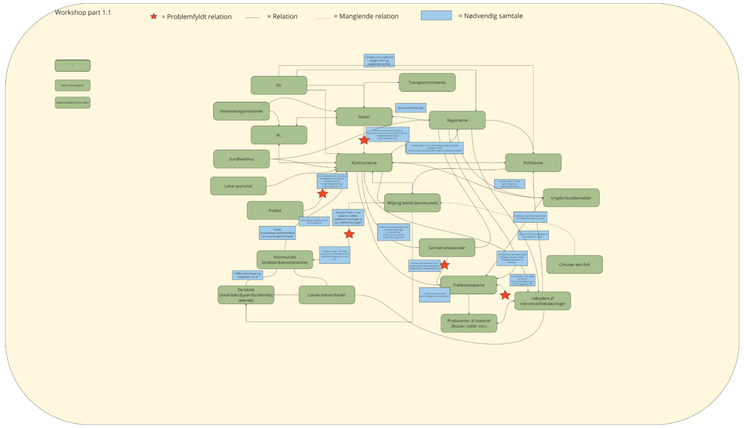


Figure 08 | Source: Own picture

6. Theories

Introduction

The use of theories can help to define a scope and understand and analyse the gained knowledge. This has also been the case for this project, where the combination of theories have been used to find the right approach for the problems. In this following section, the used theories will be presented.

This study is, as mentioned before, attempting to push the agenda for sustainable mobility thereby supporting the niche development within this field, as they try to transition the current business as usual scenario into the future of mobility. This is why this study draws on the notions of transition design and transition management, to investigate how these niche developments can become part of the current regime.

Using the Multi-level perspective (MLP) a wider understanding of the system around mobility, has been made, as it helps to gain an understanding of the dynamics of the Danish rural mobility regime. This is especially interesting, as this regime is experiencing changes, as society slowly transitions towards becoming more sustainable. Using the multi-level perspective helps to understand and map these changes.

6.1. Design for Sustainable Transition

The aim of this project is to create a more sustainable future of mobility solutions in rural areas in Denmark. This is being done by enabling development and change through interaction with relevant stakeholders. In order to do so, the use of transition management and transition design have been applied where it have supported the work with analysing the existing system.

The use of transition design have been part in conducting this study, as it helps to analyse and understand as well as support the work for future and improved solutions within an established system.(Gaziulusoy & Öztekin, 2019). Transition design does so, by working on the socio-technical level, where it can help and support the understanding of sustainable mobility solutions, by aiding the process of finding new ways to assessing values of relevant stakeholders.

As this project is working with wicket problems such as the implementation of sustainable mobility in rural areas, transition design has aided by support the understanding of challenges and uncover how to enable a transition for the system and thereby contributing to the establishment of new collaborations.

6.2. Multi-Level Perspective (MLP)

To help understand, identify and map the institutionalization of mobility implementation in rural parts of Denmark, a multi-level perspective (MLP) have been used. This has helped explore the dynamics in the landscapes as well as grasp the structure of the regime to establish opportunities for changes and development within socio-technical niches. Geels (2002) presents three separate 'levels' within a regime. They are: *Socio-technical landscape*, represents the macro level with changes in political, societal, and environmental structures (Geels, 2002). S*ocio-technical regimes* represents the meso level with the 'incumbent regime' where the routes and institutionalized structures of actors within the regime are defining (Fuenfschilling & Truffer, 2014). And the t*echnological niches*, represent the micro level. They are smaller emerging developments that regularly are isolated and lesser known that the other levels. (Geels, 2002)

By using these three levels when analysing the field. A better understanding of how to approach the design process of implementing a socio-technical niche, such as sustainable mobility solution in rural areas of Denmark. Reaching an understanding of the latest development of the regime and landscape helps to find the barriers that hinders the opportunities for niche development in the future.

Picture 08 | Source: Own picture

7. Analysis

Introduction

This section will present the analytical findings. Based on the knowledge from the academic literature, theories, methods and a thorough search through newspaper articles and relevant reports an analysis of the landscape, regime, and niches has been made. The current structure of public transportation in rural areas will be established, followed by the problems and barriers that are experienced within the field. This has been done, through the process of desk research and a series of interviews with relevant actors. Followed by two workshops. One where different actors from Movia, were to help understand the concerns and challenges that they face. And a second workshop was later conducted with a broader view, where actors from outside of Movia were represented too. Here the focus was to brainstorm and develop a solution, based on the concerns presented in the interviews and in the first workshop. Furthermore, a series of podcast episodes have been made, to document the problem at hand and experience the statements firsthand.

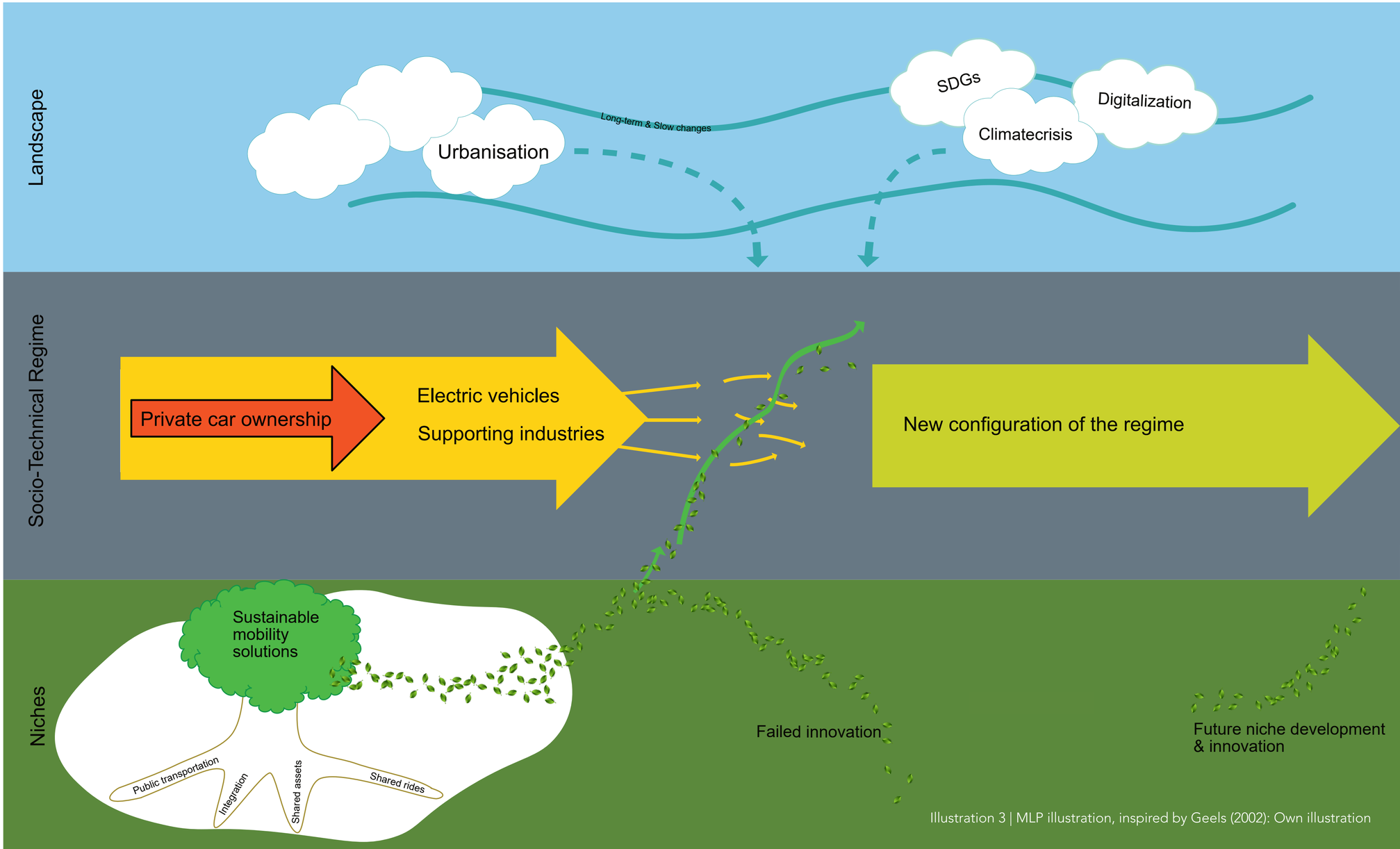


Illustration 3 | MLP illustration, inspired by Geels (2002): Own illustration

7.1. Public transportation in rural areas

This next analytical section has been developed by using empirical data, that has been collected from publicly available data sources such as reports from relevant organisations, authorities, and statistical databases such as the UN, The Danish Ministry of Transportation, and Statistics Denmark.

For 21% of the Danes living in rural areas, the possibility of choosing some sort of mobility solution, such as having access to public transportation or micro-mobility (scooters, bikes, etc.) is the only way for them to independently travel between their residence and their chosen destination (*Analyse om fremme af samkørsel : en national, tværgående rapport om samkørsel*, 2022). Two reasons for this are the large down payment required to purchase a car, as well as having to acquire a driving license.

This can be problematic, as the current public transportation system, is based on the principle of creating 'Mest til flest' which translates, to creating the most public available transportation options to the most people available. This effectively means that the resources are being diverted towards, areas with higher demand (Cowi, 2020). This leaves less densely populated areas, with an insufficient supply of mobility solutions.

The public transportation system is undergoing changes in these years, as the current government of Denmark is keen on establishing better connectivity for people living in rural areas. In that process, they are currently establishing an expert committee, that is meant to find solutions that will create better and cheaper mobility for young people in rural areas(*Analyse om fremme af samkørsel : en national, tværgående rapport om samkørsel*, 2022), (*Ansvar for Danmark Det politiske grundlag for Danmarks regering*, 2022). This indicates that changes are coming, but the committee will have to find solutions, that can change business as usual, which currently is very stable.

Public transportation can generally be divided into five groups depending on the frequency of departures.

1. Very high = 10 or more departures/hour + several means of transportation
2. High = 10 or more departures/hour
3. Medium = 4-9 departures/hour
4. Low = Less than 4 departures/hour
5. Nothing = No access to public transportation within a radius of 500 meters

(Rasmussen et al., 2021)

In the areas with the lowest level of public transportation, more than 80% of families own one or more cars. While the number is 39% for the families living in areas with the highest level. The biggest increase in families with cars comes when the level goes from high to medium (Rasmussen et al., 2021). This shows how strongly rooted the two-way dependency between the car industry and public transportation is in our daily life and how much influence the service level of public transportation can affect that dependency.

The structure of the placement and interaction between the landscape-, regime,- and niche levels has been visualized in the multi-level perspective illustration (See illustration 03) inspired by Geels (2002), which shows how deeply embedded the dominant regime, of private car ownership is and how it is affected by the landscape. It also indicates the possibility of niche innovations to find a window of opportunity and become integrated into the regime. In this analysis, we begin at the macro level of the landscape, to understand the overall structures.

7.2. The landscape

At the landscape level, two dominant structures have affected the regime and the overall picture of the multi-level perspective. Those are urbanization and global awareness of climate change. Urbanization has been a trend for many years, whereas the focus and public concern about climate change has become part of the landscape in more recent times. Urbanization is supporting the dominant regime, of private car ownership, in rural areas, by creating small and highly dispersed neighborhoods. This undermines the financial foundation of public transportation systems as the distance between the customers will be bigger, resulting in higher dependence on owning a car. In Denmark it is expected that we will be around 6.3 million people by 2050 (Klintefelt, n.d.), and only 1 out of 10 will be living in rural areas (Bøggild et al., 2012). This will only increase the existing challenges in creating meaningful and economically sustainable public transportation systems.

The dominant element on the landscape level is that of climate change. The challenges caused by climate change on a global level is one of the highest prioritized challenges in society, with major political awareness (United Nations, n.d.). This results in a demand for solutions and action, a demand which has increased every year. These solutions are being pushed forward due to political will and agreements such as those made in the UN and with the Paris Agreement in 2015 (Unfccc, 2015). In Denmark, the goal is to have reduced the emissions by 70% before 2030 (*Dansk klimapolitik | Energistyrelsen*, 2020). These agreements have helped change the priorities of the municipalities and city planners who are managing public transportation. Based on climate change being a part of the landscape, a large pressure is being exerted on the regime. This shows as municipalities are working towards a sustainable transition. This includes rural areas in projects like DK2020 (*DK2020*, n.d.).

The last element to consider is the digitization of society. It includes elements that are affecting the incumbent regime, as Denmark is one of the highest-ranking digitized countries in the world (*Redegørelse om Danmarks Digitale Vaekst*, 2023). Digitization is playing a significant role, in the implementation of new apps and platforms, that support mobility services and enables real-time information, route planning, and multi-modal solutions. It follows the trend, that consumers are expecting convenience and efficient mobility. A convenience and efficiency that leads people to choose the private car.

7.3. The dominant regime: Private car ownership

The regime is highly influenced and dominated by the car industry. For many years people have become dependent on privately owned cars. Looking at the statistical overview it becomes clear, that more and more people are buying cars in Denmark, this includes people who are buying their first car and those, who are now the owners of two or more, within the same household (Cowi, 2020).

Between 2015 and 2019 there has been a rise of 8,4 % in driven personal kilometres. One of the factors affecting this is that commuters only use 1.08% of the seats in their cars - a number that is dropping significantly among people who are traveling to and from work and education (Analyse om fremme af samkørsel : en national, tværgående rapport om samkørsel, 2022). This increases the congestion resulting in more travel time and worse mobility conditions for car owners.

The Danish government decided in 2020 to begin the initiatives towards restructuring the current composition of polluting vehicles and zero-emission vehicles. Their goal is to reach 775.000 'green' vehicles, with 10% being hybrid cars and a hope of reaching a total of 1.000.000 'green' vehicles by 2030 (TV 2, 2023). However, with the current depreciation rates on the existing car fleet, and the hopes of reaching a total of 1.000.000 cars, the support for the existing regime in the future is clear, as this political goal will establish a future with more cars. This means that the political direction is towards strengthening the regime of cars, and not towards reducing the total number of cars in Denmark. At the start of 2023, 2,8 million cars were driving around in Danmark. 1,95 million of those will still be driving around in 2030. With the goal of new 'green' vehicles and the current increase in people buying new cars, the total number is set to be higher by the year 2030 (Danmarks Statistik, 2023). Such a development will only strengthen the dominant regime and increase the difficulty of new niche developments. Especially, as the car is considered by many families to be necessary as it is needed for everyday life (FDM, n.d.), (Podcast: episode 1). While Danish politicians argue that changing the combustion engine with electricity is sustainable, Henderson (2019) argues that we have to foresee the problems associated with subsidising electric vehicles on a massive scale, and instead approach mobility from a wider perspective.

"The rush to mass EV uptake could be a huge miscalculation, and a lack of scaler fluency in the understanding of EV emissions and environmental impacts must be addressed"- (Henderson, 2020)

Several technologies, practices, and institutions share the wish of maintaining the private car ownership as the dominant regime as they all benefit from it. Indicated by an increasing number of gas stations (Drivkraft Danmark, 2022), a high number of car dealerships (AutoBranchen Danmark, 2022) and a well-established network of roads and highways in Denmark, and political will to maintain and expand them(Trafikministeriet, n.d.). This political support will also strengthen the future of private car ownership, as a rapid expansion of charging points is undergoing to assist the transition towards electric vehicles (Antallet af ladestandere vokser fortsat på tværs af landet| Trafikministeriet, 2022). A transition which is already happening (Vejdirektoratet, 2023), as the regime is going to great length in order to preserve them self, by remaining business as usual.

The former Danish government has implemented policies to encourage people to use alternative modes of transportation, such as cycling (Trafikministeriet, 2021) and public transportation (Trafikministeriet, 2022) but the high convenience and increased flexibility of choosing the car, makes it difficult to shift away from the regime.

Picture 09 | Source: Own picture

7.4. Niches

There are currently several emerging mobility solutions, that are challenging or supporting the dominant regime of private cars. They are trying to establish a new structure, that will support a sustainable transition and the way we move and transport people and goods.

These niche developments are trying to exploit 'the window of opportunity' by offering more sustainable alternatives to the institutionalized pressure existing in the regime of private car ownership. They can be divided into three overall sections. Shared rides, shared assets, and integration. (see figure 09)

shared rides, Includes traditional public transportation, taxi and ridepooling, and carpooling and hitchhiking. All categories that share the same theme of service being provided by people driving strangers around in vehicles which they may or may not be owning them self.

In the category of **shared assets**, it is the vehicle itself, that people rent or borrow and act as the designated driver on their own. These could be vehicle sharing or bike sharing.

The third and last category of rural mobility solutions is **integration.** Here the focus is more on making sure that the right conditions for the two first categories are present. This includes integrated ticket systems such as Mobility as a service (MaaS) or route planning. Infrastructure in general is also part of this category, as many of these solutions can be aided by developing mobility hubs, transit-oriented developments and walking and cycling infrastructure.

(Transport Forum, 2021)

These solutions are centered around having a more holistic approach with a co-beneficial structure as more people will benefit from them by using less resources and distributing them more evenly.

The new demand for sustainable transition changes the paradigm and enable opportunities for sustainable mobility in rural areas. As the paradigm is changing with the entry of electric vehicles and the new agreements from the government and the municipalities, other niche solutions will be given the space to enter the regime as well, potentially replacing more traditionally means of transportation as well as the approach in the municipalities to designing and managing mobility for people living in rural areas.

Referring back to the literature review, the number of solutions and attention in academia to this specific area of mobility started to grow around the year 2017 (see figure 02). Thereby initiating the era of transdisciplinary and sustainable solutions. This growth was probably helped by the rising awareness of climate change, but there are still a lot of niche solutions that would be beneficial to society in closing the social gap as well as supporting the path towards reducing our global emissions. Those niches are still waiting for a 'window of opportunity' and struggling with becoming well-established. They try to gain a foothold through funded projects, thereby establish a more incremental transition towards changing the business as usual.

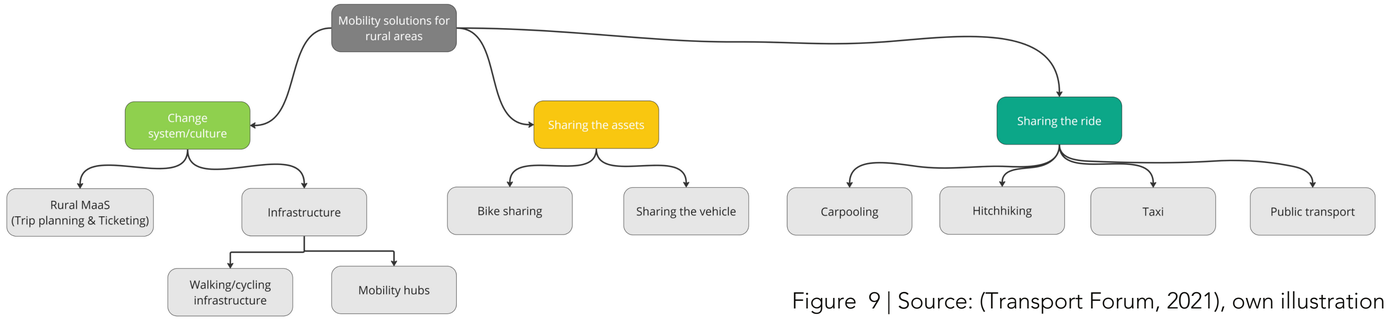


Figure 9 | Source: (Transport Forum, 2021), own illustration

7.5. Interviews

With the landscapes, regime and niches established, a deeper and more locally based analysis will be presented. This analysis is based on the eight semi-structured interviews with different professional actors from across the field. In addition to the interviews an analysis of the two workshops will be presented as well.

This thesis has been developed in collaboration with Movia. The aim of the collaboration was to gain a better understanding of the actors, that Movia is collaborating with, as well as working towards finding a solution, that would help to strengthen that collaboration in the future. For those reasons a list of relevant actors was contacted, of which some agreed to take part in an interview. This resulted in eight individual semi-structured interviews. They were all recorded using either a psychical recording device or the recording function during an online meeting in Microsoft Teams. An overview of the recorded interviews and the interviewees can be seen in (table 01 and table 02) and the transcriptions of all the full-length interviews can be found in (appendix 04). Using these interviews a more personal and field specific understanding of the regime was provided.

To gain an overview, the actors were divided into three groups. Those groups were made based on how the actors approach the subject. One group is working in public offices and two groups are working in non-governmental organizations, one with a more general focus on mobility and sustainable development and another group with actors more focused on specific solutions. A podcast episode has been made for each of these groups, where more specific details will be provided.

7.6.Podcast - interviews

At this point you should listen to episode 1-3. These episodes will provide you with an firsthand source to all of the interviews and the statements used for the next analysis. The podcast will in general give an overview of the future for sustainable mobility in rural areas, including frustrations, concerns, and solutions.

Picture 10 | Source: Own picture

7.7. Analysing the interviews

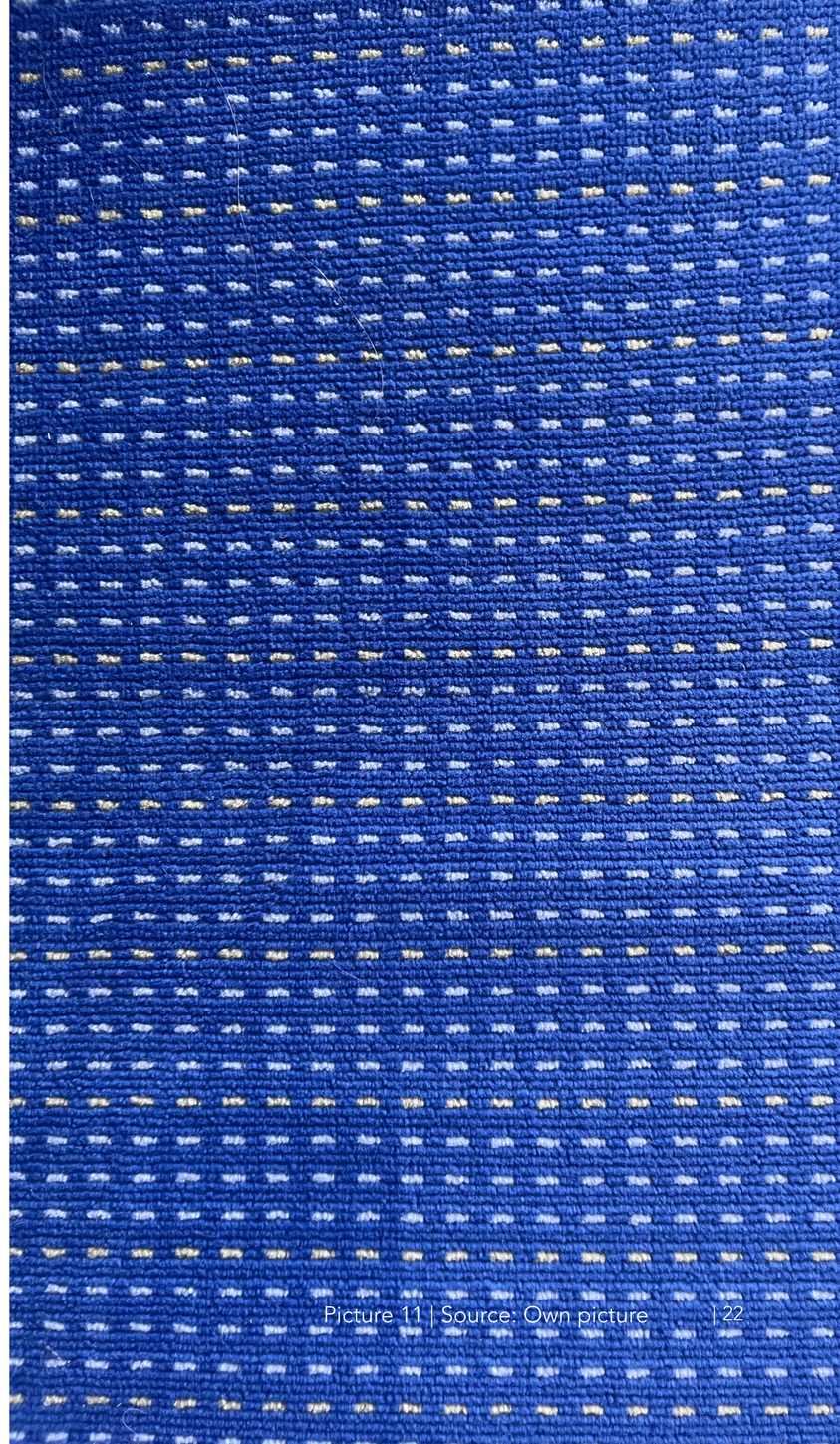
Throughout the interviews many interesting statements are made. These are some of the most relevant. The first thing is the current disequilibrium on the view of future mobility between the citizens, the practitioners and the status quo. The second thing to highlight is the need for innovation and the future possibilities for niche solutions and the third thing to highlight is the need to improve communication between all the stakeholders involved in the field of rural mobility.

The first question asked to all the actors was meant to gain an understanding of each individual actor and their opinion on how to approach the problems related to future sustainable mobility solutions in rural Denmark. Based on this question alone, the actors can roughly be divided into two groups. Those who see the implementation of a few specific measurements and solutions as needed, to reach the goal of sustainable mobility to the masses. And those who approach it from a more holistic angle, by suggesting that we implement a variety of solutions, which have been decided based on local needs, available infrastructure, and economic viability. Two of those who expressed the need for a few specific solutions, was the chairman of Cyklistforbundet (Cyclists association) and the founder of Blaffernationen (The hitchhiking nation) they respectively saw cycling and hitchhiking as being the main solutions to most of the challenges associated with the current lack of mobility (Podcast episode 3). The chairman of Cycklistforbundet mentions the lack of several laws and regulations that would prevent cars to drive closely to cyclist, thereby allowing for an expansion of cycling. He also expresses a need for reorganizing the system, as he sees radical changes to traffic companies such as Movia and other actors as needed. Another aspect to highlight is the different perspective to the needed solutions between people working in the sector and people living in rural areas being current or potential future passengers. These different perspectives clarify the urgency of ensuring effective communication between people involved in the field. Otherwise, there will continue to be a dissatisfaction and a lack of ownership and usage among the locals.

Communication and understanding of ownership for a project, is a focus area which is mentioned, as a more general concern by many of the interviewed actors. As several different organizations and public offices, lack a common understanding and an interdisciplinary communication between each other.

Another general observation is the view on more traditional public transportation, and the role it will possess in the future. One group consider new mobility solutions, as being a measure that will help support the future of public transportation, by create reliable alternatives, for when the desired route is not being covered by buses or trains. The other group had another perspective, they see traditional public transportation as a future niche section of mobility, as they think that it should only operate on the direct lines between the bigger cities. Based on the literature review, the need for social awareness in the rural areas of Denmark is high. Especially considering people's ability to transport themselves and the effect the lack of it has. However, going through these interviews, you become aware of how little that concern is represented.

It was with this knowledge preserved, that the workshops were developed and facilitated.



Picture 11 | Source: Own picture

Picture 12 | Source: Own picture

7.8. Podcast - workshops

At this point you should listen to episode 4. This episode will provide you with an firsthand source to the two workshops, including statements used in the next analysis. This episode will give you an introduction in how Movia is working towards sustainable mobility in rural areas and which tools they are missing in doing that work.

7.9. Analysing the workshops

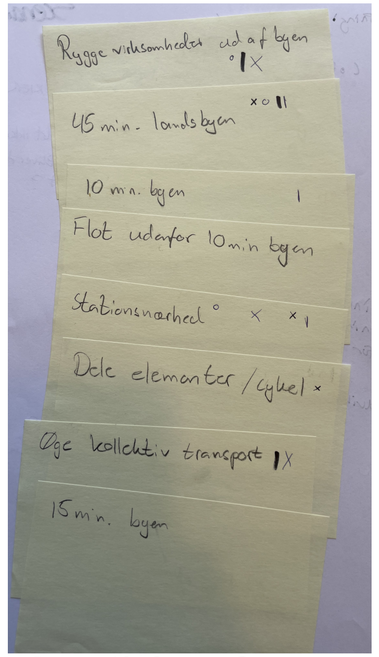
As mentioned in the podcast, the two workshops wanted to achieve different things. For that reason, this part if the analysis will be divided into two as well.

The first workshop

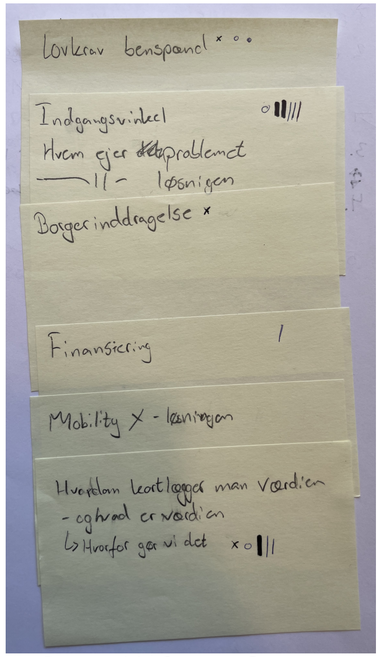
In the first workshop the goal was to brainstorm based on two different scenarios (See picture 07 and figure 03 and 04) They were made to create a space, in which new ideas could exist, no matter how wild or innovative they may be. The first scenario was (translated):"What would you do if there no longer were any private cars from tomorrow? – Who would you talk to?". With this scenario, the participants were only able to come up with ideas, that already are part of the existing solutions within niche developments. This becomes clear, as they suggest solutions such as increasing public transportation, creating 10/15 minute cities, where everything can be reach by a short journey and establishing more mobile and demand responsive mobility systems, to help those living outside the cities. None of these results were innovative and they all originate from outside the workshop. Based on this the first scenario ended up being a warm-up exercise, where the participants established the foundation for the newest ideas within rural mobility. With this in place, the second scenario could be presented. It went like this (translated): "You are about to implement a new mobility solution, which tools would you use and which would you be missing?". With this scenario they were able to find more deeply rooted problems, which shows when they were asked to vote for the ideas. (see picture 13 and 14) Because examining the voting lists, two ideas from the second scenarios were favored. Based on the voting and the statements made during the interviews, it was decided to bring the following problem to the second workshop: "Who owns the problem and who owns the project". As in who is responsible for there being a problem and who is responsible of finding, implementing, and maintain the solution.

The second workshop

With the second workshop, the participants were able to successfully create a map with the relations between relevant actors. Furthermore, they were able to write several questions, that will be helpful, when facilitating future projects. Based on statements during the workshop and the solutions created itself (see figure 07), it becomes clear that some areas and actors are more closely linked than others. These areas are linked to the multi-level perspective, as actors operating in the landscape, have fewer connections, to actors operating on the regime and niche level. This could be a focus area for future development of the created solution, to strengthen that connection and create new 'windows of opportunity'.



Picture 13 | Source: Own picture



Picture 14 | Source: Own picture

7.10. Take away from interviews

The interviews provided a lot of valuable and in-depth insight into various aspects of the field of mobility in rural areas. This allowed a wider and more comprehensive understanding of the subject. The actors participating in the interviews represented the most diverse range of experts, practitioners and stakeholders as possible. This helped in contributing to a more holistic and interdisciplinary data collection. Throughout the interviews, several key challenges and opportunities were clarified, such as the need for new business models and the question of what the role of traditional public transportation will be. Included in the answers were a general concern regarding the communication across the sector, a concern that was worked on during the second workshop.

7.11. Take away from workshops

The workshops created a collaborative environment, where participants from both inside and outside of Movia exchanged thought and engaged in discussions. The first workshop helped to identify common issues among employees at Movia, issues that the second workshop tried to find a potential solution to. The second workshop emphasized the importance of aligning stakeholder, when doing a project, as the solution created showcased just how many problematic relations there are within the field of rural mobility in Denmark. Across the two workshops a co-design process allowed the participants to contribute to the development of new solutions that will support the future of sustainable mobility in rural areas.

Overall, the interviews and workshops have provided valuable insights, perspectives and collaborations, which have been beneficial to the creation of the final outcome of this thesis, as a more detailed description of the multi-level perspective analysis was possible. In this next section, a description of the final solutions will be provided.

Picture 15| Source: Own picture

8. Conceptualization

Introduction

The following section will present the outcome of this study so far. Now that the literature review, interviews, workshops, and analysis are over, the foundation for the next step of conceptualizing has been made. Here a translation of the ideas developed and exchanged by the participants at the second workshop, will reveal itself as the final concept of this thesis. A detailed description of how to approach it has been made in combination with the value possessed in the concept.

8.1. Creating a concept

Based on the interviews and the first workshop, it had become clear, that the need for better communication and facilitation during a new sustainable mobility project in rural areas is there. Such a solution should help in deciding who owns the problem and who owns the solutions. In order to begin the development of such a solution, a second workshop was established, where a map of all the current relevant actors in the field was placed including their internal relationships. With this map and the statements from the interviews and the first workshop. The need of including actors from across the field had been presented. By doing so, the foundation for designing a facilitation tool had been made. The creation of such a tool, would be useful, as many new actors will need help to enter the field. Thereby providing them with better chances of implementing sustainable mobility solution in rural areas in the future.

8.2. The concept

The concept is called 'SyncWorks' (see figure 10-13). It is a facilitation tool, that will support the synchronization of actors working and collaborating across a field. In this case, it will help a project leader facilitate a project in mobility, by having workshops throughout the duration of the project. SyncWorks will support highlighting all the relevant actors and initiate the process of dividing responsibility and ensuring interdisciplinary. This will increasing the chances of value creation and successful implementation. The overall intention is to establish an early overview of a project and clarify the roles, to help avoid misunderstandings and miscommunication. The tool is divided into four steps, that will make sure that you identify and include all the relevant actors in your project. When using the tool, the participants will start out by locating and writing down all the relevant actors in the project in order to map them and locate troubled relationships. After this, they will find the right questions, to help sort the situation out. In the end, an overview of roles and intentions should be placed on the actors participating in the project. SyncWorks should be used throughout the timeline of a project, to make sure that the responsibility kept on the right actors and that the project is still set to create value. To help new practitioners facilitate SyncWorks a user guide has been developed (See page 28).

Picture 16 | Source: Own picture

1 Aktøroversigt

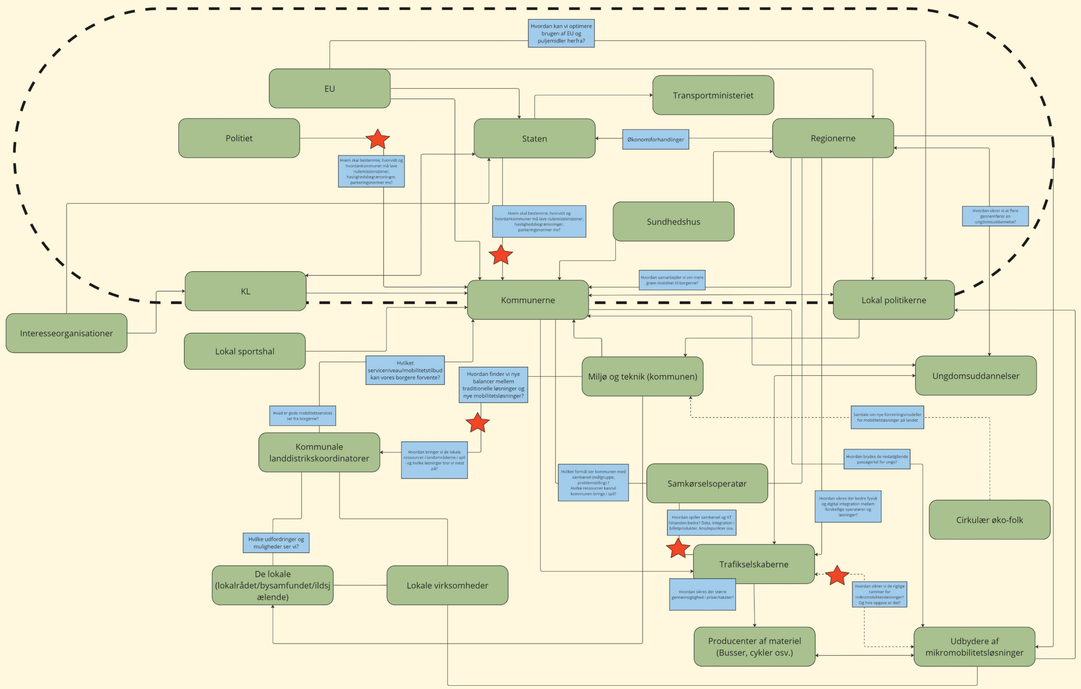
Relevante aktører for projektet

Hvem tager beslutninger i projektet?	Hvem bidrager eller har økonomisk gevinst?	Hvem har gavn af projektet?	Hvem har gener ved projektet?	Hvem har teknologiske løsningerne?	Andre aktører

SyncWorks

Figure 10 | Actor overview

2 Aktørkortet



SyncWorks

Figure 11 | Actor map

3 The Matrix

Navn table

	EU	Staten	Transportministeriet	Kommunerne	KL	Regionerne	Lokal politikerne	Interesseorganisationerne	Politiet	Sundhedshusene	Ungdomsuddannelserne	Miljø og teknik (kommunen)	Lokal sportshal/Fritid	Kommunale landistrikskoordinatorer	Samkørselsoperatør	Lokale virksomheder	De lokale (lokalråde/bysamfundet/ildsjælende)	Trafikselskaberne	Producenter af materiel (busser, cykler osv.)	Cirkulær øko-folk	Udbydere af mikromobilitet
EU							Hvordan kan vi optimere brugen af EU og puljemidler herfra?														
Staten				Hvem skal bestemme, hvorvidt og hvordankommuner må lave nulemissionszoner, hastighedsbegrænsninger, parkeringsnormer mv?		Økonomiforhandlinger														
Transportministeriet																					
Kommunerne		Hvem skal bestemme, hvorvidt og hvordankommuner må lave nulemissionszoner, hastighedsbegrænsninger, parkeringsnormer mv?				Hvordan samarbejder vi om mere grøn mobilitet til borgerne?			Hvem skal bestemme, hvorvidt og hvordankommuner må lave nulemissionszoner, hastighedsbegrænsninger, parkeringsnormer mv?					Hvilket serviceniveau/mobilitetstilbud kan vores borgere forvente? Hvad er gode mobilitetsservices set fra borgerne?	Hvilket formål ser kommunen med samkørsel (målgruppe, problemstilling) ? Hvilke ressourcer kan/vil kommunen bringe i spil?					Hvordan brydes de nedadgående passagertal for unge?
KL																					
Regionerne		Økonomiforhandlinger		Hvordan samarbejder vi om mere grøn mobilitet til borgerne?		Hvordan sikrer vi at flere gennemfører en ungdomsuddannelse ?					Hvordan sikrer vi at flere gennemfører en ungdomsuddannelse ?							Hvordan sikres der bedre fysisk og digital integration mellem forskellige operatører og løsninger?			
Lokal politikerne	Hvordan kan vi optimere brugen af EU og puljemidler herfra?																				
Interesseorganisationerne																					
Politiet				Hvem skal bestemme, hvorvidt og hvordankommuner må lave nulemissionszoner, hastighedsbegrænsninger, parkeringsnormer mv?																	
Sundhedshusene																					
Ungdomsuddannelserne						Hvordan sikrer vi at flere gennemfører en ungdomsuddannelse ?															
Miljø og teknik (kommunen)														Hvordan finder vi nye balancer mellem traditionelle løsninger og nye mobilitetsløsninger? Hvordan bringer vi de lokale ressourcer i landområderne i spil - og hvilke løsninger tror vi mest på?						Samtale om nye forretningsmodeller for mobilitetsløsninger på landet	
Lokal sportshal/Fritid																					
Kommunale landistrikskoordinatorer				Hvilket serviceniveau/mobilitetstilbud kan vores borgere forvente? Hvad er gode mobilitetsservices set fra borgerne?								Hvordan finder vi nye balancer mellem traditionelle løsninger og nye mobilitetsløsninger? Hvordan bringer vi de lokale ressourcer i landområderne i spil - og hvilke løsninger tror vi mest på?					Hvilke udfordringer og muligheder ser vi?				
Samkørselsoperatør				Hvilket formål ser kommunen med samkørsel (målgruppe, problemstilling) ? Hvilke ressourcer kan/vil kommunen bringe i spil?														Hvordan spiller samkørsel og KT hinanden bedre? Data, integration i billetprodukter, knudepunkter osv.			
Lokale virksomheder																					
De lokale (lokalråde/bysamfundet/ildsjælende)														Hvilke udfordringer og muligheder ser vi?							
Trafikselskaberne						Hvordan sikres der bedre fysisk og digital integration mellem forskellige operatører og løsninger?									Hvordan spiller samkørsel og KT hinanden bedre? Data, integration i billetprodukter, knudepunkter osv.						Hvordan sikrer vi de rigtige rammer for mikromobilitetsløsninger? Og hvis opgave er det?
Producenter af materiel (busser, cykler osv.)																					
Cirkulær øko-folk												Samtale om nye forretningsmodeller for mobilitetsløsninger på landet									
Udbydere af mikromobilitet				Hvordan brydes de nedadgående passagertal for unge?														Hvordan sikrer vi de rigtige rammer for mikromobilitetsløsninger? Og hvis opgave er det?			

SyncWorks

Figure 12 | The Matrix

4 Projektoversigten

Fokuspunkter i projektet

Hvem ejer projektet?	
Hvem ejer problemet?	
Hvem står for borgerinvolvering?	
Hvilke aktører skal løbende inddrages?	
Hvilke aktører skal orienteres?	
Hvad er strategien for at undgå manglende relationer?	
Hvad er strategien for at undgå problemfyldte relationer?	
Andet	

SyncWorks

Figure 13 | The project overview

8.2.1 User guide

Preparing for the workshop

Before using SyncWorks, every participant should come prepared, by having developed an idea of the scope of the project and arrive with an open mind, ready to find a compromise and new solutions.

The workshop in four steps

1. In the first step called 'Aktøroversigten' (The a-ctor-overview)(See figure 9), the idea is to locate and exchange every relevant actors from across the project. This should be done by beginning with a personal brainstorm, where participants at the workshop write down all the relevant actors. This will be followed by sharing those actors and going through the prefabricated questions written on the schedule to fill the table on 'Aktøroversigten'.

2. The second step is called 'Aktørkortet' (The actor map)(See figure 10). Here the participants will compare the listed actors from the first step, with the prefabricated map, to see where they fit in and to investigate which relationships, they should be aware of, in order to improve the overall communication across the project. Afterwards, the suggested questions between the actors should be exterminated, to investigate which questions to consider, as they might be useful for the specific project. These questions is also part of step 3.

3. In the third step, the questions presented in 'Aktørkortet' have been placed in 'The Matrix'(See figure 11), to ease the process of finding them. The point of The Matrix is to supplement 'Aktørkortet' and to have a place to write down new questions during a project.

4. In the fourth and last step, it comes together in 'projektoversigten' (The project overview)(See figure 12). Here the participants will have to agree on a number of central elements of the project. The goal is to have created an overview, of which can be shared with all participating in the project. This support by dividing responsibility.
When the workshop is repeated later in the project, some of the steps may just be checked to make sure that they still fit the project or skipped completely.

After the workshop

After the four steps have been completed, the facilitator has to sure that the result is being send to the relevant actors, and remember to include an invite for the next workshop, as communication and the roles should be maintained and established several times during a project, to help the process of working interdisciplinary.

Picture 17 | Source: Own picture

8.3. Applying the concept

Having defined and presented the final concept of SyncWorks, this next part, will look into how feasible the concept is among practitioners and what potential it posses.

The problem presented at the workshop was: "Who owns the problem?" and "who own the solution?". This is what SyncWorks tries to answer.

Based on the statement delivered during the interviews and the workshops. A tool for improving communication across the entire field of rural mobility was needed. SyncWorks is a facilitation tool, which will help to support the communication across the field of practitioners, users, politicians, and supporting business of sustainable rural mobility. This is one of the main reasons why SyncWorks posses a business potential, and posses a great potential of having market creation value. The idea is that one central actors, will be in charge of facilitating using SyncWorks and as this role is familiar at Movia, a tool like this would be valuable to use in current and future collaborations. It is however important to emphasize that the SyncWorks, is in it´s early stages of a concept. It will likely have to undergo several iterations, with redesign and attachments, before it will be fully functional and useful for practitioners. However, as it has been based on a significant amount of empirical data and support the outcome of the analytical work. It does as stated have the potential of adding value to the field of sustainable rural mobility.

Introduction

Now that the concept, developed in this project, has been presented, it is time to take a critical look at the overall processes, learning, and solutions that this project has provided. To do this, the project will be discussed based on the following subjects: Challenges associated with implementing sustainable mobility solutions in rural areas, how the literature review compares with the findings of this study, how the overall process of co-designing with stakeholders went, how being a sustainable design engineer fits into all of this, and what future research would be feasible to conduct. In general, the project will be evaluated on its ability and potential in creating changes away from the current dominant regime of private car ownership and towards a sustainable mobility system.

9. Discussion

9.1. Challanges in sustainable rural mobility

Working with sustainable mobility in rural areas is, just as Charlotte mentions in the interview (podcast: episode 1), a big challenge as the distance is working against you. One thing is the fact that roads, railway systems, and other infrastructure elements must be physically longer per capita, thereby increasing the resources needed. Another one is the amount of sparsely populated areas, which increasingly affects the challenges with social sustainability, especially among those who are not able to purchase or operate a car on their own. These socioeconomic factors have not been fully represented in this thesis, as only two interviews with people living in rural areas were conducted. They did however confirm the current need of having to own a car or being physically able to transport yourself by bike. If you wish to live and be mobile in most rural areas of Denmark.

The lack of representation of citizens in rural areas is justified by the knowledge delivered in the interviews by several of the practitioners, as they, on a regular basis interact with people living in rural areas. With the help of these practitioners, it can be concluded that there is a lack of communication and collaboration across the sector of rural mobility. This was a general statement among several experts in the interviews and the clearest outcome of the first workshop with participants from Movia.

Another outcome of the analysis is the effect, that changes in the dominant regime, towards electrified vehicles, have on the future of rural populations and the ability for niche developments to gain a foothold in the field. This is the case, as the dominant regime of private car ownership is trying to preserve business as usual. The subject that should be highlighted and discussed here, is the narrow political solution space and the will to support new and innovative niche solutions. The reason for this is shown in the analysis, as the government currently supports the dominant regime both directly and indirectly, thereby supporting technologies that fit into the regime of private car ownership, such as electric vehicles. This will furthermore undermine the chances of niche developments to survive. A direction, which will create less social sustainability in rural areas, as people outside the private car ownership regime will have worse mobility conditions.

9.2. Comparing literature and thesis

The literature review provided an in-depth understanding of the status of sustainable rural mobility on a global scale. For that reason, it is interesting to compare the outcome of the literature review with the results of this study. Statements from this study indicate in general, a smaller focus on the issues associated with social sustainability compared to the literature review. As the literature indicates that mobility projects in rural areas, often are linked to social sustainability. The reason for this difference could be the formulation of the questions delivered by me during the interviews or the fact that the actors who participated in the interviews see social sustainability as a natural part of the field and therefore no need to mention it. Aside from this misalignment, the literature on the field and this study show several similarities in the results. One similarity is the need for multi-modality in the solution space for future mobility. The literature review as well as statements from the interviews indicate the general agreement, that people have too many specific needs and behavioral patterns for one solution. To meet this multi-modal future, a reconstruction of the transportation companies, such as Movia, might be needed. As they will have to include or collaborate with mobility companies as part of their business plan.

With the facilitation tool developed, this study has the potential for becoming part of the toolkit for practitioners, as it can help generate an overview of the actors across the field, as well as understand the relationships between them. Furthermore, a list of questions will be provided, that can be used as a base layer for facilitating and starting a new project. This would overall support collaborations and thereby strengthen the transition towards sustainable mobility in rural areas. The hope for the tool is that all these features will be useful for experienced practitioners as well as new ones. A hope that requires further research and development, as the tool has yet to be tested in real-life scenarios. In the previous section (Conceptualization) It can be seen how the tool will function and how to use it. What has yet to be discovered, is whether or not it will support the work or just mislead future practitioners, as some stakeholders will be forgotten in the process, due to them not being represented in the tool by now.

9.3. Co-design with stakeholders

The process of co-designing has been very fruitful throughout this study, as it helped in creating a more comprehensive design process and addressing a broader range of sustainability challenges and solutions by engaging experts from across the field and having them collaborate. The engaged group of stakeholders involved primarily experts who have a vested interest in the field through their work or the people that they represent. Stakeholders who are directly affected by new mobility solutions, such as end users were only represented in the interviews and decision makers such as politicians were not represented at all. This indicates a misrepresentation in the co-design process and should be addressed in future studies. This is important as having them participate in the design process ensures that the design solutions meet their needs, preferences, and values.

During the two workshops, the participating stakeholders managed to go through several iterations and build upon ideas that had been shared across the table. This helped to strengthen the outcome of the workshops. In the first workshop, the participants clarified the most urgent problem at the moment, a process that was only possible due to co-design and the use of scenarios. In the second workshop, the co-design process was online and happened across the Miro-board, this removed some of the discussions across the table, which were present at the first workshop, but it made it possible to facilitate a process, where all the participants could work on the same material at the same time. This helped them to be inspired by suggestions and solutions developed by each other. Furthermore, it ensured that they all were able to interfere with the developed material. This interference was facilitated during the workshop, as all ideas were presented and verified by all participating stakeholders. All of the participants took an active part in both of the workshops, indicating an environment that allowed for interference. This helped the process as the representation was as big as possible increasing the chances of having needs, preferences and values represented and that the design result is not only technically but also socially, economically, and environmentally feasible.

Picture 18 | Source: Own picture

9.4. Sustainable Design Engineering

Using the sustainable design engineering approach has meant that this thesis has been developed using three different perspectives. Those are sustainability, socio-technical, and interdisciplinary. From the sustainability perspective, a holistic approach has been applied, as sustainability is far more than the emissions developed by vehicles. This is the reason why this study has been developed with an eye toward the SDGs, with a specific focus on (8, 9, 10, 11 and 13). These helps to ensure that the focus on sustainability is being put in the front where it can have an effect. The second perspective applied is to focus on including and involving the actors. It shows as the actors are being included in a Co-design process. A more general approach to involving the actors has been to approach the project from a socio-technical angle, as technology cannot be standing alone and should be studied with the people who are going to develop, need and use it. The last perspective is linked to the actors as well. When developing new innovative solutions in wicked problem areas, such as sustainable rural mobility, an interdisciplinary mindset, and workspace are needed. It has been deployed, to develop valuable and beneficial solutions for practitioners working in mobility, as it too has been needed to investigate and locate the areas that are in need of innovation as well as contribute to the development of the solution.

On the other hand, it is worth discussing how generalising the outcome of this project is.

The facilitation tool generated has been heavily influenced by the conducted interviews and the two workshops. In other words, a quite local section of the field, especially considering that most of the actors involved in the study are familiar with each other, as they often participate in the same seminars and meetings. This increases the risk of misrepresenting neglected stakeholders, who rarely are invited to participate in development projects like this one. However, as general knowledge has been drawn into the study through the literature review, it can still, to some extent, be considered applicable for sustainable design engineers, employees at Movia, as well as practitioners within the field of rural mobility in general.

Throughout this thesis, different outcomes and decisions have led to limitations and biases. These have influenced the study and they will be presented here.

A limitation has been the absent representation of some actors across the field of rural mobility. An attempt was made to contact a wide range of stakeholders, in the hope of having a representation of relevant actors, who either work with or uses different types of transportation. As several of these actors never responded, a narrower representation of opinions, challenges, and solutions was present. This was especially the case for actors from the dominant regime of private car ownership and political decision-makers. On the other hand, this resulted in more time to go in-depth with the actors who participated.

A bias to consider is the relationship between me as a researcher and the collaboration with Movia throughout this thesis. I have collaborated with Movia in the last year, as I did my internship with them in the fall of 2022. This has led to several personal connections between me and some of the participants attending the workshops. This may have influenced the statements and the overall results. On the other hand, this ensured that I had a better understanding and access to knowledge and practitioners in the field, which would have been time-consuming to gain.

As a sustainable design engineering student, my wish was to create and share as much new academic research and knowledge as possible. To do so, the interactions with participants in interviews and workshops were recorded and presented as empirical data in a series of podcast episodes. This was done to strengthen the knowledge on this subject through a new media and enable a wider audience to listen. However, this has affected the scale of this project as editing is time-consuming, and the thesis was restrained by the time available within one semester. Despite this, the thesis is contributing to the field of sustainable design engineering, and the choice of using podcasts as one of the media for publishing has been beneficial to the field, as a new and wider audience will be able to study it.

9.5. Future research

As a result of the limitations presented in the last section, not all ideas were researched in this study. These ideas will be presented in the following.

It should be considered to investigate the implementation of the developed facilitation tool. In doing so the following questions would be relevant to investigate:

How do you teach practitioners to use it?

Is it useful for them?

How will they use it in their daily work?

What improvements are needed to increase its effectiveness?

How can the use of such a tool be adapted for use in other sectors or geographical locations?

Studying these questions could be done in collaboration with Movia again or another traffic company and thereby investigate the level of influence Movia has had on this project. In doing such a study, a great effort on inviting new stakeholders should be done. These should include actors from the dominant regime of private car ownership, citizens such as end-users, and political actors, from both local municipalities to regional and national councils.

Another area for future research studies is to investigate the connections between the landscape and the niche level. As Geels (2002) argues that transitions happen when landscape levels and niche developments interact. The need for this study is supported by the developed facilitation tool, as it indicates that there currently exist few connections between the two levels. These would include studying areas such as the EU and the Danish government, besides the focus on sustainable development. There is an incongruence in the expected level of mobility service between the citizens living in rural areas, the practitioners delivering the service, and the actual service level, as Lars Wiinblad mentions in episode 1 of the podcast, which would be interesting to investigate further as well.

This thesis has had some limitations, which have resulted in various deselections. However, this study has provided some fruitful insights and a new tool to approach the future of wicked mobility problems. Conducting the suggested research would further strengthen the connection and understanding between sustainable rural mobility and the research field of sustainable design engineering.

10. Conclusion

This thesis represents a deep dive, into the wicked field of sustainable mobility in rural areas. The aim was to support the growing field of mobility developers including Movia, in strengthening the process of establishing new sustainable solutions in rural areas of Denmark.This has been done using the approaches, academic methods, and knowledge provided through the studies of sustainable design engineering. Based on this aim the following research question was defined:

"How can the use of co-design strengthen the future implementation of sustainable mobility solutions in rural areas of Denmark?".

To answer this question, the theoretical basis of the multi-level perspective has been applied. These theoretical glasses have been used to identify some of the barriers that currently hinder the development of new and sustainable mobility solutions. These solutions have applied a more holistic angle to the status quo. Combining this and the knowledge gained in the literature review, interviews, and the two workshops has led to the development of a facilitation tool. This tool can support practitioners, such as people working at Movia, in implementing and anchoring future mobility solutions. Doing so is a challenging task, as the dominant regime of private car ownership is strongly institutionalized, as life with a private car is considered to be necessary for everyday life. This viewpoint should be challenged and changed, as we have a growing population and issues with sustainability such as climate change. Through the process of co-design, the engagement of actors from across the field was created, allowing for the initial steps towards the development of the facilitation tool SyncWorks. A tool that is needed in the field, as Sustainable mobility solutions in Denmark is beginning to have political support and are set to become a bigger part of rural areas. It can therefore be concluded, that a contribution to the process of engaging and having to prepare new practitioners for establishing new well-integrated solutions are needed. And that this study have contributed to this development, by supporting the future of sustainable mobility and challenging the dominant regime of private car ownership.

Picture 19 | Source: Own picture

11. References

Aftale om 520 millioner kroner til fremme af cyklisme på plads. (n.d.). Retrieved May 28, 2023, from https://www.trm.dk/nyheder/2021/aftale-om-520-millioner-kroner-til-fremme-af-cyklisme-paa-plads

Akyol, A., Halberstadt, J., Hebig, K., Jelschen, J., Winter, A., Sandau, A., & Gómez, J. M. (2017). Flexible software support for mobility services. Lecture Notes in Informatics (LNI), Proceedings - Series of the Gesellschaft Fur Informatik (GI), 275, 2027–2038. https://doi.org/10.18420/IN2017_203

Analyse om fremme af samkørsel : en national, tværgående rapport om samkørsel. (2022). Trafikministeriet.

Ansvar for Danmark Det politiske grundlag for Danmarks regering. (n.d.).

Antallet af ladestandere vokser fortsat på tværs af landet. (n.d.). Retrieved May 28, 2023, from https://www.trm.dk/nyheder/2022/antallet-af-ladestandere-vokser-fortsat-paa-tvaers-af-landet

Ayres, L. (2008). Semi-structured interview. The SAGE Encyclopediaof Qualitative Research Methods.

B.-N. Sanders, E., & Jan Stappers, P. (n.d.). Co-creation and the new landscapes of design. Retrieved April 26, 2023, from https://www-tandfonline-com.zorac.aub.aau.dk/doi/epdf/10.1080/15710880701875068?needAccess=true&role=button

Bartle, C., & Chatterjee, K. (2019). Employer perceptions of the business benefits of sustainable transport: A case study of peri-urban employment areas in South West England. Transportation Research Part A: Policy and Practice, 126, 297–313. https://doi.org/10.1016/J.TRA.2019.04.012

Bauchinger, L., Reichenberger, A., Goodwin-Hawkins, B., Kobal, J., Hrabar, M., & Oedl-Wieser, T. (2021). Developing sustainable and flexible rural-urban connectivity through complementary mobility services. Sustainability (Switzerland), 13(3), 1–23. https://doi.org/10.3390/su13031280

Bøggild, A., Liberoth, K., Lindberg, M., Lindhardtsen, L., Sørensen, K.,

Meilstrup, P., . . . Wils, A. (2012). Der bli'r et yndigt land: Scenarier for danmarks grønne fremtid. København: MandagMorgen Og Realdania

Caroll, P., Benevenuto, R., Caulfield, B. (2021), Identifying hotspots of transport disadvantage and car dependency in rural Ireland, Volume 101, Pages 46 - 56

Ciesla, M., Oberascher, V., Eder, S., Kirchweger, S., Baaske, W. E., & Ostermayer, G. (2022). Low-emission Commuting with Micro Public Transport: Investigation of Travel Times and CO2 Emissions. International Conference on Vehicle Technology and Intelligent Transport Systems, VEHITS - Proceedings, 143–151. https://doi.org/10.5220/0011103500003191

Commission on Environment, W. (n.d.). Report of the World Commission on Environment and Development: Our Common Future Towards Sustainable Development 2. Part II. Common Challenges Population and Human Resources 4.

Costanza, R., Daly, L., Fioramonti, L., Giovannini, E., Kubiszewski, I., Mortensen, L. F., Pickett, K. E., Ragnarsdottir, K. V., De Vogli, R., & Wilkinson, R. (2016). Modelling and measuring sustainable wellbeing in connection with the UN Sustainable Development Goals. Ecological Economics, 130, 350–355. https://doi.org/10.1016/J.ECOLECON.2016.07.009

Dansk klimapolitik | Energistyrelsen. (n.d.). Retrieved May 28, 2023, from https://ens.dk/ansvarsomraader/energi-klimapolitik/fakta-om-dansk-energi-klimapolitik/dansk-klimapolitik

Danskerne har brug for bilen i hverdagen | FDM. (n.d.). Retrieved May 28, 2023, from https://fdm.dk/node/9003

David Bergman. (2013). Sustainable Design: A Critical Guide.. Princeton Architectural Press.

DK2020. (n.d.). Retrieved May 28, 2023, from https://www.kl.dk/kommunale-opgaver/klima/dk2020/

Elbiler stormer frem i Danmark: - Det er bare toppen af isbjerget - TV 2. (n.d.). Retrieved May 28, 2023, from https://nyheder.tv2.dk/samfund/2023-03-01-elbiler-stormer-frem-i-danmark-det-er-bare-toppen-af-isbjerget

Farrington, J. H. (2007). The new narrative of accessibility: its potential contribution to discourses in (transport) geography. Journal of Transport Geography, 15(5), 319–330. https://doi.org/10.1016/J.JTRANGEO.2006.11.007

Federal Ministry of Transport and Digital Infrastructure (2018), “Sicherung von Versorgung und Mobilität: Strategien und Praxisbeispiele für gleichwertige Lebensverhältnisse in ländlichen Räumen” [Securing supply and mobility: Strategies and practical examples for equal living conditions in rural areas], final project report, Germany, https://www.bmvi.de/SharedDocs/DE/Publikationen/G/abschlussberichtversorgung-mobilitaet-laendlicher-raum.pdf?__blob=publicationFile.

Flipo, A., Sallustio, M., Ortar, N., & Senil, N. (2021). Sustainable mobility and the institutional lock-in: The example of rural France. Sustainability (Switzerland), 13(4), 1–21. https://doi.org/10.3390/su13042189

Fordeling af tankstationer - på selskaber - Drivkraft Danmark. (n.d.). Retrieved May 28, 2023, from https://www.drivkraftdanmark.dk/viden/fordeling-af-tankstationer-2/

Fuenfschilling, L., & Truffer, B. (2014). The structuration of socio-technical regimes - Conceptual foundations from institutional theory. Research Policy, 43(4), 772–791. https://doi.org/10.1016/j.respol.2013.10.010

Fujisaki, K., Yasuda, T., Ishigami, T., Makimura, K., & Ishida, H. (2022). Empirical recommendations based on case studies in Japan for sustainable innovative mobility in rural areas. Asian Transport Studies, 8. https://doi.org/10.1016/j.eastsj.2022.100079

Gaziulusoy, Ï., & Öztekin, E. E. (2019). Design for sustainability transitions: Origins, attitudes and future directions. Sustainability (Switzerland), 11(13). https://doi.org/10.3390/su11133601

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. Research Policy, 31(8–9), 1257–1274. https://doi.org/10.1016/S0048-7333(02)00062-8

Hart, C. (1998). Hart, Chris, Doing a Literature Review: Releasing the Social Science Research Imagination. London: Sage, 1998. CIRS: Curriculum Inquiry and Related Studies from Educational Research: A Searchable Bibliography of Selected Studies. https://stars.library.ucf.edu/cirs/3111

Henderson, J. (2020). EVs Are Not the Answer: A Mobility Justice Critique of Electric Vehicle Transitions. Annals of the American Association of

Geographers, 110(6). https://doi.org/10.1080/24694452.2020.1744422

Hendrickson, C., M. Muro and W. Galston (2018), "Countering the geography of discontent: Strategies for left-behind places", www.brookings.edu/research/countering-the-geography-of-discontentstrategies-for-left-behind-places/

Iammarino, S., A. Rodriguez-Pose and M. Storper (2019), "Regional inequality in Europe: Evidence, theory and policy implications", Journal of Economic Geography, Vol. 19(2), pp. 273-298, http://dx.doi.org/10.1093/jeg/lby021.

Klintefelt, A. M. E. (n.d.). Befolkningsfremskrivning. Retrieved from https://www.dst.dk/da/Statistik/emner/befolkning-ogvalg/befolkning-ogbefolkningsfremskrivning/befolkningsfremskrivning

Knierim, L., & Schlüter, J. C. (2021). The attitude of potentially less mobile people towards demand responsive transport in a rural area in central Germany. Journal of Transport Geography, 96, 103202. https://doi.org/10.1016/J.JTRANGEO.2021.103202

Kristensen, I., T., Kjeldsen, C., and Dalgaard, T. (2007). "Landdistriktskommuner - Indikatorer for Landdistrikt." Danmarks Jordbrugsforskning (December 2006):1–17.

Kuhlman, T., & Farrington, J. (2010). What is sustainability? In Sustainability (Vol. 2, Issue 11, pp. 3436–3448). MDPI. https://doi.org/10.3390/su2113436

Kühn, M. (2015), "Peripheralization: Theoretical Concepts Explaining Socio-Spatial Inequalities", European Planning Studies, Vol. 23(2), pp. 367-378.

Kwiatkowski, M. A. (2021). Metropolitan bicycle-sharing system in the Polish context of various needs of cities, towns, and villages. Bulletin of Geography. Socio-Economic Series, 54(54), 97–111. https://doi.org/10.2478/bog-2021-0036

Lekakou, M., G. Remoundos and E. Stefanidaki (2021), "Applying the Island Transport Equivalent to the Greek Islands", International Transport Forum Discussion Papers, No. 2021/02, OECD Publishing, Paris, https://doi.org/10.1787/d6f3db6b-en.

Malnaca, K., & Budilovich, E. (2022). Demand and Supply of Public Transport Services in Sparsely Populated Rural Areas. 410, 363–370.

Maretić, B., & Abramović, B. (2020). Integrated Passenger Transport System in Rural Areas – A Literature Review. 32, 863–873.

Ministry of Land, I. T. and T. (2018). White Paper on Land, Infrastructure, Transport and Tourism. www.mlit.go.jp/hakusyo/mlit/h29/hakusho/h30/index.html

Movia som virksomhed | Movia. (n.d.). Retrieved May 31, 2023, from https://www.moviatrafik.dk/om-os/vores-virksomhed/

München Hbf | Chronotrains. (n.d.) https://www.chronotrains.com/da/station/8000261-Munchen-Hbf

Nelson, J. D., & Caulfield, B. (2022). Implications of COVID-19 for future travel behaviour in the rural periphery. European Transport Research Review, 14(1). https://doi.org/10.1186/s12544-022-00547-0

Ny analyse: Antallet af unge styrtdykker - især i yderområderne | SMVdanmark. (n.d.). Retrieved May 27, 2023, from https://via.ritzau.dk/pressemeddelelse/ny-analyse-antallet-af-unge-styrtdykker---isaer-i-yderomraderne?publisherId=13559667&releaseId=13623107

Ny statusrapport: Mangel på biler gør ondt, men stigende omsætning og grønt bilsalg løfter branchen - AutoBranchen Danmark. (n.d.). Retrieved May 28, 2023, from https://autobranchendanmark.dk/ny-statusrapport-mangel-paa-biler-goer-ondt-men-stigende-omsaetning-og-groent-bilsalg-loefter-branchen/

NYT: 69 pct. af dagens biler kører stadig i 2030 - Danmarks Statistik. (n.d.). Retrieved May 28, 2023, from https://www.dst.dk/da/Statistik/nyheder-analyser-publ/nyt/NytHtml?cid=45187

Plazier, P. (2022). E-bikes in rural areas: current and potential users in the Netherlands. Transportation. https://doi.org/10.1007/s11116-022-10283-y

Poltimäe, H., Rehema, M., Raun, J., & Poom, A. (2022). In search of sustainable and inclusive mobility solutions for rural areas. In European Transport Research Review (Vol. 14, Issue 1). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1186/s12544-022-00536-3

Projektoversigt. (n.d.).

Psarra, F., Piccoli, A., Karachaliou, E., Trendafili, K., Spyridopoulos, K., Masson, B., Frangulea, C., Hohenwarter, M., Streit, G., Karaberi, C., Raptis, O., & Laranjeira, C. (2021). Sustainable Shared Mobility Interconnected with Public Transport in European Rural Areas.

Pulje på 250 millioner kroner skal styrke den grønne kollektive trafik. (n.d.). Retrieved May 28, 2023, from https://www.trm.dk/nyheder/2022/pulje-paa-250-millioner-kroner-skal-styrke-den-groenne-kollektive-trafik

Redegørelse om Danmarks Digitale Vaekst. (2023).

Salg af nye biler. (n.d.). Retrieved May 28, 2023, from https://www.vejdirektoratet.dk/side/salg-af-nye-biler

Søndergaard Møller Michael Berg Rasmussen, F., Michael Berg Rasmussen, A., & Søndergaard Møller og Søren Dalbro, F. (n.d.). Har adgang til offentlig transport betydning for, om man har bil?

Šoštaric, M., Ševrovic, M., Jakovljevic, M., & Švajda, M. (2022). Sustainability of public transport in rural areas - Case study city of Jastrebarsko. Transportation Research Procedia, 64(C), 372–377. https://doi.org/10.1016/J.TRPRO.2022.09.044

Statistics Denmark (n.d.), "Statistical presentation", Statistics Denmark, Copenhagen, https://www.dst.dk/da/Statistik/dokumentation/statistikdokumentation/byopgoerelsen/indhold

Statistics Finland (n.d.), "Concepts: Urban-rural", www.stat.fi/meta/kas/kaupunki_maaseu_en.html

Sustainable Development Goals | United Nations Development Programme. (n.d.). Retrieved May 30, 2023, from https://www.undp.org/sustainable-development-goals?gclid=Cj0KCQjw98ujBhCgARIsAD7QeAhCQijqGVZ2f6787Ox0e0e_RWiaJ04DiQWC0ZrCvyoCZ01uxzv0EKoaAr6oEALw_wcB

Thagaard, T. (2007). Systematik og indlevelse : en indføring i kvalitativ metode (1. udgave). Akademisk Forlag.

Transport Forum, I. (n.d.). Innovations for Better Rural Mobility. www.itf-oecd.org

Unfccc. (n.d.). ADOPTION OF THE PARIS AGREEMENT - Paris Agreement text English.

United Nations. Department of Economic and Social Affairs. (n.d.). Reconsidering rural development : World Social Report 2021.

Verma, I., & Taegen, J. (2019). Access to services in rural areas from the point of view of older population—a case study in Finland. International Journal of Environmental Research and Public Health, 16(23). https://doi.org/10.3390/ijerph16234854

Wellbrock, W., Ludin, D., Högele, B., & Müller, E. (2021). The Importance of Green Commuting: A Campus Case Study in Schwäbisch Hall as Contribution to Responsible Urbanism. Advances in Science, Technology and Innovation, 85–95. https://doi.org/10.1007/978-3-030-63567-1_8/FIGURES/6