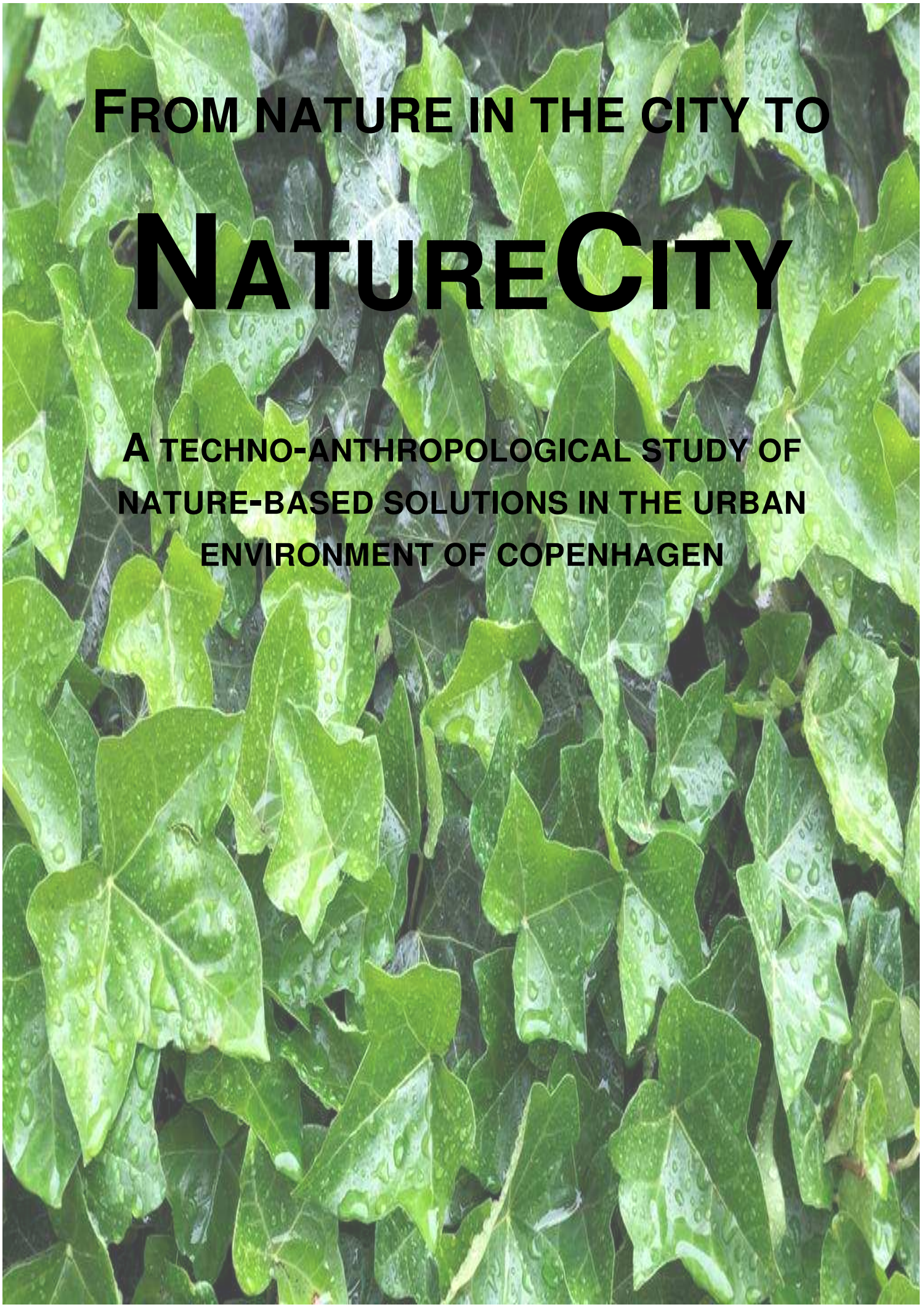

FROM NATURE IN THE CITY TO

NATURECITY

A TECHNO-ANTHROPOLOGICAL STUDY OF NATURE-BASED SOLUTIONS IN THE URBAN ENVIRONMENT OF COPENHAGEN

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ABSTRACT

This thesis examine the use of nature-based solutions in the city environment of Copenhagen, and how it can contribute to a sustainable transition. This will be done through a case study surrounding facade plants, and in close collaboration with Miljøpunkt A21 Inner city - Christianshavn. We are examining how we as techno-anthropologists can use the tool provided by our study to contribute to the field in which we immerse ourselves in.

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Summary

Denne opgave er et tekno-antropologisk studie af facadeplanter som et teknologisk løsningsforslag i Københavns streben for bæredygtighed. specialet er udarbejdet på baggrund af diverse interviews og litteratur research. Vi belyser mange af de fordele facadeplanter indebærer, både set fra et miljømæssigt perspektiv, men også i forhold til det faktum, at det er en løsning der gennem dens vertikale udformning, kan være en del af at lette det stigende pres der er at finde i Københavns gader. Københavns gader, bliver i denne opgave belyst som de horisontale flader. Vi giver gennem brugen af STS tilgangen Large Technical Systems et bud på hvorfor det kan være svært at implementere nye løsninger i Københavns by miljø.

ANT bliver derefter benyttet som et epistemologisk værktøj til at beskrive det felt vi har indgået i, samt skabe forståelse for hvorfor og hvordan aktører skaber nye relationer, samt give en ide om hvad der skal til for at skabe ændringer i netværket.
Vi argumenterer for, hvordan et paradigmeskift i den kontekst kan være behjælpelig. Med dette menes der at man skal gå væk fra tankegangen om at natur kun skal eksistere i bestemte afgrænsede områder såsom parker. De skal i højere grad indtænkes som en del af byens anlæg. På denne måde bliver naturen en mere integreret del af byens opbygning, og man sikre sig at naturbaserede løsninger såsom facade planter får ånderum til at “blomstre” i et system hvor der allerede er kamp om pladsen.

Vi vil igennem en revurdering af Miljøpunktets katalog belyse hvordan man igennem brugen af scripts såsom MIljøpunktets katalog, kan enrole og mobilisere nye aktører og derved gør det “nemmere” at skabe et succefuld facadeplante. derudover kommer vi også med et forslag til hvordan transition management kan bruges til formålet at mobilisere potentielt vigtige aktører.

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Introduction

On 25 September 2015, the world leaders adopted an unprecedented ambitious and transformative development agenda at the UN summit in New York (UN, 2019, A). This agenda will until 2030 set a course towards a more sustainable developed world for humans, but also for our planet as we know it today. The agenda constitutes 17 global goals, which all commit UN's 193 members to abolish global issues like poverty and starvation and focuses on improving topics like education, peace and environmental sustainable developments. The 17 sustainable development goals of the 2030 Agenda for Sustainable Developments came into force on 1 January 2016 (Project Everyone, 2019, A). The agenda acknowledges that social, economic, environmental developments and international corporation are closely linked in the vision of achieving sustainable developments. The 17 global goals for sustainable development is an extension of the eight *"2015-goals"*. The 2015-goals have proven that if the political willpower is present it is possible to reach the desired results (UNDP, 2019). The global goals are not legally binding and governments are expected to take ownership and responsibility of the establishment of the national policy framework, which strives to achieve the 17 goals (UN, 2019, B).

The 17 global goals each have their own specific field of interest, which they aim to target with different guidelines though they are free for interpretation, by each nation and organization.

Global goal number 11 states that more than half of the world's population have migrated to urban environments (UN, 2019, C). The prognosis is that by 2050, 6.5 billion people equivalent to two-thirds of the world's population will live in an urban environment. In the city of Copenhagen the average population have since 2008 increased from 1,645,822 to 1,835,562 people (Danmarks statistik, 2019). This is more than a 20 % increase within the last 12 years, which makes Copenhagen the second fastest growing city in Denmark (Københavens Kommune, 2018, A). One of the reasons for this is that there is a higher rate in births than there is in deaths and that migration from smaller towns outside of Copenhagen has increased and that younger people are migrating to Copenhagen, both from other cities outside of Copenhagen and from cities outside of Denmark (ibid.). The increasing number of citizens in Copenhagen, leads to the fact that there is less space for

the individual citizen. Copenhagen is the city in Denmark with least square meter available per citizen, here the average citizen has 40 square meters. The increasing migration to Copenhagen have had the effect that the municipality of Copenhagen from 2007-2016 have built more than 2,000 urban housing situations (Københavens Kommune, 2018, A).

If we do not change the way that we build and handle our urban spaces we will not be able to reach some of the sustainable developments the 17 global goals thrive for (Project Everyone, 2019, A). Goal number 11 *"Sustainable cities and communities"* are divided into 10 sub-targets. One of the targets in goal number 11 is found in *section 11.3* (ibid). This section states that the development of the city has to be more inclusive and sustainable. Due to urbanization city planners argues that it is important to integrate capacity for citizens to participate in human settlement planning (ibid). In *section 11.6* (ibid) it is stated that before 2030 negative environmental impact like air pollution has to be reduced. The section of 11.7 (ibid) states that by 2030 cities have to provide access to safe and inclusive green spaces. Another goal focus around sustainable solutions is global goal number 9. Global goal number 9 *"Industry, innovation and infrastructure"* focuses on building sustainable infrastructure and industrial solutions in order to support both economic development and human well-being (Project Everyone, 2019, B). When global goal 9 is mentioned in this project it will more specifically refer to sub-target 9.1 *"Develop sustainable, resilient and inclusive infrastructures"* as this target concerns the development of sustainable and resilient infrastructure (ibid).

Copenhagen Municipality Technical and Environmental department published the agenda strategy *"Bæredygtige sammenhæng, Agenda 21-strategi for 2016-2019"* (Københavns Kommune, 2016, B). This agenda 21-strategy is written by Morten Kabell who at this time was the Mayor of Copenhagen Municipality's Technical and Environmental department. The Agenda 21-strategy is Copenhagen Municipality's suggestion to implementing and facilitate nature-based solutions inspired from the 17 global goals. The agenda 21-strategy seeks to facilitate environmental work, along with a host of other sustainable initiatives. The agenda 21-strategy wishes to create a better and healthier life for people who live, work, travel and operate within the cityscape of Copenhagen (ibid). It suggests that one of the ways to do this would be by creating more nature in the city. Beside the health benefits of nature in the city it will make Copenhagen and the citizens within better prepared for some of the future climate changes the world is facing today (ibid).

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The vision and mission of both the 17 global goals and Copenhagen's Agenda 21-strategy is partly to be a part of solving some of the issues the environmental changes are causing to humans and partly some of the issues human and urbanization is causing to the environment. The goal is that the changes are sustainable developments both in the aspect of general climate changes, but also in the aspect of human health and well-being.
Over 30 years of research have shown that urban nature-based solutions have a positive effect on humans physical, physiological and social well-being and at a very low economic cost (Shanahan, et al., 2015). Urban nature has proven to overcome issues such as air pollution in densely packed cities, and that "green pathways" motivates citizens to use the city as their gym and thereby prevent lifestyle related diseases, like obesity and diabetes. These health related issues are proven to be worsen be the environmental issues that the world is facing, especially in urban environments. Exposure to green spaces have a restorative effects and reduce the symptoms a person with stress experiences (ibid). This could be beneficial since 25% of the citizens in Copenhagen have used their health insurance in relation to stress or the symptoms that follows (Frederiksen, 2018). Beside the health aspect of urban nature it also enhances the city's biodiversity and environmental sustainability (Shanahan, et al., 2015). Research like the above mentioned points to the fact that sustainable nature-based solutions in an increasingly growing city like Copenhagen is something that could beneficial for the environment and the citizens.

Organisations like *Miljøpunkt København, Agenda 21 - for bæredygtig sammenhæng. Indre by Christianshavn* are working with facilitating, initiating and planning sustainable nature-based solutions in Copenhagen. Their work focuses on 9 of the 17 global goals for sustainable developments (Miljøpunkt, 2018, A). Miljøpunktets (MP) work is based on an annual plan valid for a 2-year period (Miljøpunkt, 2019, B). In MP's annual plan one will find five projects each of which is put in the context of one or more of the global goals. The third project in the annual plan is *"Grøn By, klimatilpasning og bæredygtighed"* (ibid.). This project concerns sustainable nature-based solutions in Copenhagen and is put into context of the global goals number 11, 12, 13, 15 and 17. All the benefits of nature-based solutions like the reduction of noise, stress, pollution, heat etc. in Copenhagen, is stated and argued for. Beside this trees, green roofs and facade plants are suggested as a sustainable nature-based solution to solve these issues at a rather low cost. In specific the topic of facade plants as a sustainable nature-based solution in Copenhagen is interesting, since it as a nature-based solution do not put Copenhagen's already occupied horizontal spaces under further pressure, since facade plants are a vertical solution.

Sustainable nature based solutions are of great importance since the modern metropolis is under pressure and a wide range of different urban environmental issues are being faced. According to an article from 2014 *air pollution* has been the cause of premature death of more than 300-500 citizens in Copenhagen each year (Hjersing, 2014). A more recent article paints an even more bleak picture of reality since it states that the number of premature deaths are close to twice as high as previously determined and in average causes the citizen to lose an estimated 2.2 years of their life expectancy (Aagaard, 2019). Air pollution is not the only sinner in the city and issues like stress is becoming an epidemic in the large cities, as it have been shown that the citizens living in an urban environment have more activity in the areas of the brain connected to stress (Kennedy and Adolphes, 2011). Increasing global temperatures can besides create general discomfort, which can lead to heat strokes also exacerbate problems of air pollution, since more energy have to be produced to cool of residents in order to compensate for the increased heat (Miljøpunkt, 2019, C). These harsh realities is what has lead us to the following research questions:

Research question

A critical questioning about how a nature-based solution like facade plants, can contribute as a sustainable development, by solving some of the environmental issues the city of Copenhagen is facing.

The aim of this thesis is to *1.)* understand the complexity of the socio-technical system that nature-based solutions like facade plants have to be a part of and why the implementation of nature based solutions is complex. Through the understanding of the nature-based solution's socio-technical system, we will *2.)* examine what key actors have to do with a nature-based solution like facade plants, in order to facilitate and sustain it as a nature-based solutions in Copenhagen. *3.)* Investigate how we as researchers can contribute to the process of developing nature-based solutions, through the use of scripts and transition management.

We find the field of facade plants interesting due to the fact that we see it as an untapped resource in the perspective that Copenhagen has an increasing number of citizens. Scientific research has proven that facade plants have various positive properties in terms of improving air quality, reduce stress and the symptoms here of and lowering the rising temperatures in cities. It is also a resource that can be established at a very low cost, but with many benefits.

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As techno-anthropologists we see, analyse and understand the world is comprised of various socio-technical systems. We believe that the world is composed by human and non-human actors both with their own agency, behaviour, visions and goals. And that these create the possibility for us working within the field of science, technology and society (STS).

Our techno-anthropological background gives us the tools to understand and work with socio-technical systems. By using the theoretical framework of Actor Network Theory (ANT) and Large Technical Systems (LTS) we can gain insight and the ability to analyse some of the technological processes and networks surrounding nature-based solutions in Copenhagen, in specific facade plants. Our project examines micro, meso and macro levels of interests, since these are highly linked to each other. As opposed to traditional anthropology we are seeking to describe practices and social dynamics this project has a clear aim to ask a critical questions concerning the process of becoming sustainable nature-based solutions in an urban environment. The traditional anthropology ethnographic approach is usually being described as being the *"fly on the wall"* approach , as the goal of the ethnographer is to have little to no impact on the field in which they operate.

Reading guide

The aim with our reading guide is to give the reader an understanding of the thesis structure, as well as an introduction to our theoretical choices and methodology. The structure of the thesis has been divided into 5 chapters in chapter 1 We will first start off with an introduction of our previous action research project "When the roses came to the city", both in order to give the reader an idea of what kind of knowledge we had going into the new project, but also in order to explain how our new project separate itself from the old and build of itthe reason for this will be elaborated further. we will then present a literature review were our litterature is introduced and put into context to our problem formulation. The literature is to be understood as a part of our argumentation for why facade plants should be seen as a sustainable nature-based solution in an urban environment like the city of Copenhagen.

In Chapter 3 "*From the Desk to the Field"* the reader will be introduced to our methodology throughout this thesis. In the *"Large Technical Systems"* section we will use our techno-anthropological approach to analyse the road-system of Copenhagen as a Large Technical System, that the nature-based solution of facade plants has to become a part of. Critical questions concerning our qualitative data findings will be put in to context to the theory of

"Large Technical systems". This will be followed by chapter 4 which uses the theoretical framework of Actor Network Theory as an epistemological tool in order to understand and describe the dynamics of the field. Terminology such as the concept of "translations" will be utilised to describe our findings. Chapter 5 is envisioned as a discussion chapter in which we try define the role of facade plants and how it specifically can contribute to a paradigm shift in how nature based solutions are integrated in urban environments. Chapter 6 will propose two ways in which changes toward a city more inclusive of facade plants can be achieved. The first is a bottom up approach in which, we by allying ourselves with the organisation Miljøpunkt indre by og Christianhavn, try and facilitate local initiatives with facade plants. The second section of this chapter will explain and propose the use of transition management as a method to how a top-down approach could be facilitated. This is followed by our conclusion.

When the roses came to the city

At our 9th semester we conducted a project called "*When the roses came to the city"*. It was an action research project conducted in close collaboration with Miljøpunktet indre by Christianshavn, in which we worked with them on one of their projects called "*Roses to the city"*. The project was about bringing more facade plants to the city by stimulating the local community in various ways. Also as the title of their project suggest this mainly regarded roses (Miljøpunkt, 2017, C).

Since aspects and findings from our former project will be referenced during this paper, we find it necessary to briefly outline the most important aspects of our 9th semester project. We find it important to give the reader this information, since this paper both contain some elements, which is a continuation of our former project and also forms the foundation of our prior knowledge concerning *facade plants*. The former project likewise inspired us to do this project, since we felt that many aspects were still left uncovered and new perspectives could contribute with better and broader context and understandings.

In our former project we investigated *"how we as researchers could support and facilitate the citizens planning and establishment process of facade planting"* to paraphrase our problem formulation at the time (Reffeldt, Helmershøj-Johnson, Loldrup 2018). In addition to the main question we had three sub-questions those being:

- *What are the locals and Miljøpunktet's existing experiences revolving facade planting, both current and former?*
- *How is the interaction between Miljøpunktet the municipality and the locals?*
- *What is crucial for "Roses to the City" to succeed as a project?*

To shed light on these questions we conducted various interviews with employees at MP, some of the locals which had been affiliated with MP in their facade planting endeavours and eventually also two employees at the municipal branch called Technical and Environmental Department (TEA) which are responsible for the legal aspects of facade planting.

The following is a broad summation of findings from the project.

- Through extensive literature research and interviews with experts we found that facade plants have various positive properties which can play a role in achieving environmental goals. This research also shed light on many of the misconceptions about facade plants, such as how their ability to damage walls and facades are largely overstated.

- We find that expert knowledge has been critical in successful facade planting processes. Both in terms of the knowledge that organisations such as MP can provide, but also in terms of how one local might draw inspiration from other facade plant projects, seeking advice from those people as well.

- We contributed in creating changes with the introduction of an official facade plant application form. During our initial talk with MP it became evident that one of the fundamental issues in regards to facade plants was the fact that no readily available information existed in regards to legal specifications, locals had to follow when wanting a facade plant. Most commonly, facade plants require you to dig a hole in the section of the sidewalk that connects to the face of one's building, and to do this you need to obtain permission from the municipality. The lack of transparency in this regard has led to many locals in Copenhagen planting without permission as observed by MP. This was one of the motivating factors, for them being interested in having us to research this subject. One of the end products of our project was that through inquiry we eventually had the municipality make an official application form, which is currently available on their webpage (Københavens Kommune, 2018, B). The introduction of the application form will hopefully empower various actors, and

make the process of applying more easy and transparent for the locals.

- Locals allying themselves with other actors with knowledge, enthusiasm or physical ability, showed to be a commonality amongst the various informants we had been in contact with, and we believed it to be of great importance to a successful facade planting process. Before the introduction of the application form, we also speculate that it likely is a necessity to ally oneself with actors having the knowledge of how to navigate the “system” due to lack of transparency in terms of initiating and moving forward with one’s project.

We ended the paper by proposing several future solutions a couple of which related to MPs inspiration catalogue, which we due to time constraints did not have possibility to implement. In this paper we will however, make an overhaul of the catalogue as part of exemplifying how changes towards more sustainable solutions can be achieved through our accumulated knowledge.

With our current project we want to tread new ground differentiating our focus from prior research by including a broadened perspective. The former project was framed by our action research approach and close collaboration with MP, this is much less the case this time. Some aspects of our new project can be considered as a continuation of our former project, such as how we as previously mentioned have remade MPs catalogue.

While we did examine the properties of facade plants during our previous project the knowledge gained was somewhat limited in scope. We want to remedy this by putting an added emphasis on the macro perspective of “nature based solutions” and what role that facade plant can potentially fulfill, pinpointing how exactly it “fits in” amongst all of these solutions.
In this respect we want to introduce the theoretical framework of Large Technical Systems (LTS) to describe mechanisms of imbedded infrastructure and how it reacts to changes and new addition such as Face plants.

We also want to move between micro and macro, by explaining how transitions can be achieved both by bottom up momentum as exemplified by the redesigning of the catalogue, towards ultimately exploring a more top down approach through the use of transition management.

A nature-based solution as facade plants is only a fraction of what the term “nature-based solutions” can cover upon. We find it necessary to explain the term in the way that we as techno-anthropologists perceive the term and have chosen to work with it in the perspective of an urban environment.

Nature-based solutions in an urban environment

This thesis makes use of the term *“nature-based solutions”* to describe new and already existing projects, that incorporates nature such as plants and trees. We were initially introduced to the term by the researcher Niki Frantzeskaki who uses it in her studies. She will be introduced further in the project. In the text “***‘Nature-based solutions’ is the latest green jargon that means more than you might think”*** nature-based solution is understood as an umbrella term, which covers many of the different terms already “out there” such as *green solutions, ecological engineering* and *sustainable developments* (Nature Publishing Group, 2017). These terms are all very broad and does not necessitate the incorporation of actual nature in the projects they are associated with. A term like *green solutions* may to the layman, sound like a terms that include “something” actual green. This could also be the case, but many companies and organisations refers to themselves as “green”, while this might just be the company's “business strategy”.

The term nature-based solution is still being defined (Nature Publishing Group, 2017).). The text “***‘Nature-based solutions is the latest green jargon that means more than you might think”*** calls for scientists to help ground this new term. This is one of the reasons that we as researchers wanted to make use of this, as we can help define *“nature-based solutions”* as a term that differentiate itself from other terms by always containing nature as a living entity, which can change the arena in which it is being placed.

Solutions like the incorporation of trees, green rooftops and facade plants is all constituted as a “*nature-based solution”*. But facade plants differentiate itself from the other green solutions, by operating on the city’s vertical spaces and in this regard we believe it to be an untapped, overseen resource. By occupying these new spaces facade plants creates a unique opportunity as they can be incorporated in a densely packed city like Copenhagen, without “sacrificing” the horizontal space.

Facades Plants as a nature-based solution

In terms of creating a knowledge foundation on the properties of facade plants, we had a advantage at an advantage due to the fact that during our previous project we had accumulated much knowledge on the subject. Our knowledge of the properties of facade plants comes from both literature and interviews with experts and non-experts. In terms of literature, three main references has been used in this regard “Nature Based Strategies for Urban and Building Sustainability” (Perez and Perini 2018), *“Facade Beplantning: en undersøgelse af fordele og ulemper”* (Attwell, 1993) and *“Nørre Kvarters grønne lunger”* (Hvass, 2007). Additionally, the expert referred to are Peder Clements from MP who works on their “*Roses to the city”* project by consulting locals in the practical aspects of a facade planting process. There is also Jens Hvass the former head of Miljøpunkt indre by - Christianshavn and currently researcher in the subject of the effects of greenery in Copenhagen.

This section serves to describe exactly what facade plants are, and their properties. We find it necessary to give a brief overview of what exactly facade plants are since this knowledge cannot be assumed of the reader. Facade plants can take many forms, shapes and sizes and the characteristics that distinguish them from regular plants therefore deserves to be covered. Facade plants can be put into a broader category called vertical greening systems (VGS), which encompasses a wide variety of plant types and plant systems with the common features of either growing on or decorating walls and facades. Traditional facade plants can be characterized by the fact that they grow up from the ground. The plants most commonly used for this purpose fall into the *“climber”* or *“creeper*” type (see. Figure 1).

Figure 1: shows the common self-adhesive plant hedera helix “vedbend”

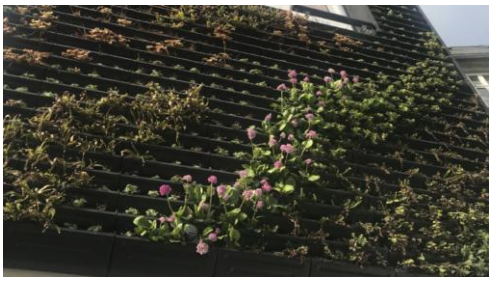
Additionally, traditional facade plants can roughly be put into two categories. They are either self-adhesive, meaning that the plant itself has adhesive organs that permits them to climb walls unassisted or non-adhesive, meaning that they require additional assistance usually by using an espalier (see. figure 2). This type of facade plant system is the most commonly used due to the fact that the installation, maintenance and expertise it requires is relatively low in comparison to the alternatives. It is also possible to install more complex vertical

greening systems such as modules, boxes, or cloth systems which provide the ability not only to have the plant grow from the ground and upwards, but instead they can be installed wherever on a given surface (see. figure 3). These solutions can have integrated fertilisation and watering systems installed as well. This kind of facade plant system can thus override the need to use traditional facade plant types of climbers and creepers and instead use a multitude of other plants, since they are not depended upon having roots at the bottom (Perez and Perini 2018). These vertical greening systems require much more expertise to install and may be too complex for the novel user

Figur 2 the facade plant, a rose called New Dawn which is growing using an espalier

A techno-anthropological take on Facade Plants

But how exactly can something like facade plants, which seemingly has nothing to do with technology be of interest to us techno-anthropologist.
A common misconception of technology is due to prevalence of so called “high tech” consumer electronics, which in so many ways shape our daily lives. These technologies indicate that what constitute technology is an artefact made of complex interconnection of various high tech components. But technology can more accurately be understood as science practically applied or manifested. On an abstract level “nature” currently seems to be considered a viable solution to complex man made problems relating to unsustainable developments across the world. In this context nature has evolved from being something “natural” into becoming a tool used to negate unsustainability. On a concrete level facade plants are a specific nature based solution, which can be used in this regard. Thus much research has gone into detail trying to uncover how the properties of facade plants.



Figur 3 shows a more complex type of facade plant system, using plant boxes.

Properties of facade plants

As aforementioned, facade plants have a wide range of positive effects besides being a "feast for the eye". We have chosen to focus on *a few* so we can give some in depth knowledge about the specific properties facade plants have on both the environment and humans.

Temperature reduction

Designing High-density Cities for Social & Environmental Sustainability edited by Edward Ng, (Wong and Chen, 2010) is a comprehensive book, each chapter of which is written by different researchers covering different aspects of how sustainable developments can be achieved in urban environments through nature-based solutions. One of these chapters is called "T*he Role of Urban Greenery in High-density Cities*", and is written by Nyuk-Hien Wong and Yu Chen (ibid). Here the scientist states how several different nature-based solutions can be used to lower ambient temperature in cities.

It has been documented that temperatures in cities can be up to 10 degrees higher than in rural and generally less densely populated areas. This is what is called the "*Urban Heat Island*" effect (UHI) (Wong and Chen, 2010). Beside the fact that densely packed cities have higher temperatures than rural and less dent cities, the issues of *global warming,* is not a new-coming issue. The world is getting warmer - and especially Denmark. Denmark is geographically the place on the globe with the fastest rising temperatures (Miljøpunkt, 2019).

One of the main reasons for UHI is due to the re-radiation effect caused by hard surfaces such as roads, pavements, buildings etc. There is simply not a substantial amount of natural cooling sources. One of the benefits of creating more nature-based solutions in urban environments is because that they act as a cooling source to combat the UHI effect and facade plants especially has potential in this regard. Studies from cities like New York, Toronto and Manchester indicates that facade plants can lower the cities surface temperature. (Miljøpunkt, 2019) A study from Japan indicates that the best way to decrease UHI is by creating an evenly distributed green "network" (ibid.). The limited horizontal space offered in urban environments to accommodate green spaces such as parks, trees along roads or rooftop gardens, means that otherwise unused vertical space offers great potential to create more cooling green spaces (Wong and Chen, 2010). More locally the effects that facade plants have is the function as an isolating layer between a wall surface and the surrounding air. The facade plants will absorb and reflect heat from the sun which reduces

the accumulation of heat on the building itself. The temperature between walls and plants will slowly equal out during the daytime but the isolation function also prevents the building from being cooled down quickly at night. Overall this causes the building to be more cool during daytime and hotter at night (Attwell, 1993). Beside the subjective comfort this might provide to the residents of the building, it could to some degree also help reduce energy usage and make a “small” yet important difference (Wong and Chen, 2010). By reducing energy usage the reduction of pollution is also relevant in the aspect of facade plants. Another property of facade plants is that they have the ability to absorb particles from cars, busses etc. Therefore, we find it more than relevant to clarify in the next section another benefit of facade plants as a sustainable nature-based solution in an urban environment.

Air pollution

Based on a literature search the article; *“The changing face of urban air pollution”* by Alastair C. Lewis was found (Lewis, 2018). Through a quantitative data collection study, Alastair shares the results of his study on air pollution in an urban environment. He states that air pollution is primarily made by prevailing energy and transport technologies. He elaborates on this by pointing out how pollution in the city is not made by a single pollutant but rather a multitude of different pollutants, all build with different chemistries, that require different solutions to resolve. Alastair made use of a technical device called mass spectrometry to map air particles in order to highlight the different pollutants. This article has been used to establish air pollution as an urban dilemma as well as to illustrate the complexity of this problem that is facilitating the need for change. We then made use of another study in order to show the connection between air pollution and facade-plants as a potential solution for this issues.

“On the air cleansing efficiency of an extended green wall: A CFD analysis of mechanistic details of transport processes” is a study by Saumitra V. Joshi and Sat. Ghosh. This article covers a case study focusing on how one can decrease the amount of pollution through nature-based solutions (Joshi and Ghosh, 2014). The study revolves around a facade plant project taking place at a university in India. The focus is on the determination of the cleaning efficiency of a facade plant project using the tropical plant *Vernonia elaeagnifolia.* The goal was to see how this green wall would absorb pollutants. It is possible to measure pollution by examining a leafs pores called "stomata", since these stores polluted particles. In this study it was done by first making a “*Phase I*” formula to measure the pollution through vehicular emissions and wind per second. This data was then incorporated into a new formula “*Phase*

II", which included data about the amount of stomata in the facade plants (ibid). This new formula was able to show the effect that facade plants have on its surroundings. Saumitra V. Joshi and Sat. Ghosh could conclude that facade plants have a measurable impact on the surrounding air quality. By being able to take in residual background pollution. This project uses this article to establish nature-based solutions like facade plants as an answer to some of the problems regarding air pollution that cities such as Copenhagen are facing. We see this as a relevant case, not only to improve the environment, but especially because studies have shown that citizens of Copenhagen are facing premature deaths due to air pollution (Hjersing, 2014).

What can also cause premature death beside air pollution, is lifestyle disease like obesity and coronary diseases. There can be various reasons for a citizen to get a lifestyle diseases, but what have been proven to be one of the reasons is *stress*. In the next section we will therefore introduce, how a sustainable nature-based solution like facade plants, can lower the risk of getting stress or the symptoms that follows.

Stress

A number of studies have according to the article "*Levels of Nature and Stress Response" (*Ewert and Chang, 2018*)* proven that issues like psychological stress, can be reduced, by exposing humans to nature. Reducing stress in itself, is not only of great importance due to the fact, that there is a rising number of citizens in Copenhagen experiencing stress or symptoms related to it (Sundhedsstyrelsen, 2019), but also because stress causes other lifestyle diseases such as coronary diseases and obesity (Ewert and Chang, 2018). Studies have shown that humans as a species react positively on specific elements of nature such as plants, trees, bushes etc. and that nature have a therapeutic effect on humans (ibid). People walking in a natural environment is exposed to a restorative effect, whereas people who are walking in an urban environment is exposed to a more stress related effect (ibid). Ewert and Chang, states that whether the natural environment is pure "natural" or "semi-natural" makes no difference, as long as people are being exposed to some elements of the "natural". Stress reduction and the symptoms thereof through nature exposure, have been proven and validated through several studies (ibid). This is not only due to the restorative and therapeutic effect nature has on humans, but also due to the fact that people tend to reduce their stress through physical exercise. People living in an urban environment, are more likely to exercise if they have access or view to green spaces (ibid). The aim of the study conducted by Ewert and Chang was to measure nature's impact on humans on both

psychological and physiological terms (ibid). Data from earlier studies trying to prove nature's positive impact on humans in relation to stress, were often self-reported data. The data from the study by Ewert and Chang was gathered from biomarkers like the presence of the stress related hormone “cortisol” in the blood, which was the physiological indicator, but also psychological stress indicators were measured through a PSQ (Patient Health Questionnaire) scale. They gathered blood from randomly selected participants of the average age range from 25,9 - 37,2 years old, both male and female. The framework of the study was located in three different settings. Setting A) was described as “*natural*”, setting B) describes as ”*semi-natural*” and setting C) describes as ”*urban built*” (ibid).

The pre-test from the physiological indication test such as cortisol showed no big difference from the participant from the three different settings. The physiological indication test was after the participants visit to one of the three settings measured again. The participant from setting A) “*natural*”, had a significantly decrease in their cortisol measurement after their visit to a natural setting. The participants visiting setting B) ”*semi-natural*” and setting C) ”*urban built*”, did not have a significant decrease in their cortisol measurement (ibid). What was interesting was one of the other physiological indication, the enzyme *α-amylase* that is an enzyme often seen in correlation with stress. Participants from setting C) ”*urban built*” had a significantly increase in this enzyme, whereas the participants from setting A) “*natural*” and setting B) ”*semi-natural*” had no significant increase in this enzyme (ibid). The physiological measurement also showed that setting A) and B) had significant increase in the level of “*joy*”, but none from visitors to Site C (ibid.). The result of the study supports the fact that nature in the urban environment is worth fighting for, since more and more people are migrating to urban areas and that nature in urban areas can have a positive effect on health-related wellness. Another health aspect that is proven to have a negative effect on humans is the invisible noise. Like air can pollute an urban environment, so can noise. We will therefore elaborate further, what facade plants can to do to an issue like *noise.*

Noise reduction

Hard surfaces commonly found in the city lack sound absorbing properties, and thus reflect sound waves in all directions, creating so called “noise pollution”. “According to Renterghem and Botteldooren in 2000 up to 44% of residents of the European Union were subject to noise levels above the recommended limits for health” (Davis et al., 2017). With an estimated increase in population in urban areas each year this issue is likely to become

more and more relevant. A study called “Evaluation of green walls as a passive acoustic insulation system for buildings” conducted by Z. Azkorra, G. Pérez, J. Coma, L.F. Cabez, S. Bures, J.E. Álvaro, A. Erkoreka, M. Urrestarazu tested how a module based facade plant system could impact acoustic performance (Azkorra et al., 2015). The test were made in a controlled environment, and the performance could vary in real world scenarios. The effectiveness of facade plants in noise reduction may vary depending on a multitude of factors, such as which plants are used, the density and materials used in the green wall system. Additional research has to be made in order for strong conclusions to be made since there is sparse studies done with facade plants in this regard and even fewer using the exact same plants, materials and methodology. With all of the before mentioned reservations they do conclude that facade plants can have a positive effect on the acoustics in the city by reducing reverberation (ibid.). Various materials and their sound absorption properties were studied such as brick, concrete, plaster, wood, glass, marble and a fibreglass board. in comparison to almost all of the other materials their module based facade plant system performed better, with the exception of the fibreglass board. (ibid.)

Part conclusion

There currently exists various nature based solutions and the road towards more sustainable cities are sure to be a complex composition of various ideas, concepts and technologies, each of which complementing one another. In this section we have outlined how facades plants in some ways do not stand out from any other nature-based solution in terms of the positive properties which they can provide. But in equal measure they seem to be an obvious and almost tailor made solution in terms of creating a sustainable nature-based solution in the city specifically. The largely unused vertical space in cities is currently an untapped resource offering great potential. Our experiences and accumulated knowledge from our ninth semester has, given us a great jumping of point to expand the scope, and we now seek to understand the difficulties of implementing nature based solution on a broader scale. In the following chapter we will delve into the methods used to examine the project and reflections relating to the process.

From the desk to the field (method)

Through our process of gathering data to our thesis we have used several methods and sources. In this section we will outline our thoughts on how to gather valid literature and how we conducted our qualitative research.

Credibility

Through the writing of this thesis, we have been attentive towards the credibility of the literature we have chosen to include as a part of our research. Depending on whether the literature is published through a *book, journal, article* or *website* etc. different factors has been taken into account. When the literature has been gathered from *books,* the author's credentials and field of expertise have been taken into consideration. This is important because the more expert knowledge we can build our master thesis on the more valid it will be. Subjects as the publish date, references, evidence and sources has also been taken to notice. When using articles, we have evaluated them, by searching for the most recently published and through our literature search narrowed our search down by applying additional search criteria such as only showing peer-reviewed scientific articles. We have gathered literature through the search database *Aalborg universitetsbibliotek (*Aalborg university, 2019*).* Additional literature we have used for research purposes have been a part of or Master curriculum and compendiums given to us by lectors from Aalborg Universitet.

When using literature from websites we have been critical to the sources and the authors' credibility. We have when possible backtracked numbers and analysis to its original publisher if used from websites. Beside using literature to collect knowledge we have conducted several interviews with both experts and non-experts. We have remained critical yet professional towards the qualitative data collection. The following section will elaborate on our qualitative method used throughout our thesis.

When wanting to understand the field of study, the internet, TV and library can provide a lot of the information needed about a field. But being in the field of practice gives the researcher different understanding of the field (Czarniawska, 2014). Barbara Czarniawska argues in her book *“Social Science Research - From Desk to Field”* that words of men and women in the field is as valid as the researchers own. She further argues that fieldwork is to be perceived

as empirical data and that it is through our curiosity as researchers that we are to learn from the field where people live, work and construct their world differently than ours. According to Niklas Luhmann, observers are in the position to see options and distinguish between them, whereas the actors being observed unlikely have the same understanding of the field. It is of great importance to also understand and gain knowledge from the practical field of study and not only from the desk (Czarniawska, 2014).

As stated in section “When the roses came to the city” (see. page 11) we became a part of MP’s project “Roses to the city” during our ninth semester. This project mainly concerned the joint effort between MP, the locals and the municipality as actors concerning facade plants. The understanding and knowledge the project gave us, lead us to some new and unexplored issues in the search of implementing facade plants as a sustainable nature-based solution in Copenhagen. During our ninth semester it became a surprise that what seemed as such a simple project (facade plants), turned out to be a rather complex one. With the approach as action researchers our initial thought was that due to a lack of communication and understanding between MP, the locals and the municipality, the “Roses to the city” project never came to its full right. We therefore chose to investigate the intermediaries between the three actors. We came to the conclusion that the “intermediary object” between MP and the locals was their “Roses to the city catalogue” and that the “intermediary object” between the municipality and the locals were the non-existing application form. After a meeting with the TEA on our ninth semester they designed an official application form for *facade plants.* As mentioned before, MP gave us the opportunity to redesign their catalogue as a part of our tenth semester.

On our tenth semester we started to work on the catalogue and conduct interviews with various actors, but quickly realised that the “issues” concerning facade plants as a sustainable nature-based solution, was more complex than an updated catalogue. For facade plants to succeed as a nature-based solution in Copenhagen more actors than the ones revealed in our network had to be included and the project had to be approached from a *broader* perspective. Through our interviews with new actors in the network, it became clear that actors especially on a macro level had more impact on nature-based solutions than first expected. From our ninth semester experience we had come to learn that MP as an organisation had a budget and an annual plan that the local committee had a big impact on. We came to learn, that fundamental things like the ways the road systems in Copenhagen works, and the way architects in Copenhagen think and predisposes their

economy also had a say in the vision of a greener Copenhagen. We got a better understanding of the fact, that if facade plants had to be adopted and implemented in Copenhagen as a nature-based solution a wider aspect of actors, institutions, organisation etc had to be taken into account, and that this process would require more structure, knowledge and a multilevel perspective. So as a natural response to our “epiphany”, we went to expand our knowledge further. How this was done, is elaborated in the next section below.

Expanding our knowledge

The qualitative data collection for this master thesis, has been conducted through interviews. These interview were conducted to obtain a better understanding of the actors and their position in the network. The interviews also gave us an understanding of how the individual actors perceived and moved between other actors in the network on different levels (micro, meso and macro).

The interviews were done with a multitude of different people spanning across multiple actor-groups, from facilitators of facade plant projects to people from the municipality TEA department governing the legislation of facade plants. These actor groups are all connected to MP and each other in some way. MP can be seen as our gatekeeper to the network that facade plants are a part of, since they have been vital for our introduction to and further work in the field. Having MP as gatekeeper was important as we as “outsiders” were moving into a new “unknown” field. Gatekeepers are important to the researcher as the researcher can have issues establishing contact without an already established actor vouching for them (Brinkmann & Tanggaard, 2015).

Many actors were introduced by MP’s Centre Director Marianne Spang and actors found by us where already known to Marianne Spang. She helped us to shape our introductory emails to our informants and we made sure that the mail had the right tone for the individual actor and hit the right notes to increase our chances of an interview. Marianne Spang also gave us the ability to send these emails through her own email address. Being linked directly to MP empowered us greatly as the email now equipped with MP’s header and Marianne Spang’s signature elevated our email to something more than just an email from a university group. How our interviews were conducted and with what method will be clarified in the section below.

Semi-structured interviews

We have primarily made use of the semi-structured interview because we wanted to examine the field and get a better understanding of the different actor's narratives and understandings. The open questions the semi-structured interview entails helped us make the interview feel less formal and more like a regular conversation (Brinkmann & Tanggaard, 2015).

In order to make sure that we got the most out of each semi-structured interview we made use of informing an interview guide to help us make sure that we got insight in the informants' practices, and understandings of the subject (Brinkmann & Tanggaard, 2015). This was done with the use of WH-words, like, who, why, when and where. The use of WH-words made it possible to get a deeper insight in narratives and stories about facade planting, and took us closer to the informants' view of life (Brinkmann & Tanggaard, 2015).

The flexible structure of the semi-structured interview, makes it possible to ask supplementary questions, that have been formed during the interview. It is very important to make sure that there is time for these types of questions before the interview is conducted. These supplementary questions was used as a tool to go in depth with different thematic uncovered during the interview. The semi-structured interview relies greatly on these improvised questions, which is why it is up to the researcher and their ability as an interviewer to maintain the professional level during the interview. When using the semi-structured interview, we experienced how the relaxed structure of the interview, made some informants side-track and talk about "off topic" themes. This can in the meantime be valuable because it can open up for the informant's way of life and often provide narratives, questions or answers that we would not otherwise have uncovered. But as an interviewer one has to be able to handle the situation as it comes with the craft (Brinkmann & Tanggaard, 2015).

Interviewguide

During these semi-structured interviews, we made use of an interview guide that was made before each interview. These interview guides were made on the background of our already existing knowledge on the subject. Each interview had its own interview guide, made specifically for the informant, in an effort to get the most data out of each informant (Brinkmann & Tanggaard, 2015). As this project is the second time we operate within this field we have lots of previous accumulated data. The knowledge gained from the previous

dataset helped shape the first interview guide for this project. This is because we chose to expand the guide through the hermeneutic spiral, as we evaluate bolster our existing interview guide based on the data the previous interviews have provided.

Unstructured interviews

During our previous stay in the field we got keys to MP's offices in the heart of Copenhagen. This means that we spent a lot of time at their office and had a lot of conversations with the employees and as this is our second semester we have established an almost personal relationship with some of our informants, which enhanced the casual feeling of these conversations. These conversations ranged in relevance and length. The conversations concerning our project where all based on broad questions. But all added to the narrative surrounding MP. We did not record these conversations even though they could be seen as small unstructured interviews because of their casual nature. This made it hard for us to use the information and knowledge during our project, due to the fact that we did not have any records of these conversations.

During this semester we also tried to make use of a "true" unstructured interview. This means that we interviewed one of our informants without an interview guide as well as not establishing a timeframe in which the interview is built around. We chose this interview structure specifically for this informant because we have interviewed him earlier with the same course of action, and got a very positive outcome. We originally got the courage to try this form of interview by talking to a former actor who had interviewed Jens herself and therefore could give us some insight concerning who this informant was as a person. The actors was described as a person deeply invested in nature-based solutions. This knowledge is what made us confident enough to try our hands on the unstructured interview method. The reason we kept trying this method was for us to attain as much insight as we could into this person's way of life (Brinkmann & Tanggaard). And since his knowledge was so broad we thought that we would let it be up to him where to start and where to end up. In this way we would end up with what he thought was the most important aspects surrounding the implementation of nature-based solutions in Copenhagen. However, the downside to this method is that it can be hard to keep the conversation within the relevant themes and Unstructured interviews is generally speaking one of the more difficult interview methods, because it places a lot of pressure on the interviewer as you have to let the informant dominate the interview, while maintaining some degree of thematic consistency (Brinkmann

& Tanggaard). This is why we only made use of this interview structure once as we in this case had the background knowledge needed for us to be confident enough to experiment with this type of interview.

Roles during the interview

While conducting our interviews we made sure that every group member present had a designated role. One was in charge of the interviewing with the primary function of leading the conversation based on the interview guide during the semi structured interviews. This person was to use the tools the semi-structured interview entails, to make sure that the informant expanded upon the themes introduced during the interview. During the unstructured interview this person had to rely solely on their own skills as an interviewer to feel the flow of the interview in order to ask the right questions at the right time. Besides the interviewer there where either one or two group members, which took notes but also supplemented with questions when it was relevant. In this way they acted as a safety net, that made sure that we gathered the most relevant data possible. A criticism of the semi-structured as well as the unstructured interview is that the data becomes clouded because the informant easily becomes side-tracked as a result of the loose structure. Another substantial criticism surrounding this data gathering method is that the collected data is not able to be recreated identically. We have tried to accommodate this by recording the interview with the informant's permission. By doing this the data gets preserved, and makes further work with the data easier to conduct (Brinkmann & Tanggaard).

Transcriptions

As stated above the interviews were recorded to preserve the data and make further work easier. These interviews were then transcribed in their entirety. This made it easy to extract the quotes needed during the writing process, as well as keeping an understanding of the context in which the quote was produced. We have in the past experimented with different ways of transcribing the recordings, and we have concluded that the full transcription is the only way to ensure the gathering of all relevant data (Brinkmann & Tanggaard). The downside of transcribing the full interview is the added difficulty of sorting through the data as the transcription grows, which potentially clouds our overview as a result. We have tried to accommodate this by analysing each transcription individually and apply different themes to the text throughout the transcription in order to see what different blocks of text entails at a

glance. The data used during this project is primarily qualitative, so we chose to recorded and transcribed our interview to get better access to our empirical work. We are furthermore aware that our data is based on a specific case and our results therefore only applies within this context. Our results cannot be generalized but through our use of method and theory we hope give a better understanding of potential problem areas when working with naturbased-solutions (ibid).

Key actors in the fieldwork

Throughout our fieldwork we have met many actors, that have helped shape our understandings of the field and subsequently this master thesis through their knowledge. These actors will now be introduced in order to validate their role in this thesis. This will be done by giving a brief introduction of where they have acquired their knowledge and how it is used in this thesis.

Miljøpunkt Indre By/Christianshavn

Marianne Spang: Marianne Spang is the Centre Director of MP in association with Copenhagen Inner City and Christianshavn local committee. She has previously been employed by different municipalities as an environmental worker, tasked with the regulation of companies so they reduced their environmental footprint in accordance with the green transition guidelines. Her connections within the network as well as her knowledge surrounding it has been vital for this project

Sabine B. Sørensen: Sabine B. Sørensen is working at MP as a facilitator on various of MP's projects. She is originally graduated as a horticulturist in 2012. She joined MP in 2013 as a volunteer but ended up being hired and assigned to the project "Roses to the city" after the municipality introduced the project as a future duty for MP. As the prime facilitator for the roses to the city project, she has an overview over the project that has helped pinpoint actors of interest. Her input surrounding the redesign of the catalogue has been fundamental, as her knowledge and experience regarding the project is unmatched.

Peder Clement: Peder Clement works as a volunteer at MP. Before retirement he was working as a Gardener and landscaping architect. He is responsible for guiding people in

their choice of plants and how these plants should be cared for. He is very passionate and knowledgeable about planting and facade planting is no exception. Peder Clement was crucial for our practical understanding of plants and their different needs when planting. This knowledge became vital during our work with MP's catalogue. He furthermore helped us understand some of the prejudice surrounding facade planting.

The municipality

Sabine & Jonas: Employee at the administration of TEA responsible for (Vejændring), which means that they administer things such as facade plants

Locals

Jens Hvass:
Architect, former CEO of Miljøpunkt Christianshavn/Inner City and the creator of "Green Lungs" project.

Inger: Local, facilitator of a facade plant project

Ditte: Facilitator of a facade plant project at a school in Copenhagen

Other informants

Oleg Koefoed: Oleg is a "København" first and a philosopher second. After finishing his Ph.D. in philosophy he created a network called "cultura21" which focused on sustainability in a cultural context. A couple of years ago he created the company "*Growing Pathways*" that has a more direct focus on bridging the gap between nature and cities by incorporation new nature-based solutions and creating strong networks around these solutions.

Jakob Næsager: Jacob is a politician representing the Conservative people's party (Det Konservative Folkeparti) He is a citizen representative at the municipality of Copenhagen and member of (TEA)

Mette Annelie Rasmussen: Mette is a politician representing the danish social-liberal party (Radikale venstre). She is a Citizen Representative at the municipality of Copenhagen and a member of TEA

A. Reffeldt , M. Helmershøj-Johnson, M. Rasmus Loldrup

Understanding the sociotechnical arena

This chapter will introduce the Danish road-system and its role as a Large Technical System (LTS) in Copenhagen. In the book *"The development of large technical systems"* Thomas P. Hughes states that integrated transport systems are to been seen and analysed as a LTS. We therefore find it relevant to use this specific theoretical approach to investigate Copenhagen's road-system. We will through LTS and our empirical data highlight the complexity of this system.

The reason we want to highlight this is to understand the arena that nature-based solutions such as facade plants has to be implemented into. By understanding the arena that facade plants are being implemented into we will be able to ask critical questions and to pinpoint potential problems in the system related to implementing nature-based solutions. When framing the road-system as a LTS we find it important to mention that, both the road for motorists and the sidewalk for pedestrians are included in this terminology because they are both relevant in terms of understanding the socio-technical arena. Thereby we will be able to use our techno-anthropological approach to be a part of a suggestion for a future solution. We have through our time in the field gained knowledge from various actors concerning the fact that the implementation of nature-based solution in the city of Copenhagen is a rather complex process. We will through the theory of LTS by *Thomas. P. Hughes* clarify why the introduction and implementation of new nature-based solutions into a socio-technical arena can be difficult to facilitate and maintain (Hughes, 1983). The theory of LTS focuses on the construction, stabilization, structure and continued success of large scale systems in a socio-technical arena.

Historically what has been of particular interest to examine under the lens of LTS is the emergence of comprehensive organisational systems that forms the framework around various of the most impactful technologies of the 18th,19th and 20th centuries such as electrical grids, railroads or the internet. What unifies each of these inventions is that they are immensely complex, they have an impact on shaping society and they can involve the workings of organizations, institutions, regulatories and legislative artefacts, which plays a role as well.

In terms of clearly defining the organisational boundaries of the Danish road-system they diverge in the sense, that it is difficult to pinpoint an exact inventor. We are aware that this

project does not go in depth with the complex details, associated with the building process of the Danish road-system and the aspect of LTS in this specific process. This is things like the construction, the obligatory law-making, the roadbed with its different layers, each designed for a specific purpose and with specific materials, which all requires a diverse set of knowledge and skills, from archaeologist and geologists to construction workers and truck drivers (Vejdirektoratet, 2013). The roads created are maintained by *The Danish Road Directorate* and are made by establishing a roadbed made up of different layers, bottom gravel, stabilizing gravel, asphalt and screeds. All these above-mentioned actors are all part of the LTS and only adds to its size and complexity. The reason why we do not go into detail with all of these comprising elements is that we do not want to make a comprehensive analysis of all of the comprising elements of this system, but instead we want to focus on how nature-based solutions like facade plants fits into this context of LTS.

From dust to concrete

In this section we will present some of the past and recent changes in the Danish road-system, as well as mention some of the actors connected to this system. At the time around 300 BC the Romans began making more advanced roads composed of materials such as stone and concrete to establish a somewhat steady road network. This became the foundation for the first similar construction made in Denmark in 1764 by the French engineer *Tresaguet* (Hertz, 2005). Later the Danish road-system have been modernised by several architects and engineers. The big turning point came in the 20th century when the cars became a regular component of the road-system in Denmark. In 1920, there was approximately 18,000 cars in Denmark, whereas there in 2018 was approximately 3.2 million cars (Danmarks statestik, 2019). Not only the total number of cars has drastically increased but also the road network in itself (Danmarks statestik, 2018). Today's focus on efficiency means that the road network in Copenhagen and elsewhere in Denmark is still increasing and movement is becoming easier and faster (ibid.). This is relevant since the road-system in Copenhagen will increase the already existing pressure to the horizontal space. The horizontal space in Copenhagen have to be shared with some of the nature-based visions from UN's 17 global goals and the municipalities Tree Policy and the Agenda 21-strategy. We have mainly focused on the three previously mentioned policies, in order to get a more in depth understanding of the pressure, that policies like these are putting on the established road-system in Copenhagen.

But before one can understand how these visions concerning implementations of nature-based solutions in an urban environment can be complex one has to understand the field in which it is being implemented in to. We will clarify relevant aspects of the *modern Danish road-system,* since this is the practical field, in which nature-based solutions such as facade plants hopefully will become a part of.

Understanding the terminology of LTS

This section will introduce some of the terminology of the theory "*Large Technical Systems"* (LTS) as well as some of the terms used to define these LTS. The reason for this is that we wish to give an introduction of the theory and the terms within.

The theory focuses on how LTS are established and how technologies do not emerge by themselves. Hughes uses Tomas Edison's invention of the electric light bulb as an example on a LTS, as Edison not only invented the light bulb but had an understand of the surrounding system that was necessary in order for the light bulb to function as intended (Hughes, 1989). This theory will be used to establish the Danish road-system as a LTS and to highlight the scale of complexity of multiple actors trying to operate within a LTS. In order to analyse and understand the Danish road-system as a LTS we have made use of terms such as *transfer, momentum* and *reverse salient.* These terms will now be briefly introduced and be elaborated further as they are utilized.

Transfer - is when a system has the ability to change, according to its geographical, political, historical and legal conditions, while still being "one and the same" with the original system.

Momentum - creates a natural progression within socio-technical systems, where new niche technologies emerges and try to stabilise themselves within the socio-technical system.

Reverse-salient - is new technologies/innovations that results in an uneven evolution within a socio-technical system. Which results in the need for new problem solvers into the system.

We will with the use of the terms above try to establish why the Danish road-system can be seen as an LTS, and what that means for the implementation of nature-based solutions such as facade plants.

The underlying system: The roads as a LTS

In the book “The Development of Large Technical Systems” Hughes argues that integrated transport systems can be seen as a LTS. For this reason, we will in the following sections through the three above-mentioned terms provided by Hughes try to understand why transport systems such as roads in Copenhagen are a part of an LTS. The roads in Copenhagen are not only assigned to cars but is a space many key actors have to share by operating closely together. Pedestrians and bicyclists are two other actor groups that have gotten designated space on most city streets, but many more operate within this space. Humans are not the only travellers along these roads. Water, electricity and gas all seperate travel along the roads in order to get to its destination. This underlying system of wires and pipes only adds to the complexity of the road-system. This is because these actors should be kept separate in order to avoid problems. Electricity and water should have as little to do with each other as motorists and pedestrians.

Transfer

It is important to note that the conditions described above do not define every part of the road-system in Denmark. Hughes states how LTS through *transfer* have the ability to change without changing the “purpose” of the system (Hughes, 1988). This is because that these systems are so vast that different parts of the system can transform without changing the systems behaviour. If one compares a city road to a highway then the city road has a thinner roadbed than the highway, while the highway has excluded actors such as pedestrians in order to empower other actors. These variations are being strengthened by laws and regulations that enforce these differences. On the highway the drivers are given the opportunity to travel at a speed that would otherwise be illegal, because of the lack of other actors. Thus they give them the ability to act in ways they would not be able to otherwise. The terms *transfer* can be applied to this system as the architectural structure that differentiate depending on the type of road. They are all connected but are subject to different laws and regulations depending on their geographical location. Let us for instance take a look at Copenhagen's road-system and keep our focus on the sidewalk. The sidewalk is where the small amount of horizontal space for the facade plants will be “taken”. If one were to look at the sidewalk as a lone standing actor in Copenhagen's road-system, this actor should according to Hughes term of *transfer* have the ability to change without the

initial purpose of it being changed. If facade plants were to be a sustainable nature-based solution in Copenhagen's streets it would not only be beneficial for the environmental and health related issues, but also due to the fact, that it would not be necessary to implement major changes in the LTS for this solution to become a part of the system. The sidewalk would still be a sidewalk facade plants or not so the actual purpose of the sidewalk and the LTS would not be exposed to major changes. One could wonder if the “purpose” of the sidewalk could become more than just a practical matter of “transport” by having facade plant as a part of this specific LTS become more than just a practical matter but also an aesthetical matter, with more to its purpose than “transport”. The “practical aspect” of changing the LTS will be further elaborated in the section “*Fighting for Spaces*”.

The municipality of Copenhagen TEA published the *tree policy,* which has a wish for a 100,000 trees to be planted in the roads and streets of Copenhagen. For this to happen a lot of the already pressured horizontal space in Copenhagen, would have to go under further pressure. The LTS of Copenhagen’s road-system would have to go through a more comprehensive change due to the fact that the trees were to take up a considerably bigger amount of horizontal space. It would not only affect the “surface layer” of the LTS but it would also affect the “underlying system” since bigger trees grows deeper roots. The city road itself also transforms depending on what the citizen uses as a means of transportation. Cyclist are subject to different laws and regulations than the pedestrians, but the use of the roads as a means of transportation stay the same.

Momentum

In this section the term *momentum* will be expanded upon as well as how *momentum* can be the reason why there is a growing need for more nature-based solutions related to the roads of Copenhagen. LTS are never fully stable but are always in a constant state of change where these socio-technical systems try to develop and incorporate new actors and technologies in order to evolve. This phase comes after the initial stabilisation process and is called momentum (Hughes,1988, 1989). Momentum creates a natural progression within technologies where new niche technologies emerges and try to stabilize itself within the socio-technical system. LTS which is in a constant state of change is being described by Hughes as being in high momentum. Exploring new niches can help the large technical system to stay relevant. Systems that lacks momentum are at risk of being challenged by new systems and can eventually lose its relevance. Systems uphold their momentum and maintain a constant state of development through the existing actors actions. Outside forces

can also affect systems in high momentum, man-made events such as war can have a large impact on the momentum of a system because the different actors within the system have to change or rebuild their momentum (Hughes, 1989). Environmental incidents can also be the facilitator for large technical systems to change their momentum. This could be the results of a lack of resources or because of climate changes (Hughes, 1989). Hughes describes a LTS as consisting of both human and non-human actors such as laws, organisations, surveys, technologies and humans. The only thing these different actors must have in common is that they work towards the common system goal. The goal and the actors working towards it can change along the way, but the actors shared vision for the system goal is fundamental for the success of the system (Hughes,1988, 1989).

Various stakeholders are putting big cities like Copenhagen under increasingly high pressure to incorporate nature-based solutions as a sustainable development in already existing system like the road-systems. This pressure is what generates the momentum within a system. This pressure will be analysed in order to establish how it can facilitate change. We have chosen to focus on UN's global goals, the municipalities Agenda 21-strategi and their subsequent Tree policy. We have chosen to focus on these policies since they can be interpreted as a manifestation of the pressure that the road-systems are under.

One of the 17 global goals published by UN, is the previously mentioned global goal no. 9, which in its sub target *9.1* focuses on the need for *"Sustainable Infrastructure"* (FN, A 2019). Global goal 9 can be interpreted as a way to renegotiate the visions and goals of the road network, and through this create momentum for the network. The pressure created by global goal no. 9 can also be identified locally as the municipality of Copenhagen has published the Copenhagen Tree Policy with the goal of making 75% of people living in Copenhagen perceive the city as "*green*" before 2030 (Københavns kommune, 2018, C).

All this pressure is what generates momentum for the LTS that eventually can lead to a renegotiation of the goals within the system. We believe that the Copenhagen Tree Policy is one manifestation of this pressure, as the goal in this policy is to implement trees into different open spaces. One of these spaces are the roads of Copenhagen. The momentum that the Copenhagen road-system have resulted in a need for the incubation of new solutions that can accommodate the need for more sustainability and human well-being (FN, A 2019). During our time in the field we became aware that it could be hard to implement

trees into the road network of Copenhagen. This is amongst others things because the horizontal space is occupied by already existing actors operating in that space.

Fighting for space and reverse salient

City roads differentiates themselves from roads outside the city by not only being a means of travel but have evolved into a social space where different activities take place.

The road-system in Copenhagen has a clearly defined layout to accommodate the three primary user groups: The pedestrians, the cyclists and the motorists. The goal with this dividend layout is to minimize the interaction between these three actor groups as their needs differentiate. By making allocated spaces the facilitators avoid a *clash* of interest between these groups. Incorporating nature-based solutions into this system can therefore be hard since the roads in Copenhagen already has most of its horizontal space occupied by different actors both above and below the surface.

If one tries to implement a nature-based solution such as a tree into this arena, then it has to be done in such a way as to not negatively impact the already existing functions of the road. Marianne Spang from MP expresses this problem during an interview:

“The Cph Municipality is very interested in getting a greener city, they write it themselves in their municipality plan and they have made their tree policy where they want to plant many new trees, but the problem with this is that there is so little space here in the city so planting a tree requires a lot of space and they also have to go down in the ground and look ... are there wires? are there drains or sewers? So maybe a solution to this is if you can't plant trees just use facade planting because it takes up much less space on the road” - Marianne Spang

According to Marianne Spang, the Tree Policies’ wish to implement trees is demanding a lot of the space already occupied by other actors in the system. A negative effect of the incorporation of trees in this space could be the loss of visibility between actors such as drivers and cyclists when planting trees along a road or it could be the negative effect the roots of the trees have on the infrastructure below the surface. As the vertical spaces are in high demand, Marianne Spang suggests the use of facade plants to accommodate these new goals and visions, that Copenhagen’s road network is facing. This is because facade

plants make use of the vertical spaces, which in most cases are freely available on most facades, while minimizing the amount of horizontal space used but one can find that facade plants like many other nature-based solutions can suffer from some of the same implementation problems such as the loss of visibility.

One thing the human actor groups share is the importance of visibility. By having good visibility one makes it easier to act in this social arena. The visibility ensures that users of the road-system of Copenhagen are aware of other surrounding actors, both human such as pedestrians and non-human actors such as traffic signs.

"The only thing I am fighting is that there is a sign telling you not to park, and twice every midsummer I have to go out and cut the facade plant , so that it is not covered, and many of those who parks here use as an excuse that they can't see it. So I'm currently having a struggle to get the sign removed." - Jens Hvass

During our initial data gathering Jens Hvass expressed his frustration over a *"No Parking"* sign that was in danger of being covered by his facade plants. He states that many have used his plants as an excuse for breaking the law and it has now come to a point where he is trying to change the placement of the sign in order to end this controversy.

This is a clear example where the introduction of nature-based solutions such as facade plants can be seen as solution to one problem and the facilitator of another. This is why we believe that nature-based solutions such as facade plants can be seen as a *reverse salient*. Because while it may have a positive environmental effect on its surrounding area, it can also affect other part of the system in such a way that it hinders or even cease up the function of the system. The effect of this is that implementers of nature-based solutions has to be aware of where to apply nature-based solutions as they have to be included in a LTS already cramped with different actors with different functions.

"As technological systems expand, reverse salients develop. Reverse salients are components in the system that have fallen behind or are out of phase with the others.(…). (…) Reverse salients are comparable to other concepts used in describing those components in an expanding system in need of attention, such as drag, limits to potential, emergent friction, and systemic efficiency" (Hughes 1989)

In relation to nature-based solutions in Copenhagen the concept of reverse salients can be used to describe how the momentum of nature-based solutions, has made evident some of the flaws of the road-systems in Copenhagen. For instance the regulatory systems governing changes to roads would increasingly come under pressure as the wish for incorporation of nature-based solutions rises. This pressure has created a need for more transparency in regards to regulation and an upgraded application form seems to have been a step towards this (Facade Beplantning, 2018). As we have discovered in this regard the regulatory and legislative authorities could at a point be described as a component of a system, which had fallen behind or was out of phase with the practice of facade plants.

“In an electrical system engineers may change the characteristics of a generator to improve its efficiency. Then another component in the system such as a motor may need to have its characteristics-resistance, voltage, or amperage-altered so that it will function optimally with the generator. Until that is done the motor remains a reverse salient” (hughes 1989).

As the above quote states the reverse salients can be altered however, which was the case with the introduction of the regulatory artefact in the form the facade planting application form.

The sidewalk section of the road has to fit certain dimensions in order to acquire facade plants, which are elaborated in the application form. This means that in some cases if these dimensions do not fit with regulation, establishing facade plants becomes at the very least legally impossible. The physical dimensions also play an important role specifically in terms of the fact that the innermost section of the sidewalk has to be comprised of easily removable stones, usually cobblestone. If for instance this section is instead comprised of either asphalt or concrete then traditional facade plants would once again become impossible. This is once again an example of how an outside force (in the shape of facade plants) has caused reverse salients to develop, which otherwise would not have been a problem. In this context making psychical chances to accommodate this outside force might prove more difficult than with the regulatory aspects, since it would make extensive changes to existing infrastructure to accommodate facade plants.

During the time of writing this thesis it became evident to us that not everything could be put into a LTS framework. Specifically there were other explanatory factors of complexity and that did not relate to the roads of Copenhagen.

Part conclusion

Looking at the roads in Copenhagen through the framework of LTS have given us the ability to describe the system in which nature-based solutions such as trees or facade plants has to become a part of as a complex arena. The road-system is complex because many already existing actors inhabits the space. This makes it hard to incorporate new solutions as renegotiations has to be made in order not to throw the system out of balance.

A theory about actors in the network

A Critic of LTS that leads to ANT

LTS functions mainly as a tool to understand how new systems emerge and achieve stability (Geels, 2007). This is typically done through historical cases, such as the construction of the electrical grid etc. (Hughes, 1989). However, there is a lack of attention to the changes *momentum* and *stabilization* facilitates within the LTS and the networks that it contains (Geels, 2007). We wish to examine what is the foundation for change in a socio-technical system. Therefore, we have chosen to expand our theological framework, by the introduction of ANT. ANT is detail oriented concerning the process actors, networks and power mechanisms goes through, when working toward mobilising a network.

By focusing on a network within the LTS we can give the actors room to act and give ourselves the chance to understand the context in which they are acting. ANT can furthermore provide us with a snapshot of the technical evolution at this moment by unfolding the complex network and then pinpoint key actors.

We have in the former chapter used the theoretical framework of LTS, to “map” the road-system in Copenhagen and the actors and objects that it carries. We have chosen to analyse this LTS with the approach of ANT.

We did this, so that we were able to understand the arena that facade plants are to be “implemented” into for it to become a sustainable nature-based solution. We have chosen

the theory of ANT because it gives us as techno-anthropologist the tools to analyse on the socio-technical mechanisms of power and describe the relations between actors. When approaching an actor or object with the theory of ANT it is in the scientists' interest not to assume much about the power mechanisms and actors that are to be analysed (Elgaard, 2003). One of the reasons for this is that ANT approaches a network with the thought that human and non-human actors are "equal" in the sense that no one can do without one another. The importance of an actor based on predefined notions of micro- meso- or macro-level is likewise not part of the theoretical framework of ANT (ibid). This is worth mentioning since this is a theoretical approach and not an ethical position.

The theoretical framework of ANT states that humans' interactions is mediated through objects and that these object comes in different forms, shapes and sizes and is often referred to as a "material" (Elgaard, 2003). The Network surrounding the implementation of nature-based solutions carries various actors on various levels. One of the ways that they mediate their knowledge to one another, is through scripts such as policies, papers, laws and guidelines. Due to the fact that the actors works on different levels they take different approaches to how their knowledge is mediated.

By using ANT, we want to analyse the "revealed" LTS and in this way we will be able to investigate some of the power mechanism this network contains. We will not be able to analyse and account for all actors, objects and mechanism in this network, due to the size of it, but we will take outset in the actors and objects most relevant to our questions concerning facade plants as a sustainable nature-based solution in the urban environment of Copenhagen. We have come the acknowledgement that for a an actor like facade plants to succeed in the network that we are investigating the participation and equal agreements from actors on all levels are highly necessary we will therefore analyse on the power mechanism between actors and objects in our LTS on both micro -, meso - and macro level. A reason for this is that we also believe that many of the interesting questions and answers are to find in the interrelations between these actors and objects.

When analysing this network we start on an "clean slate", meaning that we of course will take outset in the LTS analysis, but we will approach it with as little bias as possible. We will through the ANT analysis ask questions such as: W*hy* some actors both human and non-human seems to be more resistant and persistent (meaning that they are more entrenched and stronger) than others and how they through Callon's translations process becomes this.

As mentioned before, the theory of ANT assumes that no actors are different from each other until proven otherwise. ANT theorist argues that all actors have been micro actors, but that they through their actions are able to place themselves differently in the network and thereby change the power mechanism (Elgaard, 2003). The foundation of ANT is that the theory approaches every network with the understanding of it as being a *heterogeneous network,* meaning that society, organisations and actors are all generated in patterned networks of human and non-human actors (ibid.). With ANT as a theoretical approach it is worth mentioning that knowledge according to ANT is produced through hard work, where heterogeneous “bits and pieces”, are gathered into a patterned network and knowledge comes in the shape of *material forms*, like paper or preprints. If knowledge is gained through a scientist, technician, expert or a non-expert, ANT argues that knowledge have been embodied in that actors through a variety of *material forms* (ibid).

The forming of this knowledge relies on how the *material* are ordered and organized by actors in or outside the network. This *material* needs to be mediated, which is done by using different objects as an *intermediary object*. One actor can communicate with another actor by using for instance a computer or a thesis in paper form, as we do as an *intermediary object* between “us” and a “reader”. This intermediary object is again a heterogeneous network composed by different actors on different levels with different actions. Therefore, ANT states that various networks “participate” in creating being a part of and shaping the *socio-technical network*.

So to form a rough draft of ANT one could say that it is a process of *heterogeneous engineering,* where “bits and pieces” from the *social, technical, conceptual* and *textual* are tailored together and after this *translated* in to a scientific product (Elgaard, 2003). It offers a understanding of the “world” that allows the scientist to perceive everything as a network composed of different actors all connected, like was it a symphony by Mozart.

We find this approach so very relevant, because the network of facade plants is composed by many actors, both human and non-human. Other theories also offer an approach that allows scientists to investigate relations between various actors, but the way that ANT analysis the power mechanisms between actors and the mobilisation of these is interesting to us since we are investigating which mechanisms and actions there could be necessary for an actor like *facade plants,* to become mobilised as a sustainable nature-based solution.

Through ANT, we are introduced to the term "*punctualization*" as an important feature of the network. If we in this thesis could write that facade plants as a sustainable nature-based solution was *punctualized* there would be no reason for us to keep writing. When an actor in a network is punctualized, that specific actor is functioning as intended in that specific network. As we interpret it, facade plants are not utilized to their potential due to the lack of acknowledgement from actors relevant to their network, thus we will not (unfortunately) be able to punctualize it, but this "issue" is one of the pillars of perplexity that has formed the foundation for this thesis.

When an actor is not a resistant actor in a network, the "scientist" can investigate the actors actions through Michel Callon's *translation process* (Callon, 1984). In ANT the *translation process* covers the exploration of the process where patterns are ordered and the resistance actors are either achieved or not achieved (Elgaard, 2003). According to ANT an actor is an effect of how the network is ordered. But how does a network reach this order? The analysis of the *translation process*, can answer *why* some actors are better at *enrolling, mobilising,* and making themselves somewhat *indispensable* in a network (ibid.).

Translations

Through the process of translation something is moved or replaced and thereby a pattern is created, which contains both order and disorder (Elgaard, 2003). When an actor is gaining power by associating themselves with other actors it is referred to as a "translation process" (ibid). By establishing themselves as a spokesperson where they can speak or act on behalf of others an actor is achieving power in a network. Before an actor can speak or act on behalf of other actors the actor must establish equality and agreement in the association to the actors they wish to speak or act on behalf of. When an actor can speak or act on behalf of other actors they become the "last link" in the translation process, until a new actor *moves* or *replaces* the current actor (ibid.).

ANT analysis strategy is to follow the translation process. When wanting to analyse a translation process, it is to the scientist favour that they place themselves in the middle of the network. In this way they can place themselves as was they the centre of the universe with stars, dust and stellar remnants as actors. ANT describes how different actors have different doings in the translation process (Elgaard, 2003).

Callon have further developed on the theory of ANT's translation process analysis. He parts the translation process into four different *moments* that actors go through when trying to establish and mobilise themselves as a resistant actor in a network (Elgaard, 2003).

We will now analyse on different "situation" from our time in the field on how an actor like MP Facade plants, the Copenhagen municipality and UN are going through the process of translation in regards to environmental agenda. This analysis will help us uncover some of the obstacles an actor can be met with when trying to change power mechanisms in a network. It can be a comprehensive and complex process and involves a great amount of actors. We have therefore chosen to "limit" our analysis within the timeframe were facade plants where "firstly" introduced through Danish expert literature. Through our literature research the earliest dated book, is the book written by Karen Attwell (Attwell, 1993). We have chosen to establish this book as the *"beginning"*. We are aware that the subject of facade plants has been a "phenomenon" before the publishing of this book, but since there is no or at least very little Danish literature to be found concerning facade plants as a technological solution to issues of sustainability before this we find it arguable to start from here on. The network surrounding facade plants and the possibility for it to become a sustainable nature-based solution is extensive, we have therefore chosen to mainly focus on the "actor-groups" relevant to the network of facade plants. It is due to a limited amount of time, resource and knowledge, that we have not been able to "uncover" the whole network that facade plants are being a part of. This is of course taken into consideration throughout our t*ranslation process analysis*.

Callon's four *moments* of translation can in reality not necessarily be separated, as actors in some constellations will overlap each others actions. We will go through the four moments of translation, *problematization, interessement, enrolment* and *mobilisation* (Callon, 1984).

In the four sections below we have chosen to elaborate how we through our time in the field have identified the four moments of the translation process. As mentioned before, the moments of translations do not necessarily come in a specific order in practise. Therefore, we have taken outset in four different situations.

Problematization (establishing the problem)

The first *moment* of Callon's theory of translations, is *"problematization". Problematization* refers to the state where an actor establish him/herself as an "*obligatory passage point*" in a network and makes themselves indispensable to the network (Callon, 1984).

The process of implementing facade plant as a sustainable nature-based solution in the urban environment of Copenhagen, is as mentioned before complex.

One of the reason for this, is that facade plants carries the need for "change" in the geographical space in which it is implemented. This is to be understood in the way, that when wanting a facade plant, the citizen has to dig a hole in to the ground.

When doing this, the citizen is "interfering" with other actors in network. When digging a hole in the ground the actors' of the citizen is by doing this becoming a part of the "municipalities network", since this "layer" of the LTS belongs to the municipality and therefore is an actor in their network. During an interview with Oleg Koefoed, the founder of *Green Pathways,* he states that even though the "upper layer" might be a part of the citizen private property the municipality is still having a say. He states that;

"It is called SB 110. It is a book (...) , such a set of rules that comes from the State that states what you are allowed and what you are not allowed on your private property. It is insane how much the State interfere in the law of private property, especially in the concern of construction" - Oleg Koefoed

It is through actions like these that the new relations between actors in a network is established. In the above mentioned situation the municipality makes themselves *indispensable* as an actor in the network of facade plants and the actor of the citizens' network, because they are the facilitator of laws and regulations. By making themselves *indispensable* in the network the TEA places themselves as an *obligatory passage point.* Without agreement from the citizens of Copenhagen to form a relation or alliance with the municipality, they will not be able to "enrol" the actor of facade plant into their network. The alliance between the citizen of Copenhagen and the TEA is to be questioned, since citizens of Copenhagen are choosing to dig and plant without permission from the TEA department. This could point to the fact, that the TEA departments attempt to become an *obligatory passage point* and make themselves *indispensable* in the network has not been fully succeed.

Interessement (building interest)

The second moment according to Callon, is the moment of “interessement”. In this moment actors are trying to form a relation and define other actors, by weakening their links and relation to other actors trying to define them in another way (Callon, 1984).

To elaborate further, we will analyse the way that MP weakens actors that do not define facade plants, as they wish for them to do. This is mostly actors that do not define facade plants as a sustainable nature-based solution in the urban environment of Copenhagen.

If we divide the moment of *interessement* in to relevant actors and capital letters, we will elaborate how actors like MP makes an actor like facade plants become a part of their network by “separating” from other actors.

If one were to say that actor “A” is MP and actor “B” is facade plants. Then actor A has a wish to enrol actor B into becoming a part of their network. For this action to occur actor A has to weaken the links and relations, actor B has to act outside of the network that Actor A wish to “create”. The reason for this is that actor A, wants to define actor B in a specific way and actors from the outside, might in the current moment define actor B differently. It is important to remember that within the theory of ANT, an actor is not defined by its “doing” but it is defined by actors around it (Elgaard, 2003). Therefor actor A have to separate actor B from other actors, in this case actor “C” and “D” (See figure 4.). This could be that actor “C” are the actors who are in the old belief that facade plants do more damage than they do good or in general do not acknowledge the environmental benefits of facade plants.

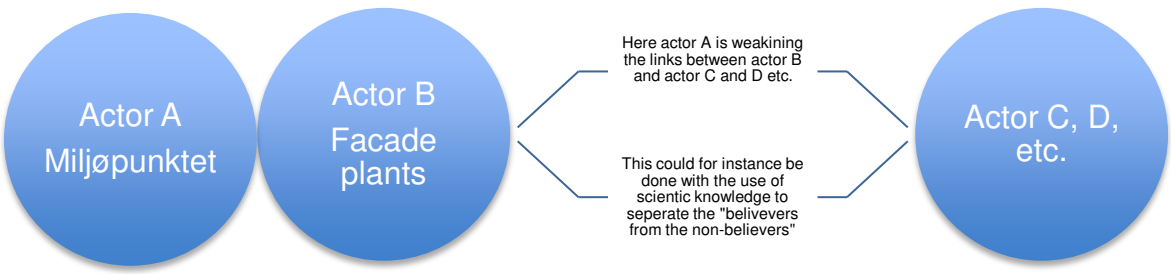
“But there are also many prejudices, for instance that facade plant gives rats in the ceiling. It is not true nobody knows that it is ruining anything but they believe it does” Jens Hvass

Jens Hvass sets an example of how some citizens due to a lack of knowledge have acquired prejudices regarding facade plants and believes that they do more damage than good. For actor A, to have actor B as a part of their network, it is necessary for actors A, to weaken the links between actor C and D’s prejudice towards actor B.

Actor “D” could be the actors who cuts of nature-based solution due to the fact that it might be hard to point out the concrete economical value of an actor like facade plants and therefore exclude this solution as their first, when having to make an economical cut. In an interview with Oleg Koefoed he states that;

“Yes green facades do not get a lot of space, but it is often included in the architect’s drawing (...) The green initiatives in the architects' plans make much more sense now than what see is today. But their suggestions get lost among other things because you cannot make an economic value. But companies have begun emphasis that it means more and more to be able to say, “now we are making green transition that follows the global climate policy of this business plan”. Oleg Koefoed

Actors A wants other actors to acknowledge actor B for its environmental and space rewarding benefits, instead of having it as a part of business strategy. If one were to look at facade plants in a economical aspect it might be an actor that have a long-term economic benefit, but as mentioned before can be established as a very low cost. Studies have proven that facade plants and nature-based solutions in general, can have an economical value, even though it can be hard to account for (Naturstyrrelsen.dk 2017) This could for instance be the isolation effect that facade plants have, that can save the energy usage in a household (ibid). One could also reverse the roles and place facade plant as actor “A” and MP as actors “B”. Actor A’s power position in the network would change if they got an actor like actor B into their network. No matter how you approach this specific above-mentioned situation the “interessement” moment is where actors find “interesting parties” to enrol into their network and then “cuts” of their supply to other actors in the network who defines them differently.



Figur 4 Illutration of actors A weakens the relation between actor B and C,D etc.

During this moment of translation Callon also introduces the term “interessement device” (Callon, 1984). Callon states that this kind of “device” can come in different shapes and forms, and be both human and non-human. The device is used as a part of the process

where actor A is trying to weaken the link between actors B and the actors C and D. In the situation mentioned above, one could perceive some of MP's actions as a form of interessement device. This could for instance be the aforementioned catalogue "Roses to the city" or their webpage, where MP in both cases argues for facade plants to be a highly beneficial actor if wanting to be a part of facilitating sustainable nature-based solutions in an urban environment. Both the catalogue and the webpage weakens the link between actors not acknowledging facade plants as a sustainable solution and the actor *facade plant*.

This thesis could also be an interpreted interessement device since it through the shape of a material form can part the "believers from the non-believers". It is important to mention that the moment of *interessement* is not necessarily a successful process and actors' actions do not always end up in "A, separating B from C and D".

As mentioned earlier in this section the moments of translation are not necessarily happening in the order that Callon present them and they can in practise be utilized when necessary and on different occasions. But in the order that Callon presents them the "next" moment of translation will be the moment of *enrolment,* which will be achieved if the *interessement* was successful (Callon, 1984).

Enrolment (strength through enrolment)

The moment of *enrolment,* focuses on how actors "enrols" new actors into their network by using different methods like "persuading", "luring" or "seducing" other actors to become a part of their network (Callon, 1984). Actors here assign new roles to new actors and the creation of interrelating roles are made with the actors who accepts their new role in the network. This could for instance be seen in our aforementioned 9th semester project. Here MP enrolled us as new actors in their network and instead of being "student", we were for a short timespan assigned the role as being a part of MP. This was possible due to the fact that we at that time had a mutual goal for the actor of facade plants.

Callon simplifies the moment of enrolment as a: "*group of multilateral negotiations, trials of strength and tricks that accompany the interessements and enable them to succeed" (Callon, 1984 p. 10)*

Through our research, we have had Callon's moments of translation in our mind, since it has been one of our theoretical analysis approaches. During an interview with MP, Marianne

Spang describes how MP has problems with the enrolment of new users of the “Roses to the city” project:

“We can see citizens are giving up. Sabine B. Sørensen asked some citizens who said “we have completely abandoned it” (...) and the next problem then becomes all those who have planted without permission because we must support the municipal work, even though we are a private fund” - Marianne Spang

Marianne Spang articulates how MP has issues with enrolling and “persuade” new actors into their network. The citizens that Marianne Spang refers to must be understood as actors not accepting the role that MP wishes for them to carry. This can be due to various reasons but one in particular is the lack off of a “mutual agreement” between the two actors.

Marianne Spang continues and elaborates how MP has issues with unauthorised facade plant projects. These projects are not a part of MP’s network because MP is representing the municipality. These illegal projects create a dilemma for MP because even though the unlawful projects are working towards the same goals as MP, MP still cannot support these due to their illegal implementation process. This can be interpreted as problems with the enrolment in MPs network regarding facade plants, as some find it easier to create a network outside of MP and the municipality in order to achieve their own goals.

Oleg articulates how visions and goals embodied in the UN’s global goal are being adopted by other actors in order to shape their approach.

“It means more and more to be able to say, now we make this business plan. Grundfos says, for example. No more now we make pumps, they say now we make clean water. So they say directly what global goals they follow.” - Oleg Koefoed

Grundfos has according to Oleg Koefoed embraced UN’s global goals and made use of the goals in order to align their goals and visions. If one were to look a Grundfos’ website, then it becomes clear how they not merely makes pumps, but that they through pumps adds the sustainable discourse made by the 17 Global Goals (Grundfos, 2019). According to Mads Nipper the CEO of Grundfos, the 17 Global Goals gives Grundfos the ability to enrol and ally themselves with new actors such as NGOs that that they could not reach otherwise (Søndergaard, 2019). In this way Grundfos accepted their new role in the network “defined” by the NGOs that Grundfos had a wish for becoming allies with.

This could indicate that the Global Goals for some actors can be perceived as an established *obligatory passage point* as they will not interact with actors who have not embraced these goals (Callon, 1984). This have a self-perpetuating effect as it only strengthens the global goals further as an *obligatory Passage Point*. This could also be seen as an example where material forms (scripts) enrols actors in the network and enable them to strengthen UN as a *spokesperson.*

Mobilisation (establishing power through mobilisation)

The fourth and "last" moment of the translation process is the moment of *mobilisation* (Callon, 1984). This moment is when an actor "gathers" the actors in their network, who's role they have defined through *interessement* and who they have been interrelated to through *enrolment* (Elgaard, 2003). Then when the relevant actors are gathered an actor will establish themselves as a "spokesperson" (Callon, 1984). When this establishment has taken place, the actor will be able to speak and act on behalf of other actors in the network.

To summarize this moment the moment of *mobilisation* takes place when the interest, goals and relations between spokesperson and other actors in the network is in order and forms a network (Elgaard, 2003). It is worth to remember, that a "single" network consist of a multiple of other networks and that these actors have been through their own translation process, and have their own *spokespersons* (Callon, 1984). Being able to speak on others behaves gives the spokespersons the ability to speak on behalf of actors with little to no "voice" and the actor with little to no voice gains the ability to be heard. One could argue that the environment is an actor with no voice, even though it might appear as the biggest actor "on the market". This is where organisation, politicians, institutions and a huge amount of other actors forms a network connected to the environment and the issues it carries.

UN published the 17 Global Goals and did in this way mediate their knowledge concerning global environmental issues. The 17 global goals were then "free for interpretation" for the individual actor to act on. When an actor like the municipality of Copenhagen adapted this mediation as a part of their *Agenda 21-strategi*, one could argue that the UN succeeded in mediating their knowledge to an actor from a different "level" in a the network concerning global issues and here by enrolling them. Once again this moment is a result of the three former moments where actors find interest in each other's goals and agrees on each other's roles in the network. Another way to meditate through material forms is ex. the way that MP

mediate their project on facade plants through a catalogue in paper form, that the local citizen of Copenhagen can collect at their office. With this action both the municipality and MP, established themselves as *spokespersons* on behalf of the UN 17 Global Goals and facade plants.

In the network that there were an analysing on, the UN can be seen as one of the macro actors, carrying a long and enormous amount of micro- meso- and macro actors. The reason for this is that the UN has established themselves as *spokesperson* on behalf of 193 actors, who in this case is the countries being a member of the UN. In this way the UN can be seen as a resistant macro actor, because they have established themselves as spokesperson for all the members of the UN and for the environment and the issues it holds. Institutions like the municipality and organisations like MP, has through their environmental work, further established themselves as spokespersons for the UN, since they are speaking on behalf of the 17 Global Goals. One could say that by writing this thesis, we are also speaking on behalf of the UN, the municipality, MP, the scientist and the environment, but on a micro-level. It is worth mentioning, that even though we perceive our self as micro actors in this network, we for some might be a powerful macro actor, because we through research, time and hard work, have enrolled our self into various networks concerning facade plants. ANT argues, that an actors can change position in regards of micro- meso- and macro-levels depending on which arena they are in.The actors position, is determined by the surrounding actors in the network (Elgaard, 2003). To us, UN can be established as a macro actor in regards to environmental changes but how resistant is UN as a macro actor, if the remaining 193 actors in UN's network do not follow through on all the other levels. Again the 17 global goals is a guideline free for interpretation to each actor. During an interview with Jens Hvass we came to terms with how it could be hard for the UN to ensure that their visions and goals are being worked towards through specific projects.

"I think there are so many thoughts in municipality, but I also find it very difficult to see how to make sure that the clear ideas and visions in the overall plans are maintained in the daily decisions. It is like one forgets that one has a biodiversity policy, a climate policy, and the right overall intentions, when standing with the individual landowners and having to make a local plan. (..) it is really difficult to get the overall vision to come through in every single decision. I think if you made an analysis of the decisions made in the municipal council since the publishing of the Global Goals, at least half of the actions would be in conflict with the intention of the Global Goals" - Jens Hvass

According to Jens, a least half of the decisions made after the introduction of the 17 Global Goals, do not follow the guidelines that they contain. This means that the visions and goals made by macro actors does not necessarily manifests itself in the actual projects made by “micro” actors that UN is supposed to speak on behalf and vice versa. One could argue that there somewhere in the translation process is an actor that have not agreed on their position in the network or agreed on the role that follows.

This insufficient translation process may require a redefinition of the scripts present in the network. The scientific knowledge and *intermediary objects* there as a *material form* through the translation process has been used to mediate the different actors goals, vision and mission, is created through the term ANT refers to as *scripts. Scripts* is that way that knowledge is mediated through material forms and the whole process of creating a *script* carries along several interesting specifications.

Mediating knowledge

ANT introduces the term *inscriptions device,* which is an “actor” that comes in the shape of ex. an apparatus or material forms (Elgaard, 2003). This actor can transform a substance or other elements into a set of *“inscriptions”*. This could for instance be the “unit” that the scientist from the article “air pollution” used to transform stomate in to air particle statistics. If this inscription device did not exist the scientist would not have been able to write an article that could prove the hypothesis that facade plants have a positive effect on air pollution in an urban environment. In this way facade plants might not have been recognised just as much for their qualities and we might not have found it relevant to write a thesis on a lone standing actors like facade plants. This was just an example of how a scientist with the use of a *inscription device* can be a part of changing an actor’s “destiny”. Between the case of facade plants a sustainable solution in an urban environment there have of course been many more *inscription devices* and scientist than the one just mentioned. The more scientist who “accepts” the statement that “facade plants could be a sustainable nature-based solution in an urban environment” the more an actor like facade plants becomes resistant. There is due to a rotation in the power mechanism and the matter that more actors are *enrolled* in to the network of facade plants and accept the facade plants role in their network.

When scientist like Alistar C. Lewis and Saumitra V. Joshi speaks and act on behalf of other actors, in this case facade plants, a scientist fact can become constructed through the *an inscription device* (Elgaard, 2003). That is why ANT do not acknowledge scientific facts as discoveries but as constructions in a network made of *inscriptions devices*, literature and theories (Elgaard, 2003). This thesis could also be understood as a part of the facade plants' network because we speak and act on behalf of many of the former scientist studies and work that have been used as a part of the research that we have studied. So according to ANT, the strength of facade plants is not *in this* actual thesis but in all the relations that we have established throughout the writing of it. Translation is in short all about creating equality and relations where there before was inequality and no relations. The finished result of the aforementioned by article Alistair C. Lewis have written on the background of his findings, will in the end be referred to as a *script*, were an *inscription device* is a tool one can use to form the script. A script is a process of various steps, were the "designer" have what it referred to a the "prescriptive force", "inscription" and in the end the receiver will "descript", what the designer have formed of the two former "steps". The process is relevant and important to us, since the making of the *script* is a way for actors to mediate and enrol new actors to their network. As mentioned before, during our ninth semester we became a part of MP's network in the process of trying to analyse how MP mediated their knowledge concerning facade plant to the "locals". After our finding, we got the opportunity to re-design MP catalogue belonging to the project "Roses to the city".

Part conclusion

In the process where relations are formed, actors are creating alliances through their actions. The more allies an actor has, the more "mobile" the actor becomes. In the translation process an actor uses various inscriptions to persuade other actors to become an ally, it is in this way actors changes or replaces their position and the power mechanism in a network. By analysing, using LTS and ANT, we have discovered the importance of the translation process, when actors on "different levels" want to pursue a common goal. In the following section we will have a discussion on the merits of facade plants as a solution, which the purpose of defining its place amongst nature based solutions, but likewise also put it into context of sustainability. With this we then intend to propose solutions to how one can work with should be further emphasized.

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Exploring the idea of a paradigm shift

This section serves as a discussion on the effects of new nature based solutions into urban environments and defining the unique role that facade plants can have in this regard.

Outside pressure from nature-based solutions creates scenarios in which existing infrastructure and ways of thinking are challenged making evident a black boxed way of thinking that could be seen as the “Nature in the City” paradigm. In much the same way as with the concept of *reverse salient*, in which certain aspects of a system does not keep pace a black boxed way of thinking about nature in the city seems to have be made evident due to this pressure.

We want to challenge the current paradigm of “Nature in the City” and propose the idea of a “*NatureCity” paradigm*. Before venturing into this subject we are first and foremost going to give a brief introduction on the concepts of paradigms and black boxes, and especially in terms of black boxes how we conceptualize them a little differently than how they are typically used in ANT.

Paradigms

Paradigms and paradigm shifts are terms first introduced by the philosopher Thomas Kuhn and they describe how an existing way of thinking can be replaced with a new way of thinking. Kuhn’s focus was primarily in the scientific realm, in which he described the process of when “normal science” became incapable or insufficient in terms of problem solving. It eventually becomes replaced by a new paradigm more capable and sufficient in terms of problem solving (Kuhn, 1962). We find that this concept is easily transferable to other contexts outside of the internal scientific realm.

Black box

The term “*black box”* is central to the theoretical framework of Actor network theory. It refers to any given artefact which inner workings and complexity has been obscured by its success or well functioning. If an artefact is functioning properly it negates reasons to question it, thus reducing the given artefact to a series of inputs and outputs *(Cressman, 2009*). Inherent in

ANT is the wish to open these black boxes so as to question the self-evident nature of their function unveiling a complex network of actants interacting to form a cohesive whole.

“Opening the black box of technology leads the way to an investigation of the ways in which a variety of social aspects and technical elements are associated and come together as a durable whole, or black box.” (Cressman, 2009).

Multiple aspects of the project beg to be examined through this framework. “Black boxing” is at the same time also a goal for us since we wish to contribute in terms of establishing facade plants as a sustainable nature-based solution in the urban environment of Copenhagen.

Black boxes usually refer to a technical object. We instead want to conceptualise the black box as what could be called the “nature in the city” paradigm.
But is it possible to alter the context of how black boxes are traditionally used, while still staying connected to the theoretical framework?

As mentioned before that for something to be a black box it in short terms have to have some kind of inner working an input and an output. When something is not working as intended, the black box is to be opened up, investigated and fixed.

If we imagined a car fx. as a black boxed artefact or piece of technology with an input and output, the black boxed nature of it, would become apparent and the inner working in need of examination, if a component malfunction caused it to seize to function or perform insufficiently all of a sudden.

On an abstract level if one were to “open” the black box of Copenhagen relation to nature based solutions, and take a look at it’s inner workings, with the intention of fixing it one might have to “switch” or “replace” one or more components. For one to “close” a black box the inner working of it has to be fixed, but to fix something does not necessarily mean to use the old components. In much the same way as with the concept of reverse salient, in which certain aspects of system does not keep pace, If the old components has run out of steam due to a “modernisation” or “change” around the black box the component in the black box might have an advantage if “replaced” instead of “fixed”. If we once again use the car analogy this would be like replacing a car running on fossil fuel, with an electric car instead.

So could it be possible to open the “black box of Copenhagen” and “replace” the old paradigm of “Nature in the City” with a new paradigm called “NatureCity”.

The defining idea of this paradigm is the self-evident nature of the separation between “nature” and the “city”. With this we mean the idea that nature parks or pocket green spaces are the most common way of integrating nature in cities at a certain scale.

In the municipality of Copenhagen particular emphasis has been put on the importance of the “green oases”. These are intended as places in which it is possible to escape the otherwise bustling metropolis. These can come in multiple shapes and sizes. The parks of Copenhagen, such as Fælledparken, Kongens Have or H.C. Ørstedsparken are such examples.

“Pocket green spaces” are another initiative, which has been of particular interest. These are green spaces, typically less than 5,000 square meters and are intended to replace surplus spaces, which are not used for anything else (Teknik & miljøforvaltningen, 2009). In a document called *“LOMMEPARKER, TRÆER OG ANDET GRØNT - strategi for et grønnere København”* made by TEA, one of the goals is that 90 percent of the resident of Copenhagen has to be able to be in a walking distance of 15 minutes or less, to reach a nature area of some kind, which include parks, beaches or "harbour baths”.

This paradigm thus has what we would describe as an inherent horizontal focus. Meaning that these initiatives largely focus on making horizontal spaces into shared community green spaces.

By proposing alternatives, we in no way want to downplay the importance or traditional green spaces, but instead pinpoint where the current focus is. Interesting discussions can be had in regards to how one conceptualises the integration of nature into urban environments.

One of the potential downsides of this paradigm is the conflict in “fighting for space”. Multiple aspects can be examined/mentioned in this regard. As previously established, the number of inhabitant of Copenhagen is on the rise, which needs to be facilitated by housing and functional transportation spaces for both pedestrians and motorist. Additional green initiatives such as the municipality of Copenhagen's plan to have 100,000 trees planted in Copenhagen by 2030 for instance, could pose issues of this kind as well. The limited

horizontal space, combined with the existing ways of using this space, poses a problem, since these trees are either going to take up space on the sidewalk or on the road, which we argue could partly be solved by emphasising the use of facade plants, which represents a vertical approach. Again we do not propose a shift from a horizontal focus to a vertical focus exclusively, but a lot of potential benefits could be in a horizontal-vertical focus in regards to nature-based solutions. The characteristics of the current paradigm is one of clearly defined borders between nature and city. The new paradigm proposes a shift to one with less defined borders between nature and the city so that many of the positive properties of nature can be more evenly distributed. Facade plants are an ideal candidate for this purpose, since, the utilize the inherent abundance of verticality of the urban environment. Although we propose this kind of transition we have had a focus on nature based solutions, which is only one of the ways of Approaching sustainability in the city.

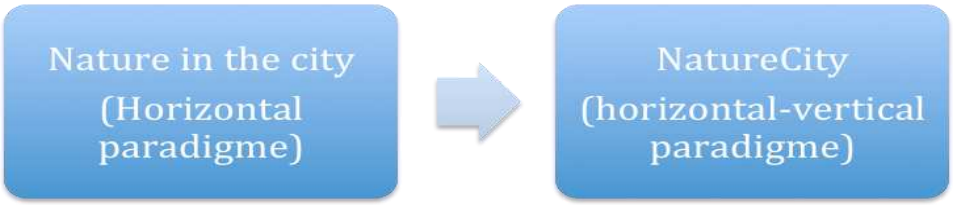

Figure 5 showing the transition from one paradigm to another

As previously stated many terms and definitions exist in regards to “sustainability” and rightly summarised in the article ‘Nature-based solutions’ is the latest green jargon that means more than you might think” (Nature Publishing Group, 2017) nature-based solutions are just one of the more novel ones. Difficulty can be had trying to navigate all of these terms and definitions, due to the fact that although they overlap they do not always mean the same, and even those using the same terms might approach their implications differently.

“Many people seem to have an ideal for Copenhagen, which celebrate everything which it is not. There should be more trees, higher to the heaven, more space between houses and the people. All of this is the qualities of being on the country, but a city becomes environmentally green and sustainable by all of the opposite. It is in fact all of the people, the dense and

compact mass of buildings, houses and work places all confined and fitted together in as little space as possible, which turns the city into its most climate friendly form" - Simon Kjær Hansen.

In an article Simon Kjær Hansen stated the above quote in broad strokes (Hansen, 2018). C40 is an organisation, which works with addressing climate change, by creating networks of influence between cities across the world. At the time of writing 94 cities are members, each of which represented by the given mayor of the respective city.

The quote itself represents the fact that there are multiple ways of thinking about sustainability and although each of the properties of facade plants might contribute in terms of solving issues of sustainability, sustainability as proposed by Simon Kjær Hansen does not involve nature-based solutions. The focus which he represents and he further elaborates on in the article is one in which the compactness and density of the city is already counteracts climate change by making the use of cars ineffective as transport and the energy usage of each household being less than in more rural areas, thus adding less to overall carbon emissions. People living in the city should accept it on its premises or go elsewhere. He himself seems to be at odds with the current initiatives of transforming unused spaces into more greens oasis, thus also opposing the nature in the city paradigm, stressing the fact of a growing population in need of housing. However, the solution proposed takes on an altogether different form from the "NatureCity" paradigm this once again adds to the discussion of what a city should and should not be, and it shows how the quest for sustainability can take many forms.

However, in the current paradigm nature still plays a role in terms of sustainability in the city. Facade plants find themselves in a bind in terms of who should take responsibility for their further mend. We were interested in uncovering whether or not it was possible to push facade plants on a regulatory and policy level. During our interview with Oleg Koefoed, we asked him if he thought this was possible and Oleg Koefoed replied:

"The short answer is yes, of course you both can and should do this.(…)(…) what you use legislation for is a huge political and ideological question. Some wants to use legislation only a little, some want to use it constructively, and some want to use it preventively and defensively, and whether or not u want one thing or another in individual cases varies all across the political spectrum." - Oleg Koefoed.

We were interested in getting closer to the source of these regulations, and we ended up having interviews with two politicians, those being Jacob Næsager from The Conservative and Unionist Party (Konservative) from and Mette Annelie Rasmussen from the Danish Social-Liberal Party (Radikale Venstre). We found it important to obtain regulatory insight from at least both sides of the political spectrum, although we are aware that opinions might vary more and give a more representative description if more politicians were included from various other parties. We found that the willingness to directly intervene in matters of regulation pertaining to "forcing or pushing" facade plants on residents of Copenhagen diverged between these two actors. As suspected and indicated by Oleg Koefoed what and how to use laws is a highly political subject matter. Both of them were in agreement that sustainable nature-based solutions were of great importance, but how to implement these specifically in regards to the legislative and regulatory tools used was in conflict with one another.

"There is a host of demands which we are not able to set, with the current "planning act" (Lov om Planlægning) in terms of how houses and buildings should take form and we are also pressed in terms of the demands we can make to the requirement of "greening" and currently we are running against a wall with this (…) (…) we can make the demands in the municipal act about some things but the greening we can only wish and hope for. We (Radikale Venstre) would like that we had more green tools looking forward and we would like to have a look at the planning act again so that we can make it better facilitate green transition" - Mette Annelie Rasmussen

Mette Annelie Rasmussen was of the opinion that current legislation and regulation does not provide sufficient tools, in order to push nature based solutions in a top down perspective. According to her actors at the policy level are lacking behind the common people in regard to rising to the responsibility of dealing with current issues of sustainability.

Jakob Næsager, however, is more sceptical of such an approach and instead proposes that the top down approach should be limited to function as an encouraging force.

"Legally we have the means to make the demands in the "local act" (Lokalplanen) but in practical terms we do not see it as a smart way of going about things. We would much rather prefer an awareness campaign in regards to what is appropriate and what would be good

and effective, and then try to motivate the landowners and developers to use the methods" - Jakob Næsager

Without including much nuance into this distinction between the respective statements, popular sentiment of whether there should be more or less top-down approach or amount state interference seems to be upheld by the respective wings of red and blue dichotomy. However, Jakob Næsager explains the reluctance to want to engage in this kind of initiative slightly differently.

"The challenge is that the demands that we make today, will be of the materials choices of today, and that can have an effect on the longevity and well being of the buildings which they are implemented on. So if we make demands now and a development of materials or other smarter things develop then (...) (...). The way that we regulate is through the local act and if that stands for 80 years, and we have been very specific with our demands, then it would relatively quickly become obsolete, and it takes a lot of time and money to develop new "local acts". Jakob Næsager

Jakob describes how making very specific requirements, could have the implication of making them obsolete quickly, in regards to an ever growing and changing knowledge and technology development. One of the balancing acts of the current local acts are thus, to steer people in the right direction without making requirements so specific that would render people less adaptable to new technologies.

However, Jakob Næsager and Mette Annelie Rasmussen both seem to be in opposition to the viewpoint presented by Simon Kjær Hansen, in the way that they both seem to value nature's role in the city. The implications of their viewpoints leads to two ways of approaching the issues. A top down approach and a bottom up approach. Although there definitely seems to be some overlap between the two. In the sense that Mette Annelie also endorses and want to stimulate local initiatives. However, in her opinion the motivation of the public does not seem to be lacking, and more action at top level seems to be warranted. In terms of Jakob although he does not want strong regulation warranted by a concern of running into "dead ends" so to speak, he does not exclude the possibility of "nudging people" or giving incentives in terms of moving in one direction. Not top down or bottom up are mutually exclusive and a paradigm shift from nature in the city to naturecity, spearheaded by facade plants would undoubtedly include both approaches.

Part conclusion

Facade plants is an ideal candidate in terms of introducing nature-based solutions into an urban environment like Copenhagen. Although they have their own hurdles to overcome as previously established. Although they are not novel in the context of their longevity through human existence, their technological contribution in terms of contributing to sustainable change is just beginning to take form, and we find that it shows great potential in this regard. However, discussion is still to be on nature-based solutions place in the city. Many different paradigms contribute to different forms of sustainability. In terms of furthering nature-based solutions and specifically facade plants, both a top-down and bottom-up approach seems to be warranted.

We will therefore in the next chapter introduce a “bottom-up” approach to how we as researchers through the use of scripts can become a part of the translation process, change power mechanism in the network and ally us with various actors. We see the need for both a “bottom-up” and a “top-down” approach, if the thought of implementing facade plants as a sustainable nature-based solution in the urban environment of Copenhagen has to be realistic

We see the need for a “bottom up” approach to be a part of the establishment of facade plants as a sustainable nature-based solution. At the same time we see the need for a “top-down” approach and will also come with a suggestion for that, in the chapter *“Bottom-up, Top-down”*.

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“Bottom-up, Top-down”

Approaching the creation of knowledge with action research

As mentioned in the former chapter, we will now come with a proposal for both a “bottom-up” and a “top-down” approach to how an actor like facade plants can become a sustainable nature-based solution in the urban environment of Copenhagen.

As stated before, during our ninth semester we gathered data with the thought of investigating why the locals did not use MP’s offer considering facade plants. We came to the conclusion that one of the reasons for this was the catalogue was not established as a strong mediator between MP and the locals. Then, during our tenth semester we got the opportunity to re-design the catalogue and the information that it contained. This gave us the opportunity to approach it with the aforementioned ANT term of *scripts.*

Creating a *script* is a way for one actor (*the designer*) to mediate knowledge to another actor. The “steps” that we as the designer in this case have to go through in the process of creating a *script* will be elaborated for in this chapter. Before this is done, we will explain how we approached the process of forming a *script* with the approach of *Action Research.*

The reason for this is that the Action research approach contains democratic and inclusive values (Andersen, Bilfeldt, Jørgensen, 2014). This gives the designer the opportunity to create knowledge through co-production (ibid). A researcher can through the action research approach, empower actors in a network. Actors can be empowered both horizontally and vertically (ibid.)

When being empowered horizontally MP for instance takes in actors as a part of their organisation, who can be beneficial for their network. This is what could be defined as a “horizontal empowerment”. When an actor becomes horizontally empowered, their chances of becoming vertically empowered also increases (ibid).The vertical empowerment is to be understood as a “upwards” going empowerment. For instance the more actors MP have in

their network, the more resistant they become as an actor. This resistance can be “used” to make a “upwards” action by fx. being heard by more mobilised actors.

Since we were aware of the importance of both MP’s need to mediate their knowledge and the locals need to understand it, we knew that it had a great importance to use parts of the data gathered on our ninth semester to shape this specific *script*. Action Research aims for the researcher to actively take part in the shaping of collective actions and forming of knowledge (Andersen, Bilfeldt, Jørgensen, 2014). With the approach of Action Research we together with MP and the data gathered from the locals, made a shared understanding of which kind of knowledge the *script* were to carry.

Facilitating buttom-up through the catalogue

The Roses to the City catalogue can be downloaded on the MPs webpage. It serves several functions, trying to answer “what”, “why”, and “how” questions relating to facade plants. It intends to inspire the reader by giving information on the positive properties of facade plants, and then list several good plant options for facades, and their individual properties, and needs. The catalogue also describes the process and what one should be aware of in a step by step manner, in regards to facade plant projects. In our former project we established the catalogue as an intermediary object between MP, the locals and other relevant actors. It intends to function as a means to build networks by linking MP together with locals under the agenda of expanding the use of facade plants in Copenhagen (Law, 1991). The information it contains, how it is perceived and what is omitted is potentially very important in regards to whether or not the intentions are fulfilled. MP’s position as a intermediary object between themselves, the locals and other actors, is a part of the bottom-up approach, since MP is enabling the locals to facilitate actions on their own.

During our collaboration with MP in the previous semester it became apparent, that one of the things that they were interested in doing in the near future, was updating their facade planting inspiration catalogue, and in this regard they were very interested in having our input on how it should be updated. In the period between semesters we actually met up with Marianne Spang from MP to discuss some of the things, which we had identified could be included or changed in such an update. Instead of actually going through our input in depth, she instead proposed that we had access to an application, called *Indesign*.

Indesign

Indesign is a design software application made by Adobe in 1999 (Smith, 2018). It can be used as a tool to create layouts, both for print and digital publishing. It gives tools to combine pictures, text and colour into simple illustrations (Smith, 2018). Indesign has a wide range of tools that can be utilized when working with digital publishing. An example of this is the use of hyperlinks. Hyperlinks makes it possible to connect different actors by e.g. linking directly to a website. This can also be used as a tool to ease readability, since it can make it easy to find exactly what you are looking for. However the problem with these implementations is that they require the catalogue to stay in a digital from, as their functionality are anchored in the digital world. Indesign seeks to become a platform where one can combine other tools made by Adobe such as Photoshop and illustrator. This makes Indesign very flexible in its uses.

We were very interested in this opportunity. Making the new catalogue was also a chance to put action research into practice. During our former project, action research was heavily integrated into our project, but due to time constraints being able to focus on the catalogue in depth in this regard eluded us. By incorporating the insight and knowledge provided by various actors, being MP, TEA and the locals into the design of the catalogue, we intend to make a co-produced product, which in various ways empowers the relevant actors. We therefore insisted on conducting an interview with both Marianne Spang and Sabine B. Sørensen, in order to properly discuss what kinds of changes both we and them were interested in implementing. In this way the catalogue would be a co-producing effort between MP and us as researchers, trying to also represent the locals and the municipality of Copenhagen through our previous interviews conducted with them on our ninth semester (Andersen, Bilfeldt, Jørgensen, 2014).

Viewed in an action research perspective, the enrolment of us as researchers into MP's Network, helps to vertically empower them (Andersen, Bilfeldt, Jørgensen, 2014). Our competences, combined with the fact that we are essentially a free workforce, uncovering new knowledge that might prove useful to them, makes us valuable allies to them. Likewise we are empowered by MP, through both the expert knowledge we receive through them, the contacts they contain, and the credibility which they give us, when reaching out to potential informants. We adopted the agenda of MP by working with them to improve their catalogue, which with or without our help had to be renewed. At the same time we retain our role as

independent researchers by incorporating the knowledge and input of other actor groups in order to create changes based on a democratic methodology (ibid).

The original plan was to borrow one of MP's laptops which had indesign installed on it, and work of that. Due to the fact that this laptop was not allowed to be removed from MPs offices, this would limit the opportunities we would have to use the application. Another small but not insignificant problem besides the fact that the computer itself was old and slow was that once we booted the application we were greeted by an interface straight out of the nineties due to the fact that the laptop was running an old version of the application. Since the catalogue had been designed by a third party professional outside of MP, we were not going to be able to learn how to actually use the application from any of the employees at MP. This prompted us to use the internet and specifically YouTube tutorials as guidance. However, most of the instructions we were able to find were using a more contemporary version of the application. This eventually led us to decide that we would install the application on our own computers, in order to have a more updated version. The problem with this was that the licence required to run the application was quite expensive. Our last option was to use a trial version lasting a week. We decided to use the trial version and take turns in intervals having it installed giving us a time frame of 3 weeks to have it done.

Using Scripts

The following section will outline the various changes that were made to the catalogue and rationale for doing so. We chose to approach the renewing of the catalogue with Akrich and Laws theory about scripts and with the "guidance" of Jelsma, to form the actual script. We place ourselves as the designer in the making of the script and perceived both the Locals, MP and TEA as co-creators of the script.

During the process, we came to notice the importance of studying the conditions and mechanisms, which would define how "society" was able to reconstruct our knowledge (Bijker & Law, 2010). To ensure and understand this process it is important that we constantly move between "the technical", which in this specific case is the catalogue and the renewing of it and "the social", which is the locals/users and other human actors involved in the network. Also moving between "the inside" and "the outside" of the technical and the social, is of great importance to the studied object. This process is not something which is

quickly done, it takes knowledge and understanding of the actors who already are or ought to be involved or enrolled (Bijker and Law, 2010)

As previously stated during our previous semester, we worked with “Roses to the City” and tried to clarify, why the citizens of Copenhagen did not use the offer from MP concerning the project “Roses to the City”. During this project it became clear that the way the information concerning the project was communicated by MP, was in some cases not received and understood as needed by the locals. The information from MP concerning *why* and *how* to establish a facade plant, was in addition to verbal communication also communicated through their catalogue, also called “Roses to the City”. We saw it as necessary to renew and change it, because we through our earlier project became aware that the understanding of the catalogue and the information that it carried did not work as intended.

Sociologists of Technology and the world surrounding it, have argued that the characteristic of an object have to have a hypotheses built around it (Jelsma, 2003). For some this is necessary because one has to know which kind of arena the object is being placed into. The “designer” has to define the actors, who are in the arena the object is inserted into. These definitions of course vary depending on what the object is and what arena it is being inserted into. Most likely it is definitions as competences, motives, political prejudices, economy and knowledge. These definitions, gives the designer a partial prediction of the arena and thereby increases the chances of the object to succeed. The end product of this process is referred to as scripts. The whole process of “building” a script upon an object and its surroundings, is an attempt to predetermine the outcome at the bottom-level.

A script defines the objects framework of actions and the space they together with actors, are supposed to act in (Bijker and Law, 2010). As mentioned before, we as designers have to move back and forth between our project; in this case the new catalogue and our “projected user” and the “real users”. So moving between the world inscribed in the object by the designer and the world described by the user (ibid.).

The data we gathered in our previous projects indicates, that some of the boundaries of applying for facade plants are to be found in the catalogue. This is due to the fact, that the information MP has put in their catalogue is not perceived by the local as intended (Faber Reffeldt, A., Helmershøj-Johnson, M. and Loldrup, M. 2018). For this reason it could be beneficial to use the data gathered from the locals, because as it can help configure the

user, so he or she reads the object in the intended way and understand the requirements better (Bijker and Law, 2010). By using data and knowledge about the user to form a script you can empower the object and the structural features the script holds, because an object is empowered and represented through the script. All these thoughts are referred to as the *"prescriptive force" (*Jelsma, 2003*).* These are mainly thoughts concerning the design of the catalogue. Then there are thought concerning how to shape and design the project in general. The script also has to contain elements that motivates the user to go through the process of behavioural changes and commitment to these. In our case it calls for the need to motivate the locals of Copenhagen to go through a behavioural change, in their thoughts of the importance of a greener Copenhagen. In order to facilitate change through a bottom-up approach, the actors on the "bottom level", has to desire the change. This desire can act as a motivation factor that gives the actors a reason to align themselves with other actors and work towards a shared goal from the bottom and up.
A greener Copenhagen can be created and described in various ways, but we have chosen to keep our focus on facade plants and how to make the establishment of this a rather simple process.

When a locals decides to get a facade plant, they have to go through various kinds of processes. They have to decide what kind of plant they wish to grow and if it has to grow from the soil or from a flowerpot. They also have to decide who takes the responsibility for maintaining the plant and that every plant requires different levels of maintenance. All the decisions and many more must be presented in the catalogue in a manageable way, where information is turned into knowledge. The prescriptive force is used to both build on knowledge from the users, but is also built on the fictive users. The fictive user is built on the new users we wish to enrol in the network and on the vision of a new target group. When creating a fictive user, one has to take in to consideration that the user might be mistaken or incomplete, which can lead to a misfit between the way we wish the user to perceive and understand our script.

The prescriptive force, is the foundation of the actual "*inscription*" which has to be made. The inscription is the process where the designer shapes the prescriptive force to fit and become a part of the artefact/object. When using the prescriptive force to make a first draft of the catalogue, the actual process of using that draft for the final catalogue is referred to as the process of inscriptions. When these final inscriptions are made, the goal is that our

predeterminism thoughts in the prescriptive force process, matches the *"description"* of our script. The description is the way the user in this case the locals interpret and understand our script. This is the "moment of truth" where the designer will know whether or not they have foreseen the outcome of their object. In our case, it would be if the locals got highly motivated by the catalogue and saw the process of facade planting as simple and if new actors find interest in the more general part of facade plants instead of only roses.

It is of great importance to have in mind that this is only *one* script, in a landscape full of scripts, all with the opportunity to be taken up for different interpretation. For this reason, we are to understand and think of a script as a mediating concept and not as a deterministic one. MP's catalogue is up for interpretation, but does still have to be kept in a certain "arena". MP, Copenhagen, Denmark and the world is full of scripts. Some of them are still under construction, while others are from the past, guiding and supporting the way specific actions work today. Jelsma argues that:

"We could portray ourselves as acting in a scripted material landscape, constituted by networks of artefact with which we live together" (Jelsma, 2003)

Jelsma (2003) refers to these networks as *"infrastructures".* These infrastructures can guide individual actions if they can be understood and read. One might argue that MP and the facade plant projects are in the need of a more established infrastructure in its surroundings. Jelsma (2003) states that our techno-material infrastructures are social-cultural phenomenon at the same time. This points to the fact that techno-material infrastructures has a big importance for the shaping of a socio-cultural phenomenon and the change within. One can argue that for us to "change" and shape the socio-cultural aspect of a greener Copenhagen by using facade plants, the techno-material infrastructure like e.g. the catalogue and the infrastructure surrounding MP has to be in order. The in-between of the techno-material and the social-cultural, is by Jelsma referred to as the "*socio-technical*" landscape (Jelsma, 2003). This landscape reflects our society's dreams, desires and ideas, but under the political compromise. Organisations like MP and other environmental organisations all has a vision about a greener agenda for Copenhagen and Denmark in general. But due to things like public economy, public cuts, political legislations and different political priorities, a "simple" task as facade plants, becomes a rather complex project to follow through.

The landscape is a result of earlier inscriptions and their details. The official “Agenda 21 strategy” is an infrastructure created from hundreds of scripts, created and inscripted by hundreds of people. MP is inspired by the Agenda 21 script and have by this inspiration made their own script. From MP’s script, we have created a script inspired by the prior scripts in the landscape. These are just a few scripts, and they all have different meanings for the landscape that they are a part of. They all carry different gradients for behaviour and what there is desired or not.

Jelsma (2003) argues that the designers tend to follow the old patterns of the landscape, because we so heavily rely on our infrastructure and that without it, we would be lost. The world as we know it today, stands in front of a big change, as the morality of sustainability is emerging. This change means that the infrastructure is changing and the behaviour and the landscape we are in now is going against this new morality. Therefore, Jelsma (2003) argues that the landscape has to be reinvented. Organisations like MP and other environmental organisations all fight for the reinvention of this landscape and the scripts they hold. The reinvention of this landscape would not only require changes from the locals on a micro-level, but would also require changes on a macro-level. Jelsma (2003) states that the government appeals to behave eco-friendlier, but due to high costs in terms of time, effort and money the changes were never made. But by inscribing the new morality we foster the distribution and embedding of new norms and values, by giving them material bases.

Redesigning the Catalogue

In terms of the changes made to the catalogue, they vary from big to small. Simple things such as the order the information was executed in what could be beneficial to change. e.g. the big question of “why” to get a facade plant first came along on page 16 of a 23 pages long catalogue. We thought of this information as being a part of some of the most important information and therefore chose to move it along to page 3, since this is the piece of information that are to argue for the whole process the local is about to go through.

The original idea for the “Roses to the City” project came from “Copenhagen indre by christianshavn” local committee and was as the title of the project suggest centred around the use of roses specifically. In our last project we concluded that the “Roses to the City” project could benefit from a broader approach, in order to make it appealing for a larger part of the locals. One way to do this is to move away from roses as the primary point of focus.

During our interview concerning the future of our partnership it became clear that MP likewise have had these ideas but where constrained by the municipality's vision of the project as solely a rose oriented project.

“it is because of Sabine that this catalogue reflects much more than roses, in the areas which is about greenery, and we shouldn't forget Peder as well” - Marianne Spang

The initial envisioning of the project was focused on roses only and it was only because of Sabine B. Sørensen the Project Manager, that any other specimen of plants was incorporated into the catalogue. Her reason for this was the following;

I think that they had an idea that it was roses that had to be planted in here (indre by/ Christianshavn), because they (the local committee) had some good examples from Krusemyntegade. It is very idyllic, but we have also met people which are saying this is the capital and not some Morten Korch idyllic fantasy, and that is why we have used other examples as well” - Sabine B. Sørensen

Sabine B. Sørensen acknowledges in the above statement that people might have different preferences on what constitutes good facade plants.

A script will encourage a certain kind of user, to take a certain kind of action, while preventing others. In our case, we are to reconstruct the “Roses to the city” catalogue and the project itself. Due to our previous knowledge, we are aware of some of the “do” and “don’ts’” , and thoughts and ideas about the project have been added, while others have been removed. We together with MP decided to change the title of the catalogue from Roser i byen (Roses to the city) to something else. This choice was made in the belief, that “Roses to the city” narrows down the target group. Originally we were contemplating changing the name to *“Facade plants”* but we instead deciding upon the name Farverige facader (Colourful facades) because that both MP and we wanted to retain the less formal nature of the original title while also broadening its reach. The original name indicates that for you to get a facade plant, it has to be a rose. By changing the name of the project to “Colourful Facades” the target group might expand to locals who have a more general interest in plants and greens and not only roses (see. figure 6). The vision and mission is to expand and upscale the target group and enrol new actors into the network. It can both be actors who can be a part of scaling up the project on more practical terms, but also organisations and institutions who can link to new relevant actors and locals who can “spread the word” and thereby expanding the network from a bottom-up perspective. Of Course by broadening the focus from roses to also include other plants, meant changing several passages and

headers throughout the catalogue as to now reflect this, making it quite an extensive makeover.

One of the most important changes we wanted to make to the catalogue was to further emphasise the importance of obtaining permission from the correct authorities, when wanting to plant on ones facade. In an interview with TEA this point was brought up as Response to Marianne Spang from MP. Sabine states;

Figur 6 shows the new frontpage of the catalogue

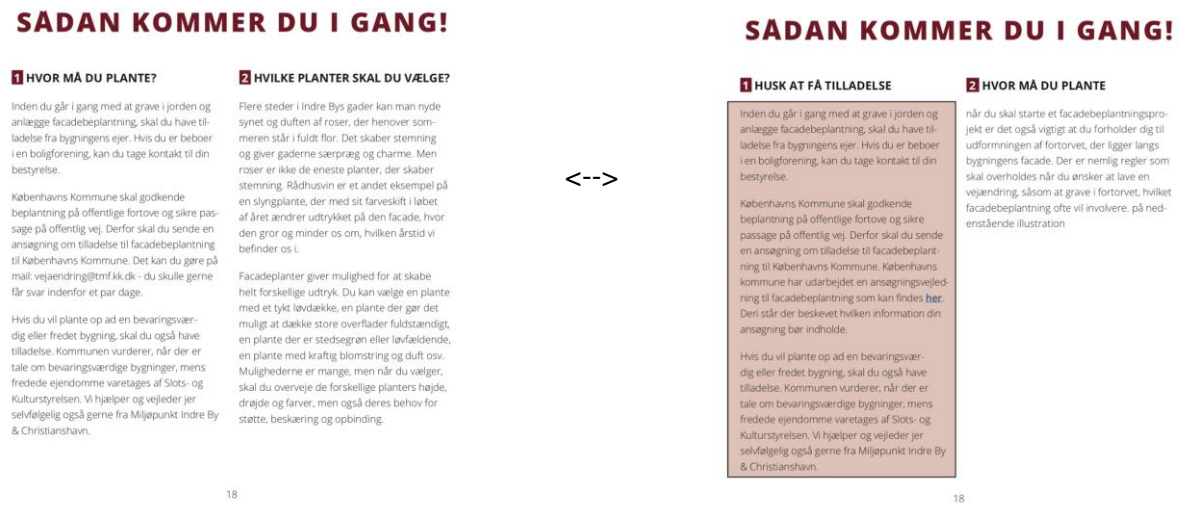
I can see that you have a good application for a grant scheme, but it does not appear very clearly when u have actually gotten the grant, what u have actually gotten a grant or permission for, or what i am allowed to do. i would wonder that if it was me. because u have to read the catalogue and quite far into it at that, and written in quite small text, to see okay this is the place where i have to ask for permission. maybe it could be further emphasised that when you have gotten the permission for a grant from you that the applicant should also send an application to us. - Sabine (TEA Vejændring)

According to TEA, MP could more clearly communicate the fact that applicants should also apply for permission from the municipality. During some of our interviews with the locals this notion was also evident.

"Ditte: It is funny that you mention it, i don't recall having written or filled a municipal application. I only used the one from Miljøpunktet.
Us: But that doesn't have anything to do with the municipality.
Ditte: Yeah but you don't need that right. we have gotten permission just from the one form?
Us: But have you gotten permission directly from the municipality?
Ditte: No but we have gotten permission from MP. "- Ditte

It is important to note that going forward MP will no longer be offering the grant that is referred to in the previous quotations. This will in itself serve to alleviate any potential

confusion as to whether or not the applicant has received the right kind of permission. In regards to the last quote, when asked, MP ensured us that they had in fact informed the local about the subject in verbal communication. Nonetheless, the very fact that planting facade plants requires permission from a governing body in most cases, seemed in need of being further emphasized and having it more clearly stated in the catalogue would be beneficial for all parties.

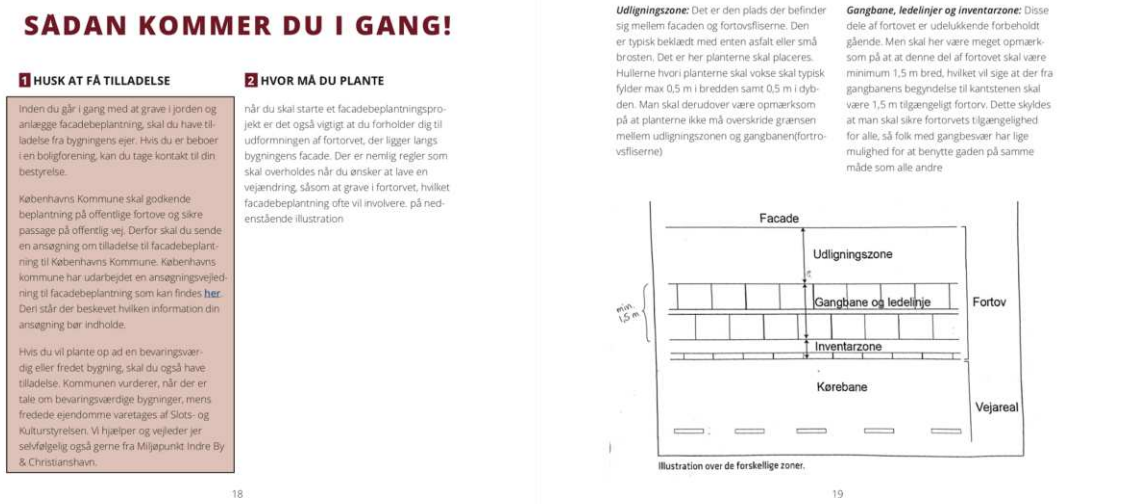


Figur 7 Show the original introduction page and the reevaluation of the introduction page

An example of how this was done can be seen in the images above (see figure 7). The picture on the left is of the old unedited version of the catalogue and the right is from the new. To start off we changed the header from “Hvor må du plante” (Where are you allowed to plant) to “Husk at få tilladelse” (Remember Permission) to emphasize the importance of having permission, but also because the original header did not properly fit the text content. In addition, we also highlighted the section in a red background colour so as to catch the reader’s eyes more easily. The text in this section was also changed slightly, the most important addition in this regard is in the directions as to where and how the user obtains permission. Since the catalogue was originally written more clearly defined guidelines have come into place, due to the fact that during our previous semester our group of researchers

along with MP pressed the municipality for the existence of an official application form on the subject of facade plants. This application form now exists and is readily available on their website (Facade Beplantning, 2018).

In another section called “sådan kommer du i gang” “this is how you get started” which previously outlined 6 steps to be aware of when planting facade plants, we have now added a 7’th step. This new step is called “where are you allowed to plant” (hvor må du plante) which is a reuse of the previous name header, but now in a more fitting context (see. figure 8). This addition was the result of both us and MP wanting to elaborate on some of the specific requirements for obtaining facade plants, specifically pertaining to how the shape of the sidewalk in front of the local’s house has to fit certain dimensions for it to be legal to plant. The addition was implemented to create more transparency on the legal requirements,

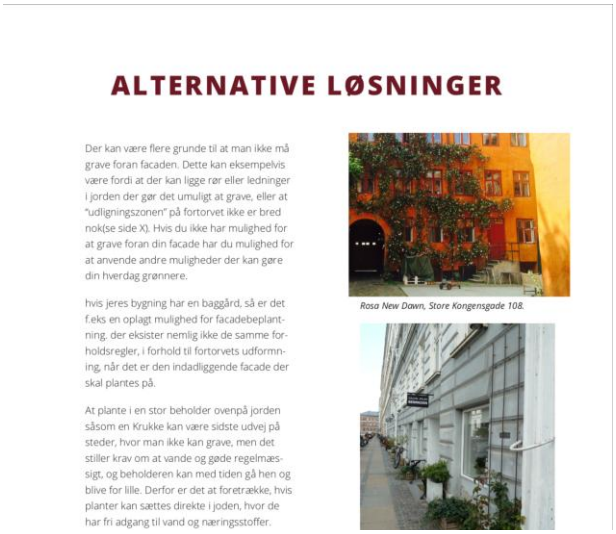


Figur 8 shows the introduction of a new illustration added to the catalogue in order to mediate more knowledge

so as to avoid people planting in places not allowed. This addition should help empower both locals in terms of knowledge, and the municipality (TEA) in terms of having their guidelines better understood and hopefully followed.

In the new catalogue we wanted to include a chapter which served to reflect the broadened nature of the catalogue. We made a chapter called alternative solutions (Alternative løsninger) which talks about three previously none explored aspects of facade plants in the catalogue (see figure 9). The original catalogue was made on the basis that the locals would be able to apply for a grant of DKK 1,000 for facade plants and one of the requirements was that the facade had to be outward facing towards the road. Since this grant no longer exist

this opens for the opportunity to also present planting on inwards facing walls as an option. Secondly we wanted to mention the idea of planting in a container instead of in the ground. We see this addition as important to mention, since planting in some form of container circumvents some of the legal requirements in regards to planting on outward facing walls. If it is the case that e.g. the innermost section of the sidewalk is different from the norm by having solid concrete or cement instead of cobblestone making the option to dig a hole tough, a container can be a viable option. As a third option we wanted to mention that there are other alternatives to conventional facade planting. An option that is gaining traction is what we have chosen to call green modules, since there is no official designation for them. These modules can contain many different kinds of plants and can be relatively self-sustaining, in some cases having watering systems build in. Of course these modules are probably more targeted towards enthusiast or businesses with sufficient economic means, but they are nonetheless a considerable option. Besides reflecting the broadened nature of the catalogue, highlighting these additional options also intends to empower the locals, by widening their potential actions in terms of obtaining facade plants. It also serves to potentially enrol more people into MPs facade planting network. By enrolling more people MP becomes horizontally empowered as their network grows, which in turn adds to their vertical empowerment. To close of the catalogue we wanted to implement a page that summed up the most important aspects of the catalogue in a quick fashion. In that regard we made a section called 5 good advices (see. figure 10)


ALTERNATIVE LØSNINGER

Der kan være flere grunde til at man ikke må grave foran facaden. Dette kan eksempelvis være fordi at der kan ligge rør eller ledninger i jorden der gør det umuligt at grave, eller at "udligningszonen" på fortorvet ikke er bred nok(se side X). Hvis du ikke har mulighed for at grave foran din facade har du mulighed for at anvende andre muligheder der kan gøre din hverdag grønnere.

hvis jeres bygning har en baggård, så er det f.eks en oplagt mulighed for facadebeplantning, der eksister nemlig ikke de samme forholdsregler, i forhold til fortorvets udformning, når det er den indadliggende facade der skal plantes på.

At plante i en stor beholder ovenpå jorden såsom en Krukke kan være sidste udvej på steder, hvor man ikke kan grave, men det stiller krav om at vande og gøde regelmæssigt, og beholderen kan med tiden gå hen og blive for lille. Derfor er det at foretrække, hvis planter kan sættes direkte i joden, hvor de har fri adgang til vand og næringsstoffer.

Rosa New Dawn, Store Kongensgade 108.

Figur 9 shows one of the pages from the added section called "Alternative løsninger

In much the same way as a conclusion in an article or paper, this quick summation serves to give the most important advice in a short time. Another reason was to account for people who


5 GODE RÅD

1. Tag gerne en snak med de andre beboere i din bygning, omkring forventninger og ansvar før der plantes.

2. Sørg for at formaliteter såsom at få tilladelse fra de rette myndigheder er i orden, før du planter. Husk at hvis din bygning er fredet, så er slots og kulturstyrelsen ansvarlige, hvis ikke så er det vejmyndigheden hos teknik og miljøforvaltningen der er ansvarlige.

3. forhold dig til hvilken plante der passer dinne behov. nogle planter kan være mere krævende end andre. vi hos miljøpunktet står til rådighed for at besvare alle de spørgsmål du kunne have i dette henseende.

4. Opgiv ikke håbet! Hvis det ikke er muligt for dig at få facadebeplantning, grundet diverse årsager, så er der stadig andre muligheder, såsom plante containere, facadeplante moduler eller hvis jeres bygning har en baggård hvor der i stedet, der er mulighed for at plante.

5. Vær ikke bange for at spørge om hjælp. Spørgsmål vedrørende tilladelse og vejrforhold bør du kontakte kommunen. Hvis du har spørgsmål omkring planter og plantning kan miljøpunktet kontaktes. vær ikke bange for at tage kontakt til andre plante projekter i dit nærområde for at udveksle ideer og erfaringer.

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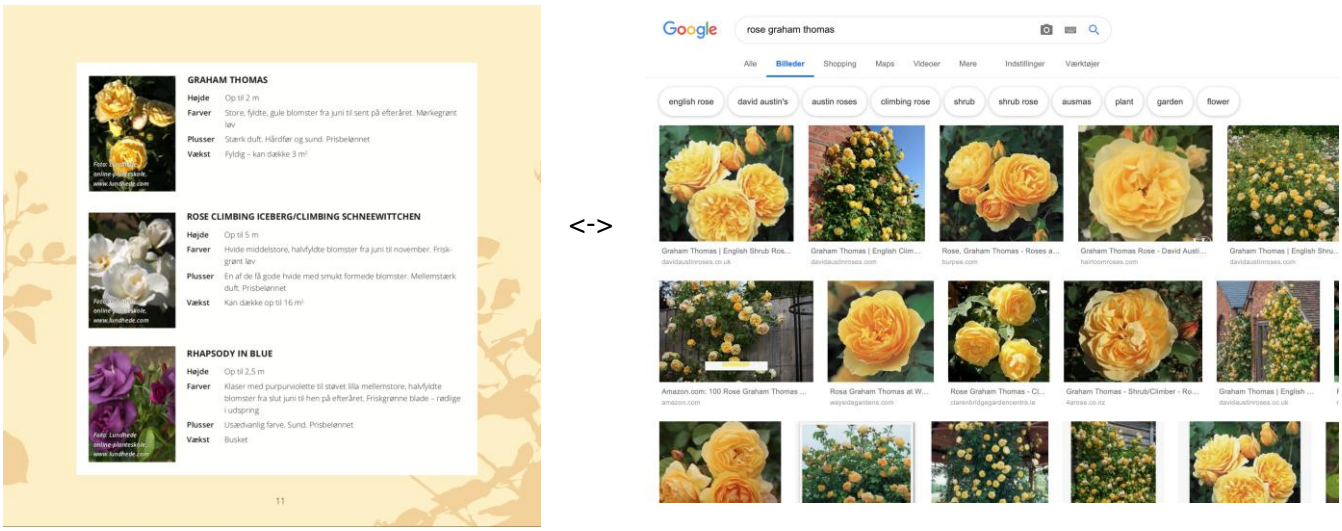
Figur 10 shows the added section "5 gode råd"

for some reason or another are not interested in reading through the whole catalogue, trying to make sure that such a reader can still get important information.

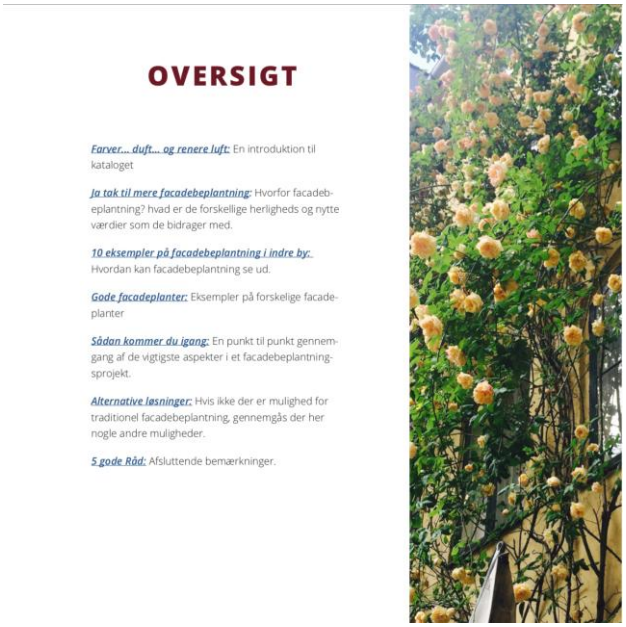
During our preliminary discussions with MP on how the catalogue should be updated it became clear that the previous version of the catalogue in addition to its digital version was also intended to function as a printed version. This updated version of the catalogue emphasis was to be added to the digital aspects of the catalogue since there was no immediate need for there to be a physical version. We therefore wanted to take more advantage of the digital platform, and we choose to do this by using hyperlinks in several different ways. One implementation of this, was that we made all of the images in the inspiration for specific plants section interactable, so that when pressing them you are directed to the google search image section of the respective plant as can be seen below.



Figur 11 shows the transportation of the user from catalogue to search

There was much discussion back and forth between us and MP as to how this digital interaction should be implemented. We went over several options as to what and where these hyperlinks should direct the user (see figure 11). Most of the websites with information on the plants was also online stores, which posed a problem, being that MP did not want to promote a specific webpage, since it could potently give them a competitive advantage. We therefore chose the option of directing to google search as it would give the user themselves easy navigation of pictures, information and buying options. Another implementation of hyperlinks can also be seen in illustration 12 in which the text now contains a hyperlink that directs the user to the municipalities facade plant application form.

In order to make all of the information contained in the catalogue more manageable, we decided to implement a table of contents which can be seen. It was important for us that right at the outset of the catalogue, any reader would get an overview of its contents so that navigating content and information would become easier. In this regard we once again implemented hyperlinks, so that when pressing any of the headers, the reader would be transported to the given page.All of the digital implementations serves the purpose of making the navigation of information easier for the potential users, empowering them in regards to information gained and ease of use.



Figur 12 shows the table of contents the the hyperlinks it contains

To conclude on this section of our paper, the broadened nature of the catalogue aims to empower both MP and the locals, by expanding the target group and enrolling more people into their network. By empowering the script, we as researchers aim to horizontally empowers MP as an organisation. This is done by the fact that if MP has a catalogue, which is inscripted so that the user de-scripts in the way as intended, they will have a greater knowledge about the process of face plants. This places MP in a better position because, they will have a better chance to enrol new actors in their network and thereby get vertically empowered.

The added emphasis on the role of the municipality aims to empower the municipality and locals in terms of more transparency for users and ease of navigating to their application form. The municipality having their role better explained helps their agenda of having procedure done legally. Improving the ease of navigation both internally in the catalogue but also to external plant information from the internet through the use of hyperlinks, likewise aims to empower the users.

We as researchers have empowered the script of the catalogue by using data and knowledge of various actors that we have gathered in a previous study. However, whether or not the desired effect of these inscriptions will result in the desired descript by the end user, has yet to be uncovered. The new catalogue has not yet been completely finalised and released, as our changes is going through a final review process from MP and thus can not be evaluated in this regard. The next step would be to take the re-inscribed catalogue out to the locals i n order to evaluate the de-scription of the catalogue. If the re-inscripted catalogue is not de-scripted as intended, the cyclical process of re-inscription continues

Managing sustainable transition

When governing a sustainable development it seems to be rather complicated to manage the process for various reasons. It is a complex situation to “fit” the need for a long-term radical change as we wish for facade plants to be and the practical short-term change that it requires to get the actors in the network of facade plant to take action. When a change has to be sustainable there is a need for a joint effort between all the actors involved in the change. This requires that the actors in the network all share the same value of the change as one another. One of the complex aspects of transition management is the fact, that what is sustainable on a short-term basis might not be sustainable on a long-term basis and what seems to be a sustainable solution for one actor might not be a sustainable solution for another actor.

The constant change of the world and its environmental challenges the thoughts of a sustainable development and change, since the development and change would also have to be in a constant change. Denmark, specifically Copenhagen and its municipality, has a mission to create more nature-based solutions. Nature-based solutions can be found in various shapes and sizes so as mentioned before we have narrowed our field of interest down to facade plants. Not only is the environment changing but also the city is in a constant change. New buildings are being build and old ones are being torn down or restored. Everything around and in society is in a constant change, which makes it even more complex to come up with a long-term solution for a radical change. We wish for the citizens of Copenhagen, Copenhagen's municipality, the politicians and other relevant actors for the field of nature-based solution to see and understand the value of facade plants and for facade plants to become a sustainable nature-based solution in Copenhagen. This process would take a great effort by a lot of different actors and also a radical change in the

knowledge and understanding of the importance of facade plants. All the relevant actors intertwined in the subject of facade plants such as the politicians, Copenhagen's municipality and the citizens of Copenhagen would have to go through some sort of transition - some more than others.

Niki Frantzeskaki and Derk Loorbach (Frantzeskaki and Loorbach 2012) suggests that an approach to this challenge could be a *transition approach*. The *transition approach* implies the necessity of a “large-scale” structural change in one or more societal subsystems. A large-scale structural change have throughout our empirical data collection proven itself an interesting option in terms of attaining sustainability.That is why we came to the conclusion that with our proposal for a paradigm shift from “Nature in the City” to “NatureCity” transition management could be a resourceful tool in attaining this goal.

According to *Frantzeskaki and Loorbach (Frantzeskaki, 2012)* these changes might take several generations just to prepare, but also to realise. When changing the nature of society, the nature of the problems also has to change. The interaction between societal structures, actions and technical innovations, leads to a change in the societal systems, which leads to the need for a radical transformation, namely transitions. A transitions is described as a “fundamental change” that takes place in the societal system (Frantzeskaki and Loorbach 2012). The “purpose” of these transitions are to facilitate and tackle persistent problems, like the environmental ones the world is facing today. By approaching the facade plant project with the thought of a paradigm shift and thereby a transition one might also be able to apply the knowledge surrounding the facade plant to another project in the societal system handling persistent problems.

Persistent problems are often rooted in the deep structure of the societal systems. These kind of problems needs to be treated with a fundamental change, otherwise the system cannot become sustainable. Transitions can and often shall occur on different levels. It is not enough to call out for a transition on a micro level, if the transitions do not follow through on a meso and macro level, but especially the need for a top-down approach seems to be of great matter. Oleg Koefoed states;

If you look at the city as a form of organization. Then it requires all the employees, and it requires that you to listen to them and give them the tools and opportunities to participate. It requires that the middle managers, the companies and actors who works specifically with

this in practice and there, and it requires top management, if top management is not a part of it, you will constantly hit a wall. - Oleg Koefoed

The aforementioned *Agenda 21 strategy* (Københavns Kommune, 2016, B) have the purpose to support and facilitate the 17 global goals that the world's top leaders agreed on in 2015. The strategies vision is to facilitate and develop sustainable environmental work and address the importance of the citizen of Copenhagen to be a part of the environmental work. This aspect is of great importance because the municipality of Copenhagen believes that it is necessary for the citizens to be involved in the change and create a community around it. The vision is for the citizens to cooperate with the municipality and take voluntary initiatives for environmental changes and engage in newly-founded projects (ibid.). The municipality believes that the social act in a community and the will to change and implement new habits is connected.

The municipality of Copenhagen perceives themselves as a facilitator in the project of engaging the citizens in voluntary environmental projects (Københavns Kommune, 2016, B). It seems as if Copenhagen's municipality are working through a transition on a macro-level and at the same time initiating and supporting a transition and a radical change on a micro-level by motivating guiding and facilitating the citizens to do environmental work throughout Copenhagen. If a transition has to become sustainable it requires a somewhat "radical" long-term change on more than one level. This is why one would come to think that the municipalities work and engagement of the citizens is very important because it might generate a "multi-level change". Sustainable development is also defined as a way to combine social cohesion and environmental protection *(Frantzeskaki and Loorbach, 2012)*. In Copenhagen's municipality *"Agenda 21 strategi"* the former Mayor for Technical and Environmental Affairs Morten Kabell writes that:

"An important prerequisite for the work on the sustainable development of Copenhagen is that citizens of Copenhagen gets the opportunity to take active part in the efforts and that their knowledge and experience in the city is put into play. The Copenhagen contributions qualify the municipality's work and gives the opportunity to create solutions that are holistic and rooted in citizens' ways of living and their everyday life." - Agenda 21 strategi, 2016

Is seems as if the definition on sustainable development and Morten Kabell's wish for a sustainable development in The City of Copenhagen through the "Agenda 21 strategy" have the same vision. That is why one can be surprised about the news from December 2019 that report that the municipality of Copenhagen will shut down the work position of the *volunteer-coordinator* (information, 2018).

Even though the Agenda 21-strategy wishes for the municipality and the citizens to work together, the shut-down of the position as the volunteer coordinator, have had the consequence that 39 green volunteer projects, have had to close down in the district of Copenhagen. The reason for this, is due to economic savings. The politicians have chosen to shut down the position due to economic adjustments in the Environment and Technology departments (TEA) budget. This means that volunteers in Copenhagen, will no longer help the municipality, maintaining trees and nature areas in Copenhagen. One of the volunteer citizens at Utterslev Mose, Kirstine Lorenzen is highly affected by this and states that:

»The mail says that we have to close down by April and the field must be cleared. It is really upsetting in terms of having worked with the municipality for 15 years. It is contrary to its own policies and visions of being green and involving citizens. You save no money and miss so much, " - Kirstine Lorenzen (Information, 2019).

This sentiment is not shared amongst some of the actors which we have been in contact with however. Both Marianne Spang from MP, Jakob Næsager and Mette Annelie Rasmussen do not see the problem with removing the volunteer coordinator. According to them the decision was due to the fact that almost none of the locals working on volunteer project had been in contact with the volunteer coordinator in several years. Jakob Næsager also specifically points to the fact that TEA are still at the locals' disposal if needed.

"Many of these projects could easily continue despite the fact that the coordinator function has changed. Those who are involved with the Utterslev Mose project still has access to the technology and the environmental department to hear how can one advantageously run the land cleaning facilities and the like out there, and it is the same with the others (other projects) so you can easily be a volunteer association without a municipal employee you can call." - Jakob Næsager.

This is a good example of *why* a more structured approach as *transition management* might be relevant, since several macro actors in this specific case have the opinion that their action does not affect the volunteers at a micro-level. The transition management might be able to prevent some of these issues, since they through transitions management will make a mutual agreement on the transitions visions and mission.

The fact that sustainable development is ambiguous about future plans and needs, makes it even more complex. These plans and needs are determined by cultural, ecological and economic developments. If viewed through the lens of Kirstine Lorenzen one can refer to the volunteer coordinator as a “need or a plan” that due to a “economic development” did not become a sustainable part of Copenhagen municipality TEA. This can be compared to the shutdown of four out of eight “Miljøpunkter” in Copenhagen due to economic savings. Without organisations and work from volunteers, one might think that the municipalities wish for a sustainable development in Copenhagen concerning the environment could be furthermore complex due to the facts that the changes as a part of the transition do not seem to be “equal” on all levels.

As mentioned before, that for a transition to be sustainable, the (radical) changes can not only take place on one “level”. It seems as if the municipality is sending mixed signals to the volunteer citizens of Copenhagen by communicating their wish for a better partnership with the citizens, but at the same time shutting down a very close link between them.

Changes on so many levels can take decades to occur and is described as “highly” uncertain, in terms of future developments. The word *future* in the aspect of transition management has a big say beside due to the fact that i can take This is not only because of the need for a transition on different levels, but also due to the fact that it is often up to the individual to define what and when something is a “sustainable development” and when something is important or big enough. During the interview with Oleg Koefoed, we asked him when something in his opinion was important enough to be a part of a nature-solution. Oleg Koefoed states:

“It depends if it has to be big enough to contribute with something. It has to contribute with more that it consumes. It has to give more than it costs, not only economical, but also ecological wise” - Oleg Koefoed

It is also a complex process because a transition is “open-ended” and uncertain, which can make it even more complex to predict, both on social and economic terms *(Frantzeskaki and Loorbach, 2012)*. A sustainable development seems to require that the need of the current generation also matches the need of the future generations so that the changes that are carried out “today” also can be beneficial and achievable on later terms. This again makes it complex when the transitions revolve around the environment since the environment is in a constant state of change. So when working with issues that include both predictable (building etc.) and unpredictable (nature) objects the time period can transcend into a long time horizon. At the interview with Oleg Koefoed, he sets an example for how the processes that contains both predictable and unpredictable aspects has a rather long and complex time horizon:

“Some of the things that I hear a lot is that the “living systems” behave basically differently than buildings do. Some of what building developers have been good at and seen in the aspect of both good and bad, is to isolate the buildings away from the “living systems”, so in that way they could build buildings that actually behaved pretty predictable, in a relatively long amount of time. There you have to go into a thinking, where if you look at the construction in Copenhagen harbour for example, then it has been a work where life in the harbour and in the water has been a job that has been eased by the fact that it has stopped being an industrial port. It is really good for the water and life in the harbor, that there is not always sailing such giant ships. But it has also been a part of a “conscious strategy” and then it has just been something that has taken a really long time and when you today can brag about having a fairly high water quality in the inner harbour of Copenhagen. So you can actually jump into the water almost anywhere, and that it the result of a 20,30,40 year period. And in the same way you also have to remember that it is the same with all the other living systems in the city. That they are complex, they require a long time and that they need attention, you have to be inside of it, it takes a lot more time” - Oleg Koefoed.

This sometimes unpredictable and long time horizon is what Frantzeskaki and Loorbach (2012) defines as the “intergenerational nature”, which is the *first out of three* characteristic of a sustainable development (Frantzeskaki & Loorbach, 2012).

The second characteristic is the “importance of scale”. This characteristic concerns the fact that sustainable development often can and will occur of different levels. This is where conflicts often arise because what seems absolutely necessary for one actor in a network,

might not have the same importance for an actor from another level in the network. During the interview with Oleg Koefoed he states that:

“There are very few who uses the saying we will make “life on land and life under water". These are two of the “world goals” that are the closest to "nature in the city". There is no one who says this when building buildings. But that is where we should go! It seems obvious in some other industries, therefore one could also try to do in a nature development context. Most people understand goal number “11”, but it becomes easy if understood in the way that the C40 Director described it in an article last summer. He described it as “people who want space between houses and trees, they have to leave the city. They have not understood what a sustainable city is and I think that is a disaster, that the Director of the C40 in Denmark can say such a thing, then there is something wrong. One can only hope that it is only he who has that thought, and that there are others who think it is wrong.” - Oleg Koefoed

What Oleg Koefoed refers to in this section is a statement given by the C40 Director in an article concerning sustainability in which he directly states “

“It is not more grass, trees or the height to the heaven above and more space between houses that makes cities efficient in the fight against climate changes. A city thrives og becomes environmentally green a sustainable by doing the opposite” - Simon Kjær Hansen

This statement confirms the fact that the importance of a project can have on one level, might not match the importance on another level since the Director of C40 according to this statement do not see a value in nature-based solutions, which we had also previously established. For a transition to be sustainable the importance of the change must match somewhat along the way. One might think, that if a change has to be radical a “top-down” approach might have greater success with this due to power relations.

The third characteristic concerns the “integrative nature” of sustainable development. This means that different domains have to be considered in sustainability, ex. ecological, economics and socio-cultural values and stakes. Multiple actors have to be taken into consideration and have to be included in the decision-making process (Frantzeskaki and Loorbach, 2012).

The various actors will have to commit and participate on all levels for a sustainable transition to come through. In the interview with Oleg Koefoed, he argues the importance of an interdisciplinary approach to nature based solutions and the importance of enrolling these different domains as a part of a transition. Oleg states that:

"There is something about getting more collaboration across and opening up the whole process" - Oleg Koefoed.

Not only will it increase the chance of a sustainable development and solution, but it will also ensure a stronger commitment. It also shows the more complex side of the process, which include getting the various actors to participate and commit on a multi-level perspective.

"If you look at the city as an organization it requires all the employees. It requires listening to them and that they have tools and opportunities to participate and it requires that the middle management is on board, it requires all the companies and actors working with this in practice, and it requires top management. Because if the top management is not included, you will run into every possible wall." - Oleg Koefoed.

The biggest challenge in a sustainable transition remains in the terms of policy agendas and policy actions. It requires dealing with different trade-offs, between different values and interest, between different actors. It is individual how each country can and will integrate sustainability into their national policy. For instance, the Danish company Ørsted acknowledged to work with the 17 global goals. Ørsted says about themselves that they work purposefully to run their business in a way that contributes to the world goals. They have identified 12 goals out of the 17 goal that they want to work with, including Goal # 7: Sustainable Energy and Goal # 13: Climate Action " (Ørsted, 2019).

These integrations are negotiated and balanced on a multi-level perspective and perceived differently by each generation. One might think that the benefits of sustainable development and transition in the aspect of nature-based solution should be a little more obvious since it being a matter concerning all actors on all levels. A political party might not have nature-based solution as their political focus, but as soon as they leave work and eat dinner with their family or so they are just in the same position as everybody else who lives on this globe. The effects of global warming, pollutions, and general unsustainable progress, are going to catch up to every one of us even if you do not commonly relate to it in the present.

One might say, that we all have a common responsibility due to the fact that the environmental changes on longer terms will affect this and the future generations. During an interview with Jens Hvass he argues that:

“It is going the wrong way and it is going the wrong way fast. One simply cannot sit down politically and decide that it is not a problem” (Jens Hvass).

Jens argues that no matter a political party’s interest one can simply not take the stand of not “acknowledging the problem”. Frantzeskaki and Loorbach (2012) states that the transition approach to sustainable development will occur different from different actors’ point of view. A transition will not have “one way” of reaching a goal due to the multiple of different actors in the field of interest. MP’s take on a sustainable development is their different takes, on different projects, all concerning environmental developments. During the interview with Oleg Koefoed, he gives Grundfos as an example on how different companies can have different takes on sustainable developments and how a company can approach, include and work with the recognition of the 17 global goals. This is a good example on how different actors, organisation and companies goes through some of the steps of a transition and work towards a sustainable development.

The transition approach does not come with a guidebook on the exact way to govern the process (Frantzeskaki and Loorbach, 2012). First it offers a conceptual frame to make greater dynamics and understandings throughout a transition. The transition approach supports the value of sustainability, but it the same time allowing it to be pursued in various ways. This is worth mentioning because other management approaches often aim or forces a change in practice and thereby often further complicating processes and not taking the sustainability aspect in to matter. The transition approach also has a specific focus on the “transition to be sustainable” whereas other management approaches has a predetermined target. It argues for the importance of understanding the social act, in a sustainable development and the fact that inputs from different social actors will facilitate the pathways to pursue sustainability.

The way to a sustainable change

With the actors in mind whom we have met throughout our fieldwork in our prior and current project one could investigate if and how they are going through some parts of the transition with the approach inspired from Frantzeskaki and Loobach. It has to be taken into consideration that due to a limited amount of time, resources, knowledge and access to the field it might be complicated to make a fully sufficient “transition analysis”.

First, to achieve sustainability coordination and commitment is required. This is a responsibility distributed amongst all of the actors in the network. The reason for this is to create a common vision and coordinate efforts, which hopefully in the end will lead to the achievement of a sustainable development. With MP in mind and their project on green facades, they are trying to make the locals commit to their project and hereby their vision by sharing the advantages facade plant have, not only to the individual citizen but also the advantages facade plants have on some of environmental issues a metropolis like Copenhagen is facing today. MP is also coordinating events, workshops and helps create new network surrounding the facade plant projects. They as an organisation, work as a link between the locals, the municipality, other organisations and institutions. Secondly, is the innovative aspect. Innovation and sustainability are “interlinked”. This means, that to develop sustainability the process constantly has to be redefined by the existing culture, structures and practices. MP’s catalogue is only a small part of the structure, which has to be in place for a transition to come through, but even though it is small it is still a part of redefining the structure. When we were given the opportunity to “recreate” MP’s catalogue, we used data gathered from informant to shape and recreate the catalogue to fit the “need” of the locals. As mentioned before, in our prior project we had a dialogue with the Environmental and Technical Department of the municipality, concerning the application form. At this point there was no official application form, but after communicating MP and the locals needs, then municipality made an official application blanket for facade plants. Again, this is only a small scale change but it can still be perceived as a minor innovative change towards a sustainable change, due to the fact that the update of the catalogue hopefully will lead to the locals better understanding the process and commitment required in order to maintain facade plants. The innovative aspect of the transition approach is of great importance, because innovative thinking will eventually lead to more actors being able to contribute to the

multiple varieties of changes. This also allows a better understanding of governing an open-ended process of societal change.

Transition management is also a tool for a governance approach. The transition management include tools that both involves the stakeholders and community engagement elements, as the participation MP lets the locals have throughout their different projects and how the municipality until recently had a volunteer-coordinator in their environmental unit. Transition management as a governance approach can also facilitate policies with a direct link to sustainability, due to the underlying rationale that the management approach follows the principles of sustainable developments.

The transition management cycle

The governance process in the transition management is a cycle of development phases. One can distinguish between four different phases of governance activities. These phases should be followed in order to facilitate and maintain a sustainable solution, which in our case will be a nature-based one (Frantzeskaki and Loorbach, 2012). In context of societal transition, one can distinguish between the four different phases *"strategic, tactical, operational and reflexive" (ibid)*. Due to a limited amount of time and resources we are not in the position to follow through with an actual forming and approach of a transition management and the transition management cycle. We are therefore going to give a brief introduction of the four phases and a rough draft of the actions they carry. The reason for this is that we see the transition management cycle as a relevant approach when having a wish for a sustainable change. We believe that an approach like this could facilitate some of the elements of the aforementioned paradigm shift. One should therefore understand the transition management cycle as a suggestion for a solution when wanting to make a sustainable change.

• *Strategic: Activities at the level of a societal system that take into account a long time horizon, relate to structuring a complex societal problem and create alternative futures – often through opinion making, visioning, politics (*Frantzeskaki and Loorbach, 2012).

• *Tactical: Activities at the level of sub-systems that relate to build-up and break-down of system structures (institutions, regulation, physical infrastructures, financial*

infrastructures and so on), often through negotiation, collaboration, lobbying, etc. (Frantzeskaki and Loorbach, 2012).

• *Operational: Activities that relate to short-term and everyday decisions and action. At this level actors either recreate system structures or they choose to restructure or change them (Frantzeskaki and Loorbach, 2012).*

• *Reflexive: Activities that relate to evaluation of the existing situation at the various levels and their interrelation or misfit. Through debate, structured evaluation, assessment and research, societal issues are continuously structured, reframed and dealt with (Frantzeskaki and Loorbach, 2012).*

In order to establish a successful translation Frantzeskaki and Loorbach (2012) suggests following the above phases. The first phase *Strategic* focuses on how the implementers shape their visions and defining the arena in which the transition takes place. The second phase *Tactical* focuses on enrolment of key actors in the network as well as the practical agenda of the transition. In the third phase *Operational* facilitators mobilize the enrolled actors in order to realize the goals and visions set in phase one. The last phase *Reflexive* should be viewed as a constant state that revolves around the evaluation of the process and results the arena has been through. This is done in order to gather experiences one can have in mind when starting the translation cycle all over again *(Frantzeskaki and Loorbach, 2012)*.

A transition arena is comprised of a relatively small group of people according to Frantzeskaki and Loorbach.

“The transition arena is a small group of actors that are characterised as frontrunners (innovative thinkers, practitioners, social entrepreneurs) with different backgrounds. Within the transition arena, various perceptions of a specific persistent problem (e.g., congestion, climate change) and possible alternative solutions can be compared and integrated” (Frantzeskaki and Loorbach, 2012).

It is important to keep the initial actor group small to facilitate a constructive dialogue (Ibid). These transition arenas are also based on what is called “selective participation” meaning that the participants are chosen in accordance with the above quote. In addition to these characteristics there are also several other things to be considered when choosing the relevant actors.

“The groups need to be diverse and heterogeneous, in terms of different perspectives and views that actors bring in, and also in form of roles and competencies. More specifically, the people involved need to represent the different ways of thinking, different values and stakes present in the social system. They need to be already active in developing or stimulating innovations at either niche or regime level, and need to be able and willing to engage in an open-ended innovation process (Frantzeskaki and Loorbach, 2012).

In this regard it is very important that a multilateral approach is taken to the comprising actors of the arena. This is because that in order for the end result of the arena, which could be described as the “*Transition vision”* to be successful it has to be diffused somehow. The transition vision holds no formal power, thus emphasising the importance of the involved actors being able to diffuse the visions through their own respective networks (Frantzeskaki and Loorbach, 2012).

If we were to place ourselves in terms of where we are placed in the cycle, we are at the strategic phase. If we were to further the goals of facade plants through transition management, it would be by gathering people fitting these characteristics into a transition arena and pitching the idea of a shift of paradigm from “Nature in the City” to “NatureCity”. By connecting relevant actors and give them the ability to create a shared agenda we would be able to build an arena concerning the implementation of facade plants as a nature-based solution.

Through our previous work with facade plants we have come to have an understanding of which actors might be relevant to include in such a network.
We would suggest that some of the employees at MP should be included due to the fact that they currently function as an intermediary between facade plants and the locals, stimulating and facilitating local initiatives. We would also like for regulatory keeping and policy making actors to be involved, the diffusion through their networks could prove immensely valuable to us, since they would be actors with a considerable influence on how top-down solutions could potentially take form. Individuals at a business level would also be an advantage since they might have some knowledge concerning business strategies and how to promote and sell and idea. With all of these actors it is important to note that the transition arena requires that the given actor does not work on behalf of furthering the interest of their given.

A structured management approach like transition management would allow us as facilitators to test the idea of the aforementioned paradigm shift. Of course one should have in mind that a transition is not a process that is happening within a short time span. A transition often requires up to 30 years before a societal system has changed (Loorbach, 2010). In the meantime, there is the short-term operational changes, that focuses on practical projects, as a facilitator for the long-term changes. This could for instance be how a project in the more concrete practical sense can be facilitated and maintained.

Frantzeskaki has made *7 lessons* facilitators could have in mind when working towards a sustainable transition such as nature-based solutions.

7 (sustainable) lessons towards nature-based solutions

Sustainable transition is clearly a process that needs a lot more than willpower in order for it to be realised, but what exactly does a sustainable transition need for it to be a success? Frantzeskaki has made a multi-case study where she formulated seven lessons that you need to have in mind when implementing new nature-based solutions successfully (Frantzeskaki, 2019). The 7 lessons can be used as inspiration for the practical approach to *transition management.* In the following section the *7 lessons* for planning a nature-based solution in the city will be further elaborated and examined through our field study.

Lesson #1: *Nature-based solutions need to be aesthetically appealing for citizens to appreciate and protect them* (Frantzeskaki, 2019).

In the first lesson Frantzeskaki concludes that the result of a sustainable transition needs to be visually appealing to the citizen in order to make them appreciate and care. This focus on visual representation is also an aspect that has come up as important during our case study surrounding facade plants.

> *“We also prefer that it looks nice. It needs to grow to a height of 6 meters quickly, it needs to flower and it preferably needs to be red.” - Inger*

The vision was clear before starting their facade plant project, the rose had to be of the colour red. This means that the visual representation of the project is something that has

been considered beforehand. The visual aspect is also being addressed by Jens who states that:

"Personally I would have liked an ivy that is closely cut like the old library, because then it could be even more precise regarding the streetlines and other things like that. But then the majority in the house wanted it to be roses" Jens Hvass

He personally would have preferred a different plant, but he ended up choosing a rose because of the pressure from other residents in his homeowners' association. They wanted something with flowers that could make the facade more colourful. Jens Hvass differentiated himself from other locals by being an expert regarding nature-based solutions in the city. This might be the reason for his focus to be more directed at the functionality of the plant, rather than its visual representation. This is a clear example of an expert makes tactical prioritization by choosing the soft values higher than the hard ones, in order to enrol the surrounding actors and thereby mobilise a strong network associated to the facade plant project.

Figur 13 shows the municipalitys visualisation of the soft(herlighed) values and the hard(nytte) values

The importance of these soft values such as the visual and other sensual impressions, can also be seen on a municipal level. Figure 13 is an illustration taken from their Tree Policy. It clearly shows the different benefits of adding more trees to the cityscape. The aspects identified have been divided into two categories. The first category consists of the soft values such as aesthetics, the creation of identity and other sensual aspects. The second category revolves around the hard values such as noise reduction and air quality improvements. Figure 13 is a clear indication of how the municipality acknowledges the importance of these different values. The soft values are presented on equal terms as the hard values. But many

of the soft values, such as “visual representation” differentiate themselves from the hard values by being highly subjective.

Co-production can therefore be an important tool when developing these nature-based solutions, as the facilitator of nature-based solutions needs to accommodate the visions and dreams of the locals (Frantzeskaki, 2019).

Lesson 2: *Nature-based solutions create new green urban commons* (Frantzeskaki, 2019).

The second lesson is a natural continuation of the first. By co-producing new green spaces in the city, Frantzeskaki (2019) states that:

“This in turn creates space for new relations between people and nature as well as between people in their communities“ (Frantzeskaki, 2019).

She believes that these nature-based solutions not only will strengthen the relationship between the citizens and nature, but the relationship between citizens in local communities will be evolved as a result. Inger and Jens Hvass’ interaction set an example on how these nature-based solutions can strengthen the relationship between the locals. Inger says:

“Before we chose what rose it had to be I contacted Jens Hvass. Everybody around here knows the blue house. So I went past his house one day and he was out on the street weeding out. I asked him for help in regards to facade plants, and then I found out who he was” - Inger

Inger tells, that a part of her initial plan was to establish contact with an at that time unknown actor who’s facade plant she had come to notice during a walk on the streets of Copenhagen. This is a clear example of how successful nature-based solutions can create new relations between citizens and inspire other citizens to include themselves in communities engaging in nature-based solutions or make their own like Inger did.

During our time in the field we heard from Jens how these communities just as well could act as a weak point for the development of nature-based solutions:

“ (..) it is forbidden to think that it is too much with a community. I might also be of that age at a place where I would like to have something for myself ... such a project about urban solutions where you have a list of 250 voluntaries. A list that took part in the care of it and yet it ended with something that a single person could have done alone within a few hours a day. And that's because people over organizes. It is difficult to schedule because it is something to say when the bus is there, you have to get on. ”- Jens

In the quote above Jens states how he believes that the focus on communities can have a negative effect on the implementation of nature-based solutions. He started off by saying how it was almost “forbidden” to think the things that he was about to say. This was a clear indicator that the people in his network shares Frantzeskaki’s views on these communities as being unquestionably good. Jens however, sees a potential problem with the enrolment of so many actors in a project. He believes that some of these nature-based solutions are over organised. He gave an example of a project where 250 people were assigned to help maintain a park, whereas a handful of the key actors could have done the work just as well. It seemed like he felt that these communities sometimes were a bigger point of focus than the nature-based solution itself and values such as peace and reconciliation with nature got replaced by a focus on enrolling more actors through different means.
It is important to note that Jens is an expert regarding the incorporation and care of nature-based solutions such as facade plants, which means that he already possess many if not all the necessary skills. And as he does not need the help that these communities can provide, they could be seen as a hindrance for the tranquillity he feels when caring for these plant.

Lesson 3: Nature-based solutions experiments require and build trust between the city and its citizens both for the aim of the experiment and for the experimenting process itself.

Frantzeskaki’s third lesson expresses the importance of trust between the city and its citizens when developing these nature-based solutions. During our time in the field we have seen multiple accounts of the municipality trying to strengthen its relationship to the citizens and create trust. An example of this was seen when we got introduced to a facade plant project in Christianshavn:

“The property is classified as worthy of preservation class 4 I think and that meant that when we had to renovate the facades, which were in a terrible shape then the municipality became very excited when we decided to take action. They have a certain amount of money, which

they can give as a grant for these kinds of things and we applied for them and got huge support" - Julius

During the interview Julius who is a spokesperson for the homeowners' association explains how he and the others in the residence had a wish revolving around renovating their facade. Because they're building was worthy of preservation they needed an approval from the administration for Culture and Palaces (ACP). They were not only given an approval, but also a sizeable amount of money to help with the renovation. This action potentially functioned as a way to build trust between the municipality and the locals. By choosing to support the facade plant project the ACP indirectly empowers the citizens by giving them the opportunity to participate and take an active role in the development of the project, which in turn can give the inhabitants a sense of responsibility towards the projects.
This is likewise a good example on co-production, which was established as being of great importance in *lesson 1*. By ensuring that the citizens have the opportunity of creative control throughout the project the municipality also ensure that the visual aspects of the project is aesthetically appealing to the citizens, which likewise strengthens the bond between the facade plant project and its associated actors, which is essential for the continual success of the project.

During our time in the field it became clear how the municipality had made use of MP as a way to create and maintain trust between themselves and the citizens. This can be seen in the way that MP is structured and what solutions they as an organisation offers. MP is firmly anchored by its geographical restrictions, by only operating in "indre by*" and Christianshavn. This focus on the local area makes them appear as if they are meeting the locals at eye level. By narrowing the focus MP can target specific problems like cleaning a specific street or pond, which have given them the opportunity to establish themselves as an important actor regarding nature-based solutions for both the citizens and the municipality. Through our observations, we have come to notice that MP can be placed as a intermediary object between the municipality and the citizens (Law, 1991), since the municipality uses MPs skills, knowledge and know-how to spread the hopes and wishes from the municipality to the local citizens.

In MPs catalogue one will find all sorts of information. This is both information build on scientific knowledge, but also knowledge that addresses the organisational aspect. This information can be a part of facilitating and gathering a network of actors, who are relevant

for this specific project. Callon argues that through this, actors are linked together and “texts” like the catalogue will help define specific actions like how MP encourages the locals to plant and inspire their neighbours. The catalogue can be places as an intermediary object due to the fact that it communicates action and visions between certain actors, and thereby linking them together in “one network”.

Lesson 4: *Different fora for co-creating nature-based solutions are needed that include and learn from urban social innovation (Frantzeskaki 2019).*

Frantzeskaki’s (2019) fourth lesson, which focuses on the establishment of different nature-based solutions through co-creation will be the next step. MP uses events, projects, and workshops centred around environmental problems such as “clean the Copenhagen lakes” or “roses to the city” to mobilize the local citizens. The reason for creating different “fora” is that these nature-based solutions often involve the same actors over and over again, which Frantzeskaki refers to as “the usual suspects” (Frantzeskaki, 2019). Using the same actor can end up resulting in participation fatigue, which is why different fora are important as you rely on many actors instead of breaking the backs of a few. This is why these projects over time should focus on partnering with other capable social actors (Frantzeskaki, 2019).

Frantzeskaki states that;

“Local infrastructure projects such as nature-based solutions become centres for new ways of working together with citizens, changing stakeholders” - Frantzeskaki.

By co-creating nature-based solutions MP becomes a junction between the municipality and citizens and by giving the enrolling actors a voice they not only become part of the actor network, but it likewise makes them stakeholders. By having stakeholders within both the municipality and the citizen actor groups one makes sure that the performance and results of the project is important on every level of implementation as well as further maintenance.

Lesson 5*: Nature-based solutions require a collaborative governance approach. They are often initiated by local governments and require multiple actors to be designed, implemented and linked to urban life.*

In the fifth lesson, Frantzeskaki (2019) concludes that nature-based solutions requires a collaborative governance approach between the municipality and the citizens. Frantzeskaki states:

"The majority of them are initiated by local governments but their design and operation relies on collaborative efforts of many local actors" - (Frantzeskaki, 2019).

The reason for this is according to Frantzeskaki that even though the municipality is facilitating these projects, it is the citizens who have to maintain the projects. During our time in the field this way of facilitating nature-based solutions was articulated during an interview with Marianne Spang and Sabine B. Sørensen.

"It was autumn 2016 it quickly became a project, because they had some economy left in the local committee. So they wanted us to do the job... just like that (…) They wanted it to be called Roses to the City and they want to finance Sabine because they thought that it was something she just could do" - Marianne Spang.

Marianne Spang states how the "Roses to the City" project was conceived by the municipality alone and handed over to MP as a commission. This gives MP the role as intermediary between the municipality and the citizens. This results in MP ending up acting like Ratatoskr[1] as they navigate between the municipality at top-level and the citizens at bottom-level. This is done in order to convey the wishes, hopes, dreams and visions between the two actor groups, to make sure that the municipalities initial visions of the project can been seen within the end-goal created by the citizens in collaboration with MP.

***Lesson 6**: An inclusive narrative of mission for nature-based solutions can bridge knowledge and agendas across different departments of the city and tackle with departmental disputes.*

In the sixth lesson Frantzeskaki articulates how nature-based solutions can entail the need for knowledge sharing between the different departments within the municipality. She further elaborates on this by stating the following:

[1] Ratatoskr is a squirrel from norse mythology that crawls up and down Yggdrasil by traveling between worlds to communicate between the eagle at the top, and the serpent at the bottom.

“It is paramount that different departments within the city are involved and informed when a nature-based solution is discussed, shaped and planned. For this, the initiating team of city planners and occasionally citizens need to be open to ideas from different city departments so as to make the solution a common solution and to create a common inclusive narrative of mission across departments” - Frantzeskaki.

It is clear from the above statement that Frantzeskaki sees the collaboration between different departments as vital. She states that an inclusive narrative can be used as a tool to bridge different departments in order to inspire colleagues and make them feel included and thereby ensure success (Frantzeskaki, 2019). During our case study we had informants sharing similar views;

“So you have to make sure you have a common vision because then there is nothing that can go wrong and the joy of doing it and not discussing because it is a common work. And it is my best advice for people to enter such a process. It is to make sure there is a "we"” - Jens Hvass

Jens Hvass statement above could be understood as a direct continuation of Frantzeskaki’s quote, but he further explains that this narrative is needed when initiating nature-based solutions in order to create and maintain a “we”. By having a strong shared vision early in the implementation process one minimizes the risk of misunderstandings about what the goal is for the given project and how this goal is achieved. In order to create this feeling of unity one must embark on a translation process in order to enrol other actors and create a shared vision across multiple actor groups.

Frantzeskaki’s lesson 6 is primarily centered around the municipality and its different departments but during our case study we uncover how these early translation processes is crucial for the locals as well as the municipality;

“Then it was approved for the general assembly and that it was okay to go ahead with it, then there was 2 people who would like to help me. The next step was then what kind of rose to buy? ”- Inger

In the quote above Inger explains how she got approval from the homeowners’ association and enrolled two other locals before figuring out what kind of rose should be bought. This

could be seen as a way to enrol others as the vision and goals is somewhat predefined but as they are not set in stone they can be influenced by other actors which in turn makes the vision shared across these multiple actors. This shared vision is important for locals as well as the different departments within the municipality because it makes actors personally invested in the project, and therefor makes it more likely to succeed.

***Lesson 7**: Nature-based solutions need to be designed in such a way and scale that lessons for their effectiveness can be easily harvested and as thus, to be easily replicated into other locations (Frantzeskaki, 2019).*

Frantzeskaki's last lesson addresses the importance of scalability when working with nature-based solutions. She further elaborates on this by stating;

*"The design and scale of a nature-based solution are critical factors on the viability for the solution to be replicable into other locations in the same city and in other cities." -(*Frantzeskaki, 2019*).*

Frantzeskaki (2019) believes that design and scale is essential aspects when trying to replicate nature-based solutions. As each facade plant project operates on a rather "small" scale the need for replication is very important as multiple facade plant projects are needed in order for the overarching "Roses to the City" project to be seen as a success. Because each individual project is rather limited it makes it easier to implement as each project only require a little space and at minimum a single key actor. A lot of focus within MP have therefore been centred around how to make it easy to replicate these projects. One of the tools used to accompany this is the original "Roses to the City" catalogue. This catalogue was designed in order to try to collect all necessary knowledge to guide one through the initial steps of facilitating facade plants, as well as giving some idea of what would be required in order to maintain the success of the project.

During our time in the field we have found that expertise is another important aspect when wanting to implement nature-based solutions in new locations. If the local knowledge level is inadequate to facilitate and care for these projects, then it will amount to failure.

“But we have some expertise within this area and others are also being asked about it and they refer to us and then I just have to say they have to take some responsibility for themselves and join in and convey this aswell ” - Marianne Spang

Marianne Spang states in the quote above how she would like for the other MP’s to take responsibility in regards to facade plants, since other MP’s keep referring their locals to MP Inner City and Christianshavn. It is important to note that the responsibilities of each Miljøpunkt is geographically bound, which is why Marianne Spang wishes for more distributed responsibility. It is a clear indication that the other MP’s lack the necessary skills to guide their locals through the acquiring and maintenance of a facade plant project. This is a sign that knowledge and the ability to guide new actors through the initial steps of creating nature-based solutions is vital.

The knowledge that these 7 lesson contain, each contributes in their own way as a guideline to a successful implementation process. Even though the transition management cycle and the 7 lesson are each their approach one could still argue that there might be an advantage of combining theses two approaches with the actors involved in and outside the arena created through the transition management cycle.

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Conclusion

We have found that a Nature-based solutions such as facade plants can be one of the solutions to some of the sustainability problems of Copenhagen, contributing with many positive properties. Through the use of LTS we can conclude that the reason why nature-based solutions can be hard to implement is because of the complex nature of the arena in which they have to be implemented into. This means that facilitators have to be aware of other actors that could be affected by the addition of nature-based solutions, in order for a successful implantation to take place. Understanding the socio technical arena is not enough. Nature-based solutions require facilitators to ally themselves with other important actors on both micro- meso- and macro-levels. We see the necessity for a clear translation process in order to enroll and mobilize actors in the network of nature-based solutions, as this will strengthen the network, and make a successful implementation and future expansion more likely. As it seems now, actors surrounding facade plants are not interrelated in the sense that they have the capacity to become a resistant actor in the network. By strengthening the network on all levels, facilitators makes sure that the goals of the project stays intact, throughout its process. The establishment of facade plants as a technological solution to problems of congestion at horizontal spaces, can possibly constitute a paradigm shift if embraced. We believe that in order to introduce more nature-based solutions in urban environments, in a way that also take into account the rising population in the city, and the consequences of this, a solution such as facade plants can contribute with many positive properties, without sacrificing a lot of horizontal space. There are currently many visions of what constitutes a sustainable city, and not all amongst these include nature-based solutions. A transition management approach is suggested in order to facilitate the envisioning of a future which includes facade plants. By gathering relevant actors into a transition arena, strides could be made towards these goals. We also think that stimulating local initiatives is of importance, in this regard we have been active in re-inscribing the intermediary object of MP’s Inspiration catalogue, in order to multilaterally empower actors, such as the locals, MP, and the municipality.

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