Overcoming social barriers to urban green adaptation

A social representations approach to local environmental governance

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Abstract

In May 2020, the Stockholm City Council adopted a new environmental program for the period 2020–2023. The sustainability goals within Agenda 2030 have been a guide for the environmental program, and the purpose of the program is to manage and coordinate the city's operations to achieve the vision of a climate-smart and ecologically sustainable Stockholm.

With the environmental program, the city intends to advance its positions regarding climate work, urging city officials to take the lead paving the way in the strive for a more resilient city. In order to succeed with the implementation of the environmental program, it will be necessary for actors within all affected units to comply with these policies and to build consensus and synergy driving the environmental work forward. However, assuming that people will atomically adhere to and change their behavior according to a written policy or documentation, is a simplified version of the communication reality. A broader and more profound view of communication, is to understand communication as multilateral, encompassing all kinds of interactions, verbal and non-verbal. This approach takes into account receptive and non-formal communication, such as norms and practices and reflect on how we as individuals interpret, make sense of and thereby engage in environmental issues.

This study starts from this profound view of communication, paying special attention to the social factors influencing people's behavior. The study aims to better understand how social representations affect city officials' responses and compliance with the city of Stockholm's environmental policies, by investigating how these actors are understanding and coping with these policies. As green urban infrastructure and climate adaptation are important parameters to the development of more resilient cities, these two concepts form the focus of this study. Social representations theory (SRT) is used as the main conceptual framework, as it explores group-level common-sense understandings and has proven to be useful in analyzing social processes of climate change. A qualitative case study of city officials at three different units within the city was done to find out how these actors relate to the city's environmental policies, as well as their motivation, way of thinking and attitudes towards the concepts of green infrastructure and climate adaptation. Empirical data was gathered through participant observations, a qualitative survey and open-ended interviews, exploring the dynamics of the representations and the negotiation going on both on an individual level and on group levels. Three main social representations dimensions were identified relating to the concepts; the anthropocentric, the ecocentric and the technocentric dimension. Using these three dimensions, the implications of social values for green urban adaptation were explored.

The results of this study underline the need for further research on how social factors affects environmental change. By studying individuals 'and groups' interpretations, perceptions, and values of environmental policies, governments can bring more clarity to the complex social processes that form the basis for our decisions.

Keywords: urban green adaptation, green infrastructure, climate adaptation, nature-based solutions, social representations…

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Abbreviations

SLU	Swedish University of Agricultural Sciences
SRT	Social Representations Theory
SDG	Sustainable Development Goals
BGI	Blue Green infrastructure
IPCC	Intergovernmental Panel on Climate Change
PMA	Property Management Administration
WCED	World Commission on Environment and Development

1. Introduction

1.1 Background

Our cities hold our future in their hands. The official mission of SDG 11 titled "sustainable cities and communities" is to "make cities inclusive, safe, resilient and sustainable" (United Nations 2015). According to the UN, as much as 68% of the world population is projected to live in urban areas by 2050 (United Nations 2018). This rapid urbanization and increased density are putting pressure on municipalities around the world to cater for sustainability and healthy living environments. City planners and municipalities around the world are facing a new challenge, the quest of designing resilient cities of tomorrow, a complex mission requiring the courage to venture new paths. Part of the SDG 11 goal is to reduce the negative effects of natural disasters, including water related disasters (United Nations 2015). The UN International Strategy for Disaster Reduction have concluded that cities are increasingly vulnerable to global environmental change, e.g. drought, flooding, heat stress and extreme rainfall events, as they tend to suffer greater fatalities and economic losses when compared with rural areas due to the high density of people, buildings, services and the interconnected infrastructures (Elmqvist et al. 2019). Consequently, cities need to speed up their climate adaptation efforts.

One reason for cities' vulnerability to climate change effects, such as floods and rising temperatures, is the high proportion of hardened surfaces (e.g. paved streets and public spaces) which makes it more difficult for excess water to drain away. The buildings alone generate heat which along with absence of greenery raises the temperature more in cities. This high density of grey infrastructure can cause so-called urban heat islands, defined as "built up areas that are hotter than nearby rural areas" and usually observed where opened "wooden or green areas have been replaced by concrete or asphalt" (Nieuwenhuijsen 2016 p.162-163).
As an important contribution to urban climate adaptation, we're seeing a broad literature on the benefits of green space in cities. Many researchers today highlight the importance of urban green infrastructures to accommodate human needs, through conserving biodiversity and providing eco system services mitigating climate change (Coffey et al., 2020; Andersson et al., 2015; Bush 2020). More greenery and biodiversity in cities have also proven to promote health and well-being (Sugiyama 2021) and a reduction of personal exposure to

air pollution have been observed in areas with more green space (Nieuwenhuijsen 2016).

1.2 Problem discussion

Although there is strong belief in cities potential for new urban designs that integrate ecosystem services in the built environment and at the same time strengthening ecosystem functions, we only seem to be in the beginning of this urban green adaptation. Development of these measures is relatively slow despite the growing interest and the broad literature on the benefits of urban green infrastructure and ecosystem services. Still, hard surfaces can comprise as much as 67% of land area, while green areas only comprise 16% in some cities (Matthews et al. 2015). Researchers have sought the explanation to this slow development, seeking out main barriers and drivers for adopting green infrastructure for climate adaptation (Matthews et al. 2015). A brief review of current research on the contextual and governing aspects of green urban implementation indicates a need for more knowledge and research on the issue as there seem to be many aspects influencing the implementation and hence the actual outcome of green implementation. According to Wright (2011) and Matthews et al. (2015) a major challenge to the inclusion of green infrastructure facing city planners is that there is little agreement on how the term should be defined and interpreted among various disciplines, as they ascribes different environmental, political, social and economic meanings to the concept (Wright 2011; Matthews et al. 2015).

Many researchers today also point to the fact that our institutions are maladapted to today's complex societal challenges. Path dependency towards business as usual approaches and institutional unwillingness are examples of the many institutional barriers related to the integration of green infrastructure (Bush 2020). Overcoming path dependency is also brought up by Matthews et al. (2015) as a key element in order for necessary innovation to avert the worst climate change impacts of cities (Matthews et al. 2015). There is a risk that path dependency locks institutions in fixed patterns for thinking and decision-making and thus reduces their ability to respond adequately or meaningfully to new problems (Matthews et al. 2015 p.158). Elmqvist et al. (2019) is arguing that current governance systems do not match the needs of today's globalized cities because they are often limited to administrative and jurisdictional gradations and sectoral divisions, and together with the often relatively short-term political cycles, this contributes to limiting resilience (Elmqvist et al. 2019).
According to Andersson et. al successfully protecting green areas in attractive urban locations requires deliberate processes of planning and policy formulation as well as the engagement of committed stewards and broad public support based on awareness of, and insights into, the importance of these areas for human well-being (Andersson et al. 2015 p.165). We all have a responsibility to act climate consciously, however when it comes to green urban planning, the city officials have a great responsibility and an important role in maintaining and safeguarding democracy. Getting these actors to act responsibly, following the environmental

goals, and working for change in their daily operations is crucial as we citizens are not only dependent on the political decisions taken to reduce the impact of climate change on humans and ecosystems, but we are also depending on the municipal officials following these goals with great commitment.

Although we are seeing examples of cities around the world that are making a difference by successfully integrating nature, creating environments that helps both livelihoods and ecosystems, there are still significant challenges for incorporating green space into cities' policy agendas (Bush 2020). Although there is great potential to integrate nature-based solutions in urban planning methods, these are not yet well developed in either research or practice (Bush & Doyon 2019). There seem to be an apparent need for both clear environmental policies as well civil servants adhering to these policies advocating urban greenery and biodiversity. This study considers the issue by following the case of urban planning in the City of Stockholm.

In May 2020, the City Council of Stockholm adopted a new environmental program for the period 2020–2023, containing seven overall goals and 16 milestones that the city must meet (miljoprogram-sthlm-2020). The Environment Program paves the way for environmental efforts throughout all city functions. Among the seven goals is Goal 5: "A Stockholm with biological diversity in well-functioning and cohesive ecosystems", making sure that the biological diversity in Stockholm is high and resistant to change and that it contributes with many different ecosystem services (miljoprogram-sthlm-2020). In December 2021, the City Council decided on a new action plan for climate adaptation of the City of Stockholm. The action plan applies to the years 2022-2025, a concretization of goal 3 in the city's Environmental Program, which applies to a climate-adapted Stockholm (Handlingsplan för klimatanpassning 2021). In the action plan, the city formulates a level of ambition for its work with climate adaptation based on future climate scenarios and completed risk and vulnerability analyzes, focusing primary on rainfall and heat waves. In the plan it's stated that "Stockholm should be a city that combines high growth, good living environments and minimized environmental impact" (…) and "a dense and cohesive city where buildings and green structure interact and provide conditions to create good living environments." (Handlingsplan för klimatanpassning 2021).

1.3 Study aim and research questions

This study aims to better understand how social representations affect city officials' responses and compliance with the city's environmental policies on climate adaptation, green infrastructure and biodiversity, by investigating how city officials are understanding and coping with these environmental policies. The thesis is looking at both explicit communication e.g. environmental governance steering documents and implicit communication e.g. how do members of the organization make sense of, relate to and negotiate these concepts.

Consequently, I will base my research on the following research questions

> RQ1: What are current representations of green infrastructure and climate adaptation held by city officials?
>
> RQ2: What implications might these representations have for these actors' decision making and adherence to the City's environmental objectives in terms of climate adaptation, greenery, and biodiversity?
>
> RQ3: How can we overcome these social representations barriers?

To explore these research questions, this study draws on empirical data gathered from participant observations, semi-structured in-depth interviews with twelve city officials in Stockholm and data from a qualitative survey with city officials working in the property management administration in the City of Stockholm. The theoretical framework used in this study will be outlined in Section 2, followed by a description of methods in Section 3, including details on the study and interviewees. Drawing on the material from the interviews and the survey results key findings are presented in Section 4. Further interpretation of the findings related to the theories, is presented in the discussion section 5 which serves to draw conclusions and to support the implications of the findings. Finally, I conclude with a short final summary and a commentary on the implications of the study in section 6.

2. Theoretical framework

2.1 Worldview / philosophical premises

For this study I choose to understand reality as a socially constructed concept and base my research on a social constructivist worldview. The main idea of social constructivism is that knowledge develops as a result of social interaction and that meaning is constructed by human beings as they interact and engage in interpretation (Robson 2002; Moon & Blackman 2014). According to this theory our knowledge and representations of the world are not reflections of the truth or reality, but rather products of discourses, of social interactions and language used between individuals as they seek to understand the world around them (Jørgensen & Phillips 2022). The social constructivist theory emphasizes that learning takes place in the social interaction, and that learners build new knowledge upon the foundation of previous learning (Jørgensen & Phillips 2022).

However, in the context of climate change, one may argue that climate events occur independently from group members' discussions about it or not. But although awareness of climate change issues seems to be an important parameter for climate adaptation, this alone doesn't seem to be enough for succeeding with climate adaptation, as knowledge does not automatically translate into action (Amundsen et al. 2010). Everyday scientific knowledge often causes a challenge to make sense of the facts among those not familiar with it, focusing on the interpretations (Bauer & Gaskell 1999). Looking at interpretations of facts, how it is understood and communicated between individuals will help bring clarity to the various reactions related to climate change and how social interaction can be used to foster social and environmental change (Bauer & Gaskell 1999).
If we are to succeed in achieving the environmental goals, it is necessary that we understand each other and all the different aspects and perspectives that we bring with us to the table (economic, social, environmental, etc.). We must understand the underlying processes that form the basis of our decisions to find common goals and a joint vision for the future.

2.2 Scientific context

According to Bauer (2001) there is a growing amount of theoretical discussion and empirical research on social representations with the goal of understanding structures and functions of common sense, the production of hybrid forms of local knowledge in response to the societal challenges we face (Bauer & Gaskell 1999). When I searched for previous theoretical discussions and articles on the social processes and sense-making of green infrastructure and green urban development and implementation I found that this is still a relatively narrow scientific context and previous studies with a similar outline are few. However, a lot more research has been done on the social processes on climate adaptation, which refers to a broader context of actions taken to reduce climate change, also including actions

that are associated with increased vegetation. Since climate adaptation measures are closely linked to green infrastructure, as green infrastructure can often function as an adaptation measure, e.g. to prevent or reduce flooding, or to counteract the urban heat island effect (European commission 2014) this thesis will look at representations of both climate adaptation and green infrastructure with a greater emphasis on green infrastructure as this was the original subject of the study. Also, the fact that not a lot of research has been done previously on the social barriers towards green infrastructure implementation, convinced me to continue this rather unexplored path.

According to Jacobs (2006), the social constructionist research on urban studies has mostly been achieved through discourse analysis (Jacobs 2006). Although, discourse analysis share similarities to social representations theory like for example the focus on language and the cultural aspects, there are basic differences between the two theories (Moscovici & Markova 1998). For example social representations focuses on informal communication and mental constructions used by individuals to understand the world around them, while discourse analysis sees representations as constructions created by people in conversation and text. (Potter & Edwards 1999). A brief survey of discourse based urban policy research made by Jacobs (2006) found that a significant part of the research that has been conducted has been concentrated on the production of texts and how organizations use these texts to promote their political agenda. Very few examples of research have focused on the reception of the texts, e.g. how they are interpreted by the audience (Jacobs 2006). This indicates a need for more research on how messages are received by the audience and what factors influence the interpretation of the messages.

2.3 Social representation

For this study, I use the social-psychological framework Social Representations Theory (SRT), as a basis for my analysis. SRT was first formulated by Serge Moscovici to look at how scientific ideas are adopted in the larger population and become common sense among them, and has since then influenced researchers from varying disciplines (Moscovici & Markova 1998). The meaning of the expression ‘common sense’ in the context of SR is ‘taken-for-granted’ knowledge used by people to make sense of, structure and inform their actions and decisions (Raynor et al. 2017). In recent years the theory has been widely employed in rural and geography studies (Buijs et al. 2011). The purpose of social representations is to make something unfamiliar, familiar (Moscovici 2000). According to Moscovici SRT are first and foremost intended to make communication within a group non-problematic, to decrease vagueness, to find consensus among the members of the group (Moscovici 2000). Social representations are thus collective meaning making based on values, beliefs attitudes and practices that are being developed within groups (Bauer & Gaskell 1999). SRT describes how different social groups develop different understandings of an object, in this case green infrastructure, its significance for, among other things, climate adaptation, and how these understandings influence these actors communication about the object

and behavior toward it (Moscovici 2000). Social representations are not necessarily uniform across a population as there can exist several forms of social representations in their respective social milieus and natural groups just as meanings represented vary in the same society (Bauer & Gaskell 1999).
SRT does not only look at individuals as part of a group but also as separate individuals with the ability to possess many different ways of looking at the matter and representing it, according to Moscovici (2000) this is the very basis of our intersubjective relationships with social reality to be able to adapt our communication to changing social necessities (Moscovici 2000).

One way to analyze social representations is to differentiate between three dimensions; the normative, cognitive and affective dimensions of the representation. This differentiation has been applied by Buijs et al. (2011) looking at the social representations of nature (Buijs et al. 2011). The normative dimension is described as value orientations related to the concept of nature, the cognitive dimension consists of beliefs about nature (e.g.what is and what is it not considered to be), and the expressive dimension relates to the affective elements, or emotional reactions evoked by nature (Buijs et al. 2011).

2.4 Benefits of Green Infrastructure

In my research on the benefits of green infrastructure I found that the concept is relatively new, first appearing in the US in the 1990s and since the beginning of the millennium it has gained more attention, the use of the concept has grown and gained momentum and popularity in recent discourses on urban planning (Wright 2011; Hansen et al. 2021). In addition to contributing to climate adaptation of cities, the development of green infrastructure can provide economic, social and ecological benefits and contribute to sustainable growth (European commission 2014). According to the European commission the green and blue infrastructure (BGI) network delivers a wide range of ecosystem services, “improving environmental conditions and therefore citizens' health and quality of life and at the same time supporting a green economy, creating job opportunities and enhancing biodiversity (European commission 2019). Solid ecosystems in city’s are better equipped to resist extreme weather events and diseases by mitigating the effects of pollution, handling increased water volumes and coping with heat waves regulating local temperatures (Folke et al. 2021).

Today green infrastructure refers to an “interconnected network of multifunctional green spaces that are strategically planned and managed to provide a range of ecological, social and economic benefits” (Matthews et al. 2015 p.156). The concept encompasses any vegetative element enhancing the natural environment bringing multiple values and benefits e.g. green roofs, green walls, parks, gardens, backyards, green corridors, sport fields etc. Whereas blue infrastructure most often refers to any water elements, like rivers, canals, ponds, wetlands, water treatment facilities etc. Although green infrastructure has proven to have multiple benefits for climate adaptation, among them regulating temperatures and reducing storm-water outflow whereas hard surfaces increase the risk of flood events in

many cities, the adoption of green infrastructure is relatively slow. Even though the preservation of existing urban vegetation and the creation of new green areas are high on the agenda in the age of an unprecedented urbanization and climate change, there is still a lot of challenges needed to be solved before cities are fully qualified in structurally integrating ecosystem services in landscape planning, management, and design.

2.5 The role of social factors

The role of the social and institutional contexts of adaptation have been demonstrated to be important in the adoption of climate responses (Wolf 2011). For institutional factors, governance in the form of structures and other governing mechanisms, including decision processes, are influential in shaping the process of adaptation (Wolf 2011). Underlying values shape what is perceived to be prioritized and worth the effort, these values are defined as standards that guide decisions and goals, for example if the goal is to preserve the status quo for a particular ecosystem or if it is to improve quality of life and well-being (Wolff 2011). The values and goals also determine the limit to which the adaptation can be made and what adjustments are considered possible (Wolff 2011). Although this may seem obvious to many, according to Wolff (2011) there has been surprisingly little research about what these values are, whose values they are and what they imply for climate adaptation outcomes (Wolff 2011).
For this reason, there is a great need for a more explicit analysis of the role of values for climate adaptation, acknowledging climate adaptation as a social process and that values are embedded in how actors perceive climate crises and how decision-making takes place (Wolff 2011). According to Biesbroek et al. (2009) climate adaptation research primarily focuses on resources – time, money, capital, knowledge – as preconditions for effective adaptation (Biesbroek & Termeer 2009). However according to Biesbroek et al. (2014) the academic research on climate adaptation has expanded rapidly in recent years, highlighting social factors and conditions that influence our ability to be proactive to future environmental changes (Biesbroek et al. 2014). Several studies claim that what an actor values as barriers towards climate adaptation depends on the type of role they have, the values, interests, and ideas as actors interpret and give meaning to events in different ways (Biesbroek et al. 2014). Institutions can also become barriers when they constrain actors in achieving or pursuing their goal, for example if existing regulation prevents an actor to include adaptation in their daily practices (Biesbroek & Termeer 2009). According to Biesbroek et al. (2009) these type of institutional barriers can stagnate policy processes and need a collective action to be changed (Biesbroek & Termeer 2009).

As adapting to climate change is often associated with wicked, complex and messy policy problems, this wicked nature of climate change problems often clashes with more rationalistic and conventional institutions (Matthews et al. 2015). Climate change challenges us to cut across traditional silos and institutional structures, updating our routines and policy arena's (Biesbroek & Termeer 2009). Adapting to these organizational changes requires collective

action, we must work together and find consensus, since no actor alone can solve these problems, we need to interact and cooperate across borders, within networks about problems and solutions (Biesbroek & Termeer 2009).

One example of the relations between social values and individual's perception of climate change effects, is a case study on barriers to climate change adaptation in Norway, which illustrated that there was a strong correlation between a greater demand for proactive climate adaptation measures connected to sudden climate-related events (e.g. flooding), and municipalities that had experienced extreme weather events, hence adaptation efforts being mainly reactive and influenced by previous events (Amundsen et al. 2010). Reactivity, however, stands in stark contrast to the uncertainty posed by climate change. According to Matthews et al (2015) "managing green infrastructure for climate adaptation is primarily about managing risks or uncertainties created by anthropogenic activities (Matthews et al. 2015 p.158). The need for green infrastructure is thus reduced to probabilities, driven by problems that we want to avoid but not able to predict with precision (Matthews et al. 2015). A thorough categorization of barriers to adaptation is provided by the United Nations Intergovernmental Panel on Climate Change (IPCC), distinguishing between five different types of barriers; physical and ecological, technological, financial, informational and cognitive, and social and cultural barriers (Adger et al. n.d. 2007). Similar to this categorization, Biesbroek et al. (2009) also point out technical, physical, and ecological and economic factors, but choose to separate these factors from the social factors, described as the interactions of intentional actors and the outcome of these interactions shaped by the institutions in which they are acting (Biesbroek & Termeer 2009).
As climate change progresses, biodiversity is decreasing, and cities become even denser higher demands are placed on environmental governance, new knowledge and new learnings. Studying the social context of change allows us to look at how social norms, institutions or other rules are established, sustained and regulated and how that influences outcomes. It's important to recognize that knowledge, culture and norms are not static, they can evolve within organizations, groups and in society as a whole, meanings are constantly reproduced in interpretive processes between individuals, and just like meanings social rules, norms and values also develop (Joas & Knöbl 2009). These theoretical perspectives hopefully bring an understanding of how values, beliefs and assumptions are socially shared and how they influence climate adaptation strategies. Seeking to understand the social environment and the norms and practices can be a way to find advice and action for climate change and thus achieve the objectives of the Stockholm environmental policies and in the larger perspective, the goals of the 2030 agenda and the SDGs.

3. Methodology

The following section on methodology focus on how the study was designed in order to achieve the objectives of the study. This section includes the design of the study, the methods used to collect the empirical data and the digital tools used to select, process and analyze information on the research topic. Concluding, with a critical reflection upon approach discussing in terms of ethical considerations and credibility.

3.1 Case study design

Designing your research is a crucial part of the process as this is the part where the research questions turn into an actual project (Robson 2002). The strategies chosen for the design of the research depend on various aspects, among them the research questions which you want to get answered, the purpose of the study, the conceptual framework and the methods approach (Robson 2002).
This study aims to better understand how social representations affect city officials' responses and compliance with the city's environmental policies on climate adaptation, green infrastructure and biodiversity, by investigating how these actors are understanding and coping with these environmental policies. The research questions I have chosen for the research are focusing on participants representations of the concept of green infrastructure and climate adaptation, calling into question how the participants make sense of, relate to and negotiate these concepts and the City's overall objectives in terms of climate adaptation, more greenery and biodiversity. One way to answer these research questions is to apply a case study methodology. According to Robson (2002) the case study methodology usually focuses on a specific case (a situation, individual, group or phenomenon) and it allows the researcher to explore or explain what is going on in that particular case e.g. the meanings and implications of the specific case (Robson 2002). However, when applying a case study research design it's important to be aware of its limitations. According to Robson (2002) case studies are likely to be multi-faceted and as such problematic to capture adequately within one single theory (Robson), the risk is if the researcher uses a relatively tight conceptual framework and theoretical view, this might blind the researcher leading to missing out on important features or misinterpreting data (Robson 2002). This criticism mainly concerns if it's rigorous enough and the inability to generalize from one single case (Yin 2014). However, case studies are generalizable to theoretical propositions and not to populations or universes as

Yin argues, because the primary goal is rather analytical generalization, to expand and generalize theories and not extrapolating probabilities (statistical generalizations) (Yin 2014). Referring to this discussion, this research will not be understood as the presentation of objective truth but rather of subjective understandings related to the investigated concept. Consequently, as a researcher I am aware that I bring subjective values into the study (Moon & Blackman 2014).

3.2 Case selection

This case study explores the various perspectives on climate adaptation and green infrastructure among city officials, using a variety of data sources. The main context for this study is a property management administration in the City of Stockholm. This administration manages properties in the City of Stockholm, including office facilities, school buildings, public spaces, nature and outdoor areas and the city's facilities for emergency services, sports and culture. In addition to the property management administration the case study also involves city officials at an environmental administration and a district administration in the city of Stockholm. The environmental administration is responsible for the environment in the city of Stockholm, both outdoors and indoors. The administration works actively to ensure that the Stockholm citizen's live in a healthy and wholesome environment. This can apply to everything from traffic noise to water issues, chemicals, air quality and hygiene. The district administration is responsible for a number of activities based on a geographical area, among them child and elderly care, support and service for people with disabilities, management of parks, individual and family care and leisure and cultural activities. This administration works on the basis of the goal of caring for, preserving and developing the district's parks. An important part of the work is the dialogue with the citizens. Accessibility, sustainability, and climate issues are important focus areas for the district administration.

3.3 Actor and data selection

The empirical material was gathered through participant observations, qualitative surveys and open-ended interviews with important actors involved in the process of greening the city. The reason for choosing this strategy was that I wanted to research the dialogues and negotiations going on both on an individual level and on group levels when it comes to climate adaptation and urban green development. My intention with the qualitative open-ended interviews was to capture phenomenon that are not reflected in the social world, as I wanted to find out how these actors relate to existing norms and social rules, and their motivation, way of thinking and attitudes towards the concepts. It felt important to me that these interviews functioned as a way for the interviewees to open up and express their views more freely than in a social setting where you might feel the pressure to fit in, as "different forms of participation can be seen to reflect the many and varied ways in which individuals negotiate their engagement with

communities of practice" (Wenger 2011p.651). In total, I conducted in-depth interviews with 12 city officials in the city of Stockholm, and from the qualitative survey I received 22 responses from actors with various roles at the property management administration. I based my interviews on these themes: environmental awareness, previous experience, personal relation to the concepts, preconditions and mandate (see separate guides in attached appendix). Participant observations was done through participation in various meetings that focus on these issues. Using participant observation enabled me to become more involved in the social world of these property managers, observing the environment, actions and behaviors (Robson 2002). My role during these meetings was established from the beginning, as observing people as part of a research project without letting them know what you are doing is putting the principle of informed consent at a risk (Robson 2002).
The material from the in-depth interviews were recorded and transcribed and all interesting observations were noted down in a diary, to be picked up gradually for the analysis. The research on the explicit understandings was based on the written environmental policy documents relating to climate adaptation and biodiversity in the city.

3.4 Qualitative content analysis

To answer my research questions, I have chosen a qualitative research method to explore the different meanings and representations between city officials in the city of Stockholm. The study draws on empirical findings from participant observations, semi-structured in-depth interviews with twelve city officials in Stockholm and data from a qualitative survey with descriptive questions and in-depth answers sent out to property managers at the property management administration. The research questions and the theoretical framework set the direction of the analysis, focusing on defining the data based on themes or categories by coding it, e.g. identifying the passages of text and then link them with a name for that idea or theme – the code (Gibbs 2022). The data collected in interviews, survey and participant observations was analyzed using an inductive approach on qualitative content analysis according to (Mayring 2000). The basic idea of this approach is to come up with tentative themes or categories derived from the theoretical background and research questions, and within a feedback loop letting these themes or categories develop and be revised until you eventually reduce them to main categories where general conclusions can be drawn based on the data (Mayring 2000). This retrieval activity may allow for discovering deeper and more analytical connections in the text (Gibbs 2007). In order to code the data I used a qualitative data analysis software (e.g. NVivo) where all or parts of the data was coded and labelled, and later grouped by their respective theme and later analyzed and interpreted (Robson 2002). Finally, I applied these in the analysis and theoretical framework (Robson 2002).

3.5 Ethical considerations

3.5.1 Informed consent

In order to avoid any misunderstandings between the respondents and me as a researcher when conducting interviews, I made sure to obtain consent from the participants. In the interview invitation, I explained the purpose of the interview and what the study involves (Robson 2002). Before starting the interviews, I checked once again that they fully understand the research, their role of the study and asked if they had any questions or concerns before we started the interview (Robson 2002). For the survey I made sure that the respondents understand that the data gathered from the survey will be used for the Master thesis and that participation is voluntary (Robson 2002). I also provided them with contact information for any questions or concerns and in case of withdrawal (Robson 2002). As giving anonymity is considered good practice in terms of confidentiality, all data was anonymized to practice confidentiality (Robson 2002).

3.5.2 Researcher bias and credibility

Reflexivity helps draw attention to how I position myself in relation to my research, by acknowledging that as a researcher I am part of the research and influence it. One way of ensuring reflexivity is by actively reflecting on my own role as a student in the Environmental Communication and Management program and as a professional within communication, and the experiences I bring with me and how these are shaping my interpretations of the data (Creswell & Creswell 2018). As a student at SLU, I have a pre-understanding of the environmental aspect of urban planning, the norms and values that I carry are based on my understanding of these issues. Consequently, I made sure to continuously reflect on my own assumptions and how they might influence the research process and the interpretations of the data.

Another way to ensure reflexivity is to ensure that as a researcher I protect the research participants and develop a trust with them (Creswell & Creswell 2018). As this thesis was done in close collaboration with the property management administration, and I had spent quite some time there as part of my internship just a few months earlier, I had to be clear towards the participants about my role there, that I was acting as a master student at SLU with the goal of writing a thesis based on data gathered from them. Obviously, there are a wide range of scholarly literature with proposed guidelines and principles for addressing ethical issues, in my search for more guidance I found the practice-based knowledge article by Long et al. (2016) useful, as it focus on shared common ethical challenges and issues (Long et al. 2016). As there is hardly room to elaborate more on the subject, at least I want to emphasize that for this thesis I have strived to always be transparent with the purpose of the study, and my role as a researcher, I also aspired to set clear boundaries and agreements on the expectations between me and PMA, avoiding mistrust or false expectations (Long et al. 2016).

4. Findings

In the following section, the result of the study is presented, based on the qualitative content analysis and the different categories identified in the coding process. Applying the social representations ideas to my case study allowed me to explore these actors' subjective interpretations and collective understandings (formal and informal rules guiding interactions between these actors) in relation to variables influencing climate change adaptation. In my interviews with these actors, I found a range of different perspectives on green infrastructure, biodiversity, and climate adaptation. While these perspectives varied both on an individual level and at group level, a large proportion of the understandings of these concepts seemed to be nested within the collective and reproduced in interpretive process between these individuals informing their actions and decisions. Drawing on the material from the interviews and the survey results with these actors, three main social representations were identified relating to the concepts: the anthropocentric, the ecocentric and the technocentric representation (Table 1). The representations related to the anthropocentric view place humans at the center of the discussion, nature is seen as a resource to be exploited by humans in the era of capitalism and the free market (Thompson 1998).
The representations related to the ecocentric view are based on a moral value in the larger ecosystem and have faith in the rights of nature and of the essential need for a co-evolution of human and natural ethics (Thompson 1998). The third and last representation, the technocentric, is based on faith in the capacity of science to solve all environmental issues (Thompson 1998). These three representations were dominating the sense-making and explanation models expressed by the participants. As such, these social representations are formed by normative and cognitive elements. Following the structure of the differentiation between the three dimensions; the normative, cognitive and expressive elements (Buijs et al. 2011) these representations are grouped into these three dimensions. In the following section these topics will be presented in detail, forming the basis for the discussion part of the research.

Social representations	**Normative elements**	**Cognitive elements**	**Expressive elements**
Anthropocentric	Preserving the welfare of humans Nature is seen as a resource to be exploited by humans Capitalism Liberalism	The need to control nature Dictated by economic justifications and a need to define and measure green investments in relation to traditional solutions.	Mixed emotional connection to nature
Ecocentric	Nature should be protected and valued even if it's not used by humans as resources. Holism Gaianism Moral extensionism Natures rights	Humans are part of nature Green elements are important parts in building a resilient city Green infrastructure is natural and consists of elements that help nature do its job. Nature should be left uncultivated and unkept to promote biodiversity	Close connection with nature Feel attached to nature
Technocentric	Humans and technology are best suited for providing solutions to environmental issues Faith in science, technical evolution, and market institutions Decoupled from nature	Technical explanatory models are given priority when speaking about climate adaptation. Technical processes and procedures have proven measurable effect	Complex relation to nature Skepticism towards green concepts Green elements are seen as a potential threat to buildings

Table 1: Overview of social representations of climate adaptation and green infrastructure

4.1 Anthropocentric representations

4.1.1 The normative dimension

This section aims to present examples of representations related to the anthropocentric view, looking at norms, values and ideas related to the concepts of climate adaptation and green infrastructure. This part is looking at the structuring and more permanent features in social life created by norms and values, and commonly held beliefs about the concepts as well as ideas of barriers towards the inclusion of green elements.

A vast majority of the respondents at the property management administration were focusing on the economic values of greening properties. Being able to recoup the financial investments by increasing the value of the property or saving money by choosing not to invest in green elements or calculating the expected costs related to green investments versus the costs of implementing a standard solution without green elements. Very few respondents at the property management administration expressed a connection between green infrastructure, climate adaptation and environmental health.

> It’s not like you can say that it will increase the value to just smack up a green wall, but if you combine all the measures, as we do, it will increase the value, the green wall can be a small part in a greater plan, to make the area more attractive. (Interview A)

> The question is where the breaking point is, without sounding bad now, if you put vertical plant beds on whole containers and they require a maintenance effort, you have to calculate the cost of that versus having a standard trellis solution without plants. (Interview B)

These quotes indicate that the norms and values related to climate adaptation and green infrastructure in this context are mainly based on an anthropocentric and economic understanding of nature, the value of green elements are measured in economic terms and nature is seen as a resource to humans.

This was also further confirmed when participating in climate adaptation meetings at the property management administration, these types of issues were mainly discussed in terms of human welfare and decreasing the risks of increased costs due to damages caused by climate change such as flooding. The link between human life and health and a well-functioning ecosystem was not discussed at all during these meeting. I was surprised that no one brought this up, although avoiding negative impact on the environment is part of the climate adaptation strategies in the Environment Program

> The work of adapting Stockholm to climate change should primarily focus on minimizing the risk to people's lives and health, preventing serious disruptions to socially important activities and activities that are important for the city's functionality, and reducing the risk of serious material damage and serious impact on the environment. In this matter, long-term urban planning is very central” (miljoprogram-sthlm-2020).

4.1.2 The cognitive dimension

The cognitive dimension of the representations related to the anthropocentric view of climate adaptation consists of cognitive explanation models and beliefs used by these actors to understand climate adaptation and green infrastructure. When researching the individual understandings towards the concept of climate adaptation I came across opinions expressing a need to control nature and maintain it so that it is not causing trouble for the tenants and subsequently for the property managers. Many of the property managers expressed a dissatisfaction with the overall spread of green elements in the city, for example problems with shrubs getting too wide or too tight, reducing light penetration, shadowing the site, so it becomes insecure for people to pass through there, even when using extra night lightning. Vegetation growing to wide, was also mentioned as a problem causing a haunt for rats or being used as toilets.

> You usually don't want trees close to the turf football fields, because then biological material falls down on the field and require more maintenance efforts and if you do not make these efforts, it will reduce the life span of the field, and if you have a grass field, you do not want trees either, because then they cast a shadow on the pitch that can cause it to grow into moss or mold infestation on the grass field". (Interview B)

> I see that on a lot of properties, where nothing is supposed to grow, but yet it self-grows, bush wood or birches and if it is then originally intended as a green roof, the roof has greater resistance, then the waterproofing layer is better for that type of vegetation than if the roof had not been prepared for it. If a birch takes root, there is a lot of force, so the roots go through the waterproofing layer and down into the constructions. There are some places where it starts to leak and then the question is whether to turn it into a green roof or make a new ordinary roof and hope that it does not happen again. (Interview C)

The fact that there exists a common cognitive understanding of the disadvantages in including greenery next to the buildings might be an obstacle in itself, as it is reflected not only on a personal level but is collectively shared among the property managers and hinders the work of including more greenery.

4.1.3 The expressive dimension

The expressive dimension of the representations related to the anthropocentric view of climate adaptation consists of the affective or emotional responses evoked by the concept of climate adaptation and urban green elements. Many of the respondents at the property management administration were expressing mixed emotions when it comes to vegetation such as trees and shrubs. These mixed emotions were further manifested by the natural resource manager working in the property management administration and a landscape designer working at the district administration who testified that

> The green elements are seen as a potential threat to the facade and the property. (Interview D)

> There is still a strong belief that vegetation on facades is bad. I do not understand this because the vegetation absorbs the water, hard surfaces do not drain the water, it accumulates there. I can understand that there is a concern that tree roots will penetrate into pipes and tubes, there is a truth in it absolutely, but it is an old attitude that just stays the same. (Interview E)

These negative or mixed feelings towards green elements can be seen as an example of affective dimensions of representations related to the anthropocentric view because they express a view of nature that is separated from humans, which indicates that humans have a greater intrinsic value than other species, thus peoples need to control and conquer nature (Hoffman & Sandelands 2005).

4.2 Ecocentric representations

4.2.1 The normative dimension

This section aims to present examples of representations related to the ecocentric view of climate adaptation and green infrastructure, looking at norms, values and ideas related to the concepts. This part includes structuring and more permanent features in social life created by norms and values, and commonly held beliefs about climate adaptation and green elements. In my search for the ecocentric view I found that this was best represented in the explicit environmental governing documents of the city e.g. the city's guidelines for planning, implementing and managing the city's parks and nature areas, the city's environmental program for the period 2020–2023 (miljoprogram-sthlm-2020) and the biodiversity action plan for the city (handlingsplan-for-biologisk-mangfald-i-stockholms-stad 2020)

> Biodiversity is one of the basic preconditions for us humans to have a high quality of life, but also for the life on the planet to continue at all. (ref. handlingsplan-for-biologisk-mangfald-i-stockholms-stad.pdf.)

In the same document the Mayor of Environment and Climate suggests that the relevant city departments

> (…) develop multifunctional solutions by co-planning measures for biodiversity, climate adaptation, water purification, heat equalization and other ecosystem services in a public place" (handlingsplan-for-biologisk-mangfald-i-stockholms-stad.pdf.)

Based on these statements from the city's environmental policies and document, I would say that these documents incorporate ecological values and norms related to green infrastructure in cities, and climate adaptation efforts. Managing biodiversity is a central part of the environmental program according to local politicians in Stockholm City. Based on my experience of the property management administration, my understanding is that this statement challenges this administration on many different levels as green infrastructure doesn't seem to be part of the implicit understanding of property management in the city of Stockholm.

4.2.2 The cognitive dimension

The cognitive dimension of the representations related to the ecocentric view of climate adaptation consists of cognitive explanation models and beliefs used to understand climate adaptation associated with a moral stand for ecosystems and the biosphere and a duty to the whole environment (Thompson 1998). In my research I found some cases of ecocentric views were represented by the interviewees from the district and environmental administration, whose opinions were manifesting high ecological standards reflecting the environmental governing documents of the city

> We are all responsible for creating better conditions for biological diversity, such as e.g. leaving grasslands uncut, create meadows, make sure our plantings have pollinator-friendly plants and all those things. (Interview F)

> Climate adaptation is in everyone's interest and responsibility. So it's a matter of detailed planning and green urban development. That all of us share a common picture of how this should be taken further into the future. (Interview E)

These quotes demonstrate that these respondents understand nature's intrinsic value and their own responsibility in complying with the city's environmental policies. According to Thompson (1998) ecocentrists share a mistrust of large-scale technology, advocating ecological balance and an ecological approach to climate adaptation (Thompson 1998) this view was further confirmed by an interviewee at the district administration

> In terms of sustainability, we try to move towards smaller and less technical solutions because it lasts better over time, if you can use the existing land and nature, it is a more sustainable alternative than technical functions that break down". (Interview E)

This statement illustrates that the ecological approach has is not only established within the environmental administration but also with government officials within the district administrations.

4.2.3 The expressive dimension

This part aims to present ecocentric emotional responses to the concept of climate adaptation and green infrastructure. When deliberating on these concepts the interviewees expressed less emotions associated with ecocentric views, however I did come across some expressions of frustration and concern from the respondents at the environmental and district administration that could be related to an ecocentric view, when asking how they argue for ecological values and the inclusion of green infrastructure

> One of the challenges is to change old patterns, another is economics. If you can prove that it's possible to save money by, for example, having perennial plantings instead of hard ground paved surfaces, then you're in a better position (Interview F)

> Everyone in the city has the same goal when it comes to climate adaptation but still it's not easy, you hit rocky ground all the time when it comes to collaborations. (Interview E)

These quotes illustrates that the divergent representations are causing dilemmas between the different groups, collaboration is still a challenge within the city when it comes to green urban adaptation. Having studied the property management administration in detail for many weeks, I got the feeling that much of what is done today is done according to old routines for property management. The organization follow in the same footsteps as previous property managers in Stockholm and repeat old habits without questioning existing practice.

4.3 Technocentric representations

4.3.1 The normative dimension

Technocentrism is usually associated with a belief in the retention of status quo in existing societal structure and political power and have faith in the adaptability of science, to accommodate environmental demands (Thompson 1998). A majority of the respondents at the property management administration shared a technocentric view on climate adaptation and green infrastructure, using a technocentric frame of reference and a strong belief in continuing solving climate adaptation challenges in the same way that has been done so far. As an example, during one meeting at the property management administration looking at properties risking being negatively affected by climate change, the solutions discussed during the meeting were all technical solutions, such as water delay magazines and more effective drainage materials, no one brought up the need for more vegetation although vegetation demonstrably absorbs large amounts of water. Although in the Stockholm's Environment Program it's stated that "long-term urban planning is very central for climate change adaptation" (miljoprogram-sthlm-2020) a majority of the property managers are focusing on the "here and now" putting out fires, ensuring temporary technical solutions to the problems rather than planting more vegetation in the form of trees that can futureproof their properties in the long run

> We have had a dialogue about floods that have occurred nearby our properties, and we are also working to prevent floods with better runoff. The tenants have had opinions but we have not agreed. For example, in one case the tenants wanted to remove a horse farm to plant trees there instead to create better drainage. We estimated that it would take so many years for the trees to grow up and have an effect on the water drainage, so we decided instead to drain the area. (Interview G)

> We do not have enough time. We have to focus on the here and now. I wished it was half of the time focusing on the here and now and half of it focusing on long term work. Now it's rather 90 against 1. (Interview H)

These quotes illustrates that the property managers are reactive when it comes to climate adaptation and there is not space for long-term proactive planning to avoid future events. When I asked the property managers about nature-based solutions, I was told that there is no focus today on including more vegetation for

climate adaptation purposes, although some participants seemed to have an interest in learning more about it working more proactively with these types of climate adaptation efforts.
The degree of interest in nature-based solutions seemed to be relatively person-dependent, varying from person to person. Although the majority were talking about climate adaptation efforts in technocratic terms I found nature based elements among some property managers expressing the benefits associated with green elements, for example when using vegetation for drainage decreasing the risk of flooding. However, these actors used a technocratic frame when speaking about vegetation, distinguishing it in technical terms, i.e. how much water volume a tree can reject vs a technical construction.

> I have been involved in the ongoing project around centenary rain and answered questions that concerned my properties. It's important to review how we should handle it in the best way. It might be better with a green roof because it absorbs maybe 70% of the precipitation and 30% becomes superfluous so it still has to be transported away, but otherwise it is 100% that must be removed. So from that aspect, it is better with a green roof that can recycle and bind the water, relieving underground stormwater systems and releasing the rain water back into the atmosphere…(Interview C)

> I think that if you did some kind of calculation, in black and white, where it is clear what added value the project will generate, e.g. if you make a green roof or green wall, it reduces the load of our stormwater system in the event of heavy rainfall, we will save the equivalent of X liters of water that can be used to irrigate X number of football pitches ... etc. Something you can put into a relationship (…) You have to weigh in more values. If you can communicate that you save money and water by having a water reservoir, which you can water with, then it is a completely different matter. (Interview B)

The fact that the climate adaptation efforts are mainly based on conventional technical methods although nature-based solutions are advocated by the government, is problematic. Based on the survey, most property managers did not have experience of working with green infrastructure or nature based solutions for climate adaptation. A vast majority of the property managers were claiming that their main task is to focus on the properties, tenants and contracts. Although the city provides environmental policy documents communicating the importance of "developing multifunctional solutions by co-planning measures for biodiversity, climate adaptation, water purification, heat equalization and other ecosystem services in the public place" (miljoprogram-sthlm-2020) these actors don't seem to comply with these policies

> My priority is to rent out premises, there must not be empty premises. Then I have to make sure I keep my tenants in order […] I do not have time to sit in my room and think of green projects e.g. like a green wall, someone else would have to come and initiate it and supervise it. (Interview A)

All of the above examples are representations of a technocentric view on climate adaptation, decoupled from nature (an ignorance of the important functions of nature) and an overconfidence in humans and technology as best suited for providing solutions to environmental issues.

4.3.2 The cognitive dimension

When the interviewees talked in cognitive terms about climate adaptation, most of the property managers portrayed a technical approach to climate adaptation, the buildings must be protected from climate change and increased water volumes handled by technical reinforcements where necessary.

> If you build a stormwater reservoir, you build it in concrete under the football pitch, these sports facilities are usually located where the geotechnical conditions are quite poor, it is usually mud, which causes the ground to sink. If you build a concrete reservoir and the ground sinks, it becomes uneven, which means that you have to strengthen the remaining part of the ground so that the ground does not become uneven. (Interview I)

Even though, technical solutions are still largely advocated by the property managers, there seemed to exist a common understanding among these respondents that hard surfaces are not as effective as natural surfaces to take care of the water. But very few were suggesting more vegetation to be planted to take care of the increased water volumes. Many of the respondents explained this by saying that more land is needed to be able to replant vegetation and that it is currently being eaten up by the development plans in Stockholm. The need to exploit the city due to an increased demand for housing is leading to land disputes. Increased housing constructions is one of the most prioritized tasks when it comes to city planning and the goal is to build 140,000 new housings between 2010 and 2030 (riktlinjer-for-bostadsforsorjning-2021). According to one participant, problems arise when the exploration administration proposes that the water volumes should be directed to sports grounds, as the water will do less damage to a football field than a residential house. Even though most artificial pitches are constructed with drainage in all four corners and drainage pipes, so the water is led to wells where they are disposed, this solution is associated with increased costs for the property manager and the lack of natural elements in the form of trees and shrubs on the sites, further complicates the drainage process which is solely dependent on technical solutions and hard surfaces

> In Stockholm there is a housing shortage, we are behind with the housing goal and because of that there is a lot of focus on finding land for building new housings. At the same time water delay magazines are needed because there are so many hard surfaces when you constantly densify the city. Somewhere the water has to go. When they target the land on the sports grounds for taking care of the water to become a natural rainfall area, then we have to oppose ourselves, as we don't want our sports grounds to be drowned. Although we realize that the consequences of flooding there are not significantly as obvious as for housings. But we do not have much green space left there to take care of the water, it is mostly hard, gravel and artificial turf surfaces left. (Interview J)

This quote illustrates that there is a risk of exploiting potential opportunities for green urban adaptation linked to climate change events. The green areas left in the city that could be the solution to climate adaptation and the management of the

increased water volumes are decreasing as the city builds more housing. In addition, natural grass is replaced by artificial grass all over the city and shrubs and trees are removed as they take up too much space. I also believe this is a very descriptive example of how collaborative approaches are needed to meet the urban adaptation challenge. The parties involved must be able to agree on how the land and facilities are to be used and how to handle the increased water volumes from a holistic perspective otherwise there is a risk that the problems will continue.

4.3.3 The expressive dimension

When the interviewees related to expressive elements associated with climate adaptation and green infrastructure, they usually did so in a negative manner. Many of the respondents with a technocentric view seemed to have a complex relation to nature and feared it would do damage to the buildings that must be protected from it.

> As property managers we have a complex relationship with trees, I know they do a lot of good but they also do a lot of damage, branches fall on people and cars and its roots clogs pipe systems and other things, we get foliage that falls down on the roofs and we have to deal with it. At the same time, I understand that they are needed to a very high degree. (Interview J)

I also came across a skepticism towards green concepts, mostly claiming that it's more resource consuming. Many see that it could potentially benefit the city to work more with nature-based solutions in the long run even if many respondents tend to fall back into old tracks

> I absolutely see the potential! When we have had presentations of these really creative architectural concept drawings of green roofs and terraces with green surfaces and even trees, we often take on a bit of a "boring steward conservatives": Yes, but how should care and operation be handled? Who takes care of it? You forget about operations and maintenance when it comes to these really creative solutions. (Interview J)

> We don't have enough resources to run these types of projects. If you want this type of green solution, you have to spend money, it takes more hours out of the operations to maintain these projects. I feel that there are more and more goals all the time but not more money. (Interview I)

In this section the diverging social representations of green urban adaptation have been demonstrated using examples from my research. In conclusion, the anthropocentric representation towards green urban adaptation focused on the negative impacts of nature on the properties, stressing the need to control and regulate nature and viewing nature as a resource to capitalize on. This position is quite diverse from how the second position, the ecocentric and environmentally friendly representation view nature; as an important provider of various benefits, ecosystem services and securing biodiversity. Finally, the technocentric position, focus on the technical aspect of climate adaptation and have trouble seeing the multiple benefits that green spaces provide in cities.

4.4 Anthropocentric approach to sustainable development

Apart from the fact that politics are often short sighted, and institutions often stuck in routines and delimitations, the anthropocentric approach to sustainability has contributed to the continuous overexploitation of the planet and negatively impacted the environment causing climate change and global warming. The most common definition of sustainable development, dominating the discourse over the years is the Brundtland definition published in the Brundtland report in 1987 by the World Commission on Environment and Development (WCED). In this definition the term "sustainable development" is defined as

> "(…) development that meets the needs of the present without compromising the ability of future generations to meet their own needs.... Sustainable development requires meeting the basic needs of all and extending to all the opportunity to fulfil their aspirations for a better life" (Thompson 1998).

As such, the Brundtland definition has an anthropocentric, i.e. human-centered, utilitarian perspective which focus on maintaining human well-being now and in the future. However, it is worth mentioning that even though the Brundtland definition tends to regard species and ecosystems as resources for people rather than objects that have an intrinsic value, it also recognizes and believes that human quality of life can only be guaranteed if not exceeding the environmental carrying capacity of supporting ecosystems (Thompson 1998). Still, in my view the definition has a vagueness and ambiguousness over it, allowing it to be misinterpreted or mishandled for own purposes and benefits. In the light of today's complex environmental challenges, there is a need to bring more clarity to the definition, highlighting the ecological values taking an eco-anthropocentric approach, as we know today that one perspective depends on the other for its existence. As the anthropocentric view has caused a lot of damage, one would argue that there is a need for a combined eco-anthropocentric approach with stronger ecological values and weaker anthropocentric values and interests, recognizing the intrinsic value of nature and how we depend on it for our existence, this approach can be very pragmatic and has the potential to reach a wide public.

In the data I found evidence that there existed a common picture among the property managers that the reason green elements were not prioritized was that they this is not their responsibility and that they only manage buildings and not the surroundings. When asking about the inclusion of green spaces I often got the answer that they only manage one square meter surrounding the buildings". However, I also came across several examples where managers described situations where they dispose significantly more land surrounding the facilities but choose not to focus on that space. The most common explanation to why they didn't focus on that land was that they lacked clear directives or a budget for implementing more green areas.

> It must come from above. If you set a requirement that there should be vegetation included in the properties, then it will happen. (Interview I)

> My perception is that this is not the biggest demand on us right now, in the past it was more clear directives on how to work with climate change proactively. Today it's mainly about keeping the economy going as the required rate of return has increased. (Interview G)

Even though land shortage was not the main cause itself, a normative picture circulated among property managers that that was the case. In fact, there were other underlaying factors influencing their decision to not include green spaces. In addition to land shortage, there was also a general perception that the inclusion of green spaces and nature-based solutions entails an increased need for maintenance. Most of the property managers were saying that the maintenance today is limited to the most necessary activities and that it has no room for more than what is done today. When I interviewed a respondent at the environmental administration and asked her what her priorities would be to improve biodiversity within the city, among other things she mentioned the need to update current maintenance plans for green areas so that they better foster biodiversity.

> I would start by looking at the maintenance and management plans that are available and find out if they need to be updated so that they are better adapted to the city's demands on biodiversity. (Interview F)

I asked the operation manager who is in charge of maintenance of properties at the property management administration, what is included today in the maintenance plans for green spaces, he told me that above all it’s about keeping it neat and clean, like raking leaves and mowing the grass etc. and that there is all they have capacity for today

> We do not have room to develop green areas, perhaps the technology administration have capacity. They are responsible for planning and starting projects, they run these type of projects such as green roofs. (Interview L)

Although the biodiversity action plan for the city has clear directives for working with measures that benefit biodiversity, the maintenance plans are not updated according to these directives and managing biodiversity is not part of the daily operations at the property management administration. These two different views on what is needed in the maintenance plans shows that there are different opinions on what the city needs. The ecocentric view argue that it’s important we give nature a chance by letting the grass grow, plant a various type of vegetation that promote biodiversity, while the anthropocentric view argues for a tidy and clean city, where nature must not take too much place. So far, the latter has been given priority in the maintenance plans of Stockholm as a result of an anthropocentric approach to urban planning but there are reasons to believe that this will change eventually as climate change progresses, biodiversity is decreasing, and cities become even more denser it’s likely that the city will continue push for more climate initiatives to be brought forward.

5. Discussion

In this section meanings and implications of the findings will be discussed and interpreted in light of the literature by answering my research questions, and draw conclusions based on the findings. Furthermore, I will explain possible limitations of this study and provide recommendations for further research.

5.1 The different social representations and their relationship

The data analysis showed that there were three models of representations: the anthropocentric, ecocentric and technocentric dimensions. Most of the respondents were holding anthropocentric and technocentric values and norms, only a minor part of the respondents expressed ecocentric ideas, norms and values. However there seem to be no compartmentalization between the three dimensions, but instead they seem to overlap and interweave (Figure 1). Thus, some of the respondents could be said to belong to more than one representation model. Another finding of the study was that there were major differences in how the concepts of climate adaptation and green infrastructure was viewed by the respondents. This is judged by the lack of consistent normative, cognitive, and expressive responses between the interviewees. When one group expressed a certain type of norms and values, corresponding norms, ideas and feelings were lacking in the other group. Their respective ideals and beliefs did not agree with each other. In addition, some tensions were found between the different groups. Frustration and concern could be linked to the ecocentric group, as a result of repeated indifference to the ecological values of the technocentric and anthropocentric side. The cognitive contradictions between the different notions consisted of fundamental differences in the definition of sustainable development and climate adaptation between the anthropocentric notion based on economic explanatory models where economics dictates humans need to exploit nature, and the ecocentric view advocating ecological balance and an ecological approach.

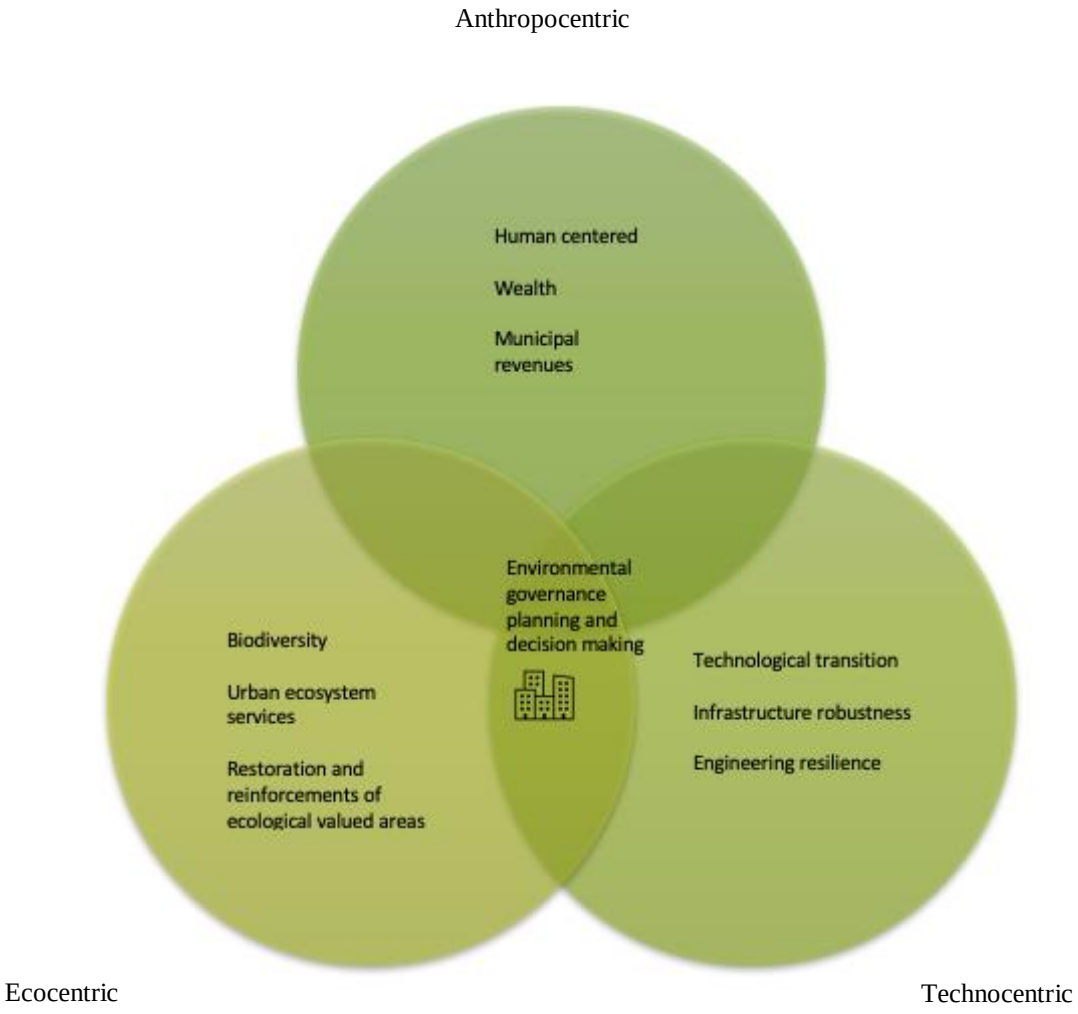

Figure 1: Overview of the three representation models in interrelation

5.2 Implications for environmental governance

As mentioned in the findings section, there was a strong tendency to talk about green elements in economic terms among the property managers, whereas the ecological values were predominant among the city officials working in the environmental administration. These underlaying understandings of climate adaptation paint a picture of how different these collectively shared understandings can be, between different units within the city. This reality of different values and principles probably makes it difficult for these actors to cooperate and find common ground. The main responsibility for the property managers is to provide premises for the city's residents and to deliver a surplus from the business to the City Management Office. This means that working with environmental management and goals are not an explicit purpose within the organization. However, there are certain areas within the Stockholm environment program that have been part of the operations for some time and that the property managers view as part of their responsibility, especially

the energy area and environmental issues linked to construction projects and to comply with applicable regulations regarding construction of buildings

> There are certain areas that our property managers feel more comfortable with and are directly affected by, such as energy. But when it comes to transport or chemicals, they do not think they have so much responsibility or are affected so much. When it comes to waste, for example, it is the tenants and their business that is responsible (…) they probably do not see that it should affect the business so much, however when it comes to climate impact in the construction process they do understand that they have a great responsibility to follow the environmental goals. (Interview K)

This indicates that the city officials focus on activity and business-related issues and priorities that seem to have a more significant effect on operations than the more far-reaching consequences of climate change. This picture corresponds well with the theories on climate change discussed in previous sections; adapting to climate change is often associated with wicked, complex and messy policy problems that don't necessary match with rationalistic and conventional institutions (Matthews et al. 2015). Institutional rules and delimitations with short-term focus block our view and hinders us from taking a long-term holistic approach involving many different perspectives.

5.3 What is needed?

The resilience of cities is dependent upon their ability to adapt in the face of climate change (Bush & Doyon 2019). According to Elmqvist et al. (2019) and Bush et al. 2019 urban sustainability is about navigating forward in the desired direction rather than avoiding abrupt change and collapse (Bush & Doyon 2019; Elmqvist et al. 2019). Many researchers today argue that urban resilience requires long term and integrated approaches to urban planning and development as well as a bringing together different disciplines, perspectives, and mechanisms, to explore future pathways (Bush & Doydon 2019). The increased demand for resilience offers urban planners the opportunity to question their old approach, and develop more transformative ways of working, challenging accepted ways of thinking, shifting environmental governance towards more proactive approaches (Bush & Doyon 2019). This study shows that the different units of the city of are still focusing mainly on their main tasks and responsibilities, naturally, but to succeed in achieving the goals for climate adaptation in Stockholm, consensus and cross-border collaborations are required, just as it is stated in the action plan for climate adaptation

> (…) coordinated and clear processes are needed. Coordination of requirements, clear division of responsibilities and a group perspective are central starting points for making the right priorities and for achieving effective development of the city (Handlingsplan för klimatanpassning 2021).

Today each separate unit's interest and liability on its individual areas of responsibility. The city's property managers are focusing on providing premises

for the city's residents and are responsible for the properties. The city districts are focusing on managing parks and public spaces and are responsible for planning and initiating city development projects, as well as managing water and waste management, whereas the environmental administration is responsible for the wholesome environment in the city. Among many things, this thesis has shown that more collaboration between units is needed in the city. This was further emphasized in interviews, a joint need to collaborate more across levels, between different actors to achieve the city's environmental goals was expressed by the participants.

> I think we will never succeed in solving climate adaptation issues if we do not try and do something together, for example when it comes to applying for climate investments, then you might be able to collaborate and make a common application or talk to each other about what are important parts to apply for. Start from a problem formulation or issue on the site, for example that more greenery is needed, for sun protection or cooling down or rain beds are needed to handle the stormwater at a specific property, and there is land outside the property that belongs to the district, I think that one should be able to cooperate. Either that you seek common funds or that you redirect funds. (Interview E)

> It would be interesting to look at how we could cooperate more closely when it comes to drainage or sun protection and heat waves and the function of the trees there. For example, that we help each other take care of the water and lead it to a nearby park area. Then maybe we could get water for trees and for our plantations at the same time. (Interview E)

> I think that it's great that the city has a desire for us to become more environmentally conscious and create more green spaces for the areas where you build properties but to be able to achieve these goals, I think we have to get better at working together. (Interview C)

There is a need for more collaboration, but at the same time there is also an obvious risk that these actors will repeatedly face rocky ground and find it difficult to agree as they represent divergent social representations which affect the degree of ambiguity among the participants. This ambiguity makes it difficult for cooperation, to find common ground and a mutual understanding of the political goals and how they should be implemented. For this reason, it would be appropriate for policy implementation to complement with a social cognitive lens where stakeholders' interpretations of policy are examined and compared.

5.4 Further research

In this part I will explain possible limitations of this study and provide recommendations for further research. The social knowledge theory of social representations specifically deals with how individuals, groups and societies understand and make sense of socially relevant or problematic issues. Since first elaborated by Moscovici's this theory has influenced researchers from various disciplines around the world. This study is based on recent theoretical and empirical studies on how adaptation strategies should be based on a more in-depth

understanding of the social processes of adaptation. Given the limited time frame I have been forced to delimit my research, by keeping it within a specific geographical area and to specific environmental management contexts. I have also limited my research by staying within the framework of the social representation theory. However, I believe that the interaction of the representations' dimensions as well as the relationship between the three representations can provide further insights into tensions within city officials in various governmental contexts. I am aware that with this study I have only scratched the surface in this area and the more I find out the more there is to investigate. In that sense, there are many ways to build further on my research to extend my findings. As an example, a broader sample size would allow for explorations of more diverse peripheries and models within the social representations theory or applying a social-psychological lens to the context, to bring more knowledge about behavior and help us to understand people's attitudes and actions in relation to these three dimensions.

In the short-term, I hope for my results to be useful and inform climate change governance practices in any collaborative context where different actors meet with varying interests, backgrounds, and approaches to the issue to be discussed. In the long-term, I look forward to seeing more research examining social knowledge in relation to climate adaptation and green infrastructure strategies, as this area is of growing interest in theoretical discussions and empirical research with the aim of better understanding the structures and functions of common sense and local knowledge in response to the societal challenges we face.

6. Conclusion

With this study, I have aimed to explore how social representations affect city officials' responses and compliance with the city's environmental policies on climate adaptation, green infrastructure, and biodiversity, by investigating how city officials are understanding and coping with these environmental policies.
A variety of data sources from empirical research of city officials working with climate adaptation in Stockholm City have been analyzed through a social representation lens. An in-depth dive into existing literature showed that a large amount of research has been concentrated on the promotion of a political agenda or issue at hand, how organizations use different means to promote or inform about environmental policies. At the same time, little research has been done on people's understanding of these policies of environmental change, the reception of these messages. The social representations theory helps us to shed light on the taken for granted 'knowledge' used by people to understand, structure and inform their actions and decisions. When we look at these perceptions in the light, we can better understand how policies are understood by those supposed to implement them. We may find clues to why some policies are not implemented fully or why some groups did not adhere to specific policies. When we share these findings in dialogues, we can learn more about each other, how we view things, what is important for us, what we prioritize and not least how to prevent future non compliances.

Through my study, I have explored three different moral positions towards climate adaptation and green infrastructure, using social representation theory as a conceptual framework, and concluded that there is a lack of consistency among these positions. The divergent normative, cognitive and expressive responses between these positions, complicates the relation between the different groups or unities within the city hence risking non compliances with environmental policies.
This thesis has helped bring clarity to why understanding the social representations of green infrastructure and climate adaptation can help to bridge the implementation divide. Based on my findings, I have suggested the use of a social cognitive lens to complement policy implementation enabling examination and comparation of stakeholders' interpretations of policies.
Having studied the social representations theory I have come to understand that looking at interpretations of science, how it is understood and communicated between individuals helps to create more clarity in the different reactions related to climate change and sustainable development, why groups govern and act as they do. The thesis has brought to my attention that perceptions and values, can hinder climate adaptation efforts and will continue to do so unless we bring more clarity to the complex social processes underlying the basis of our decisions.

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Popular science summary

In May 2020, the Stockholm City Council adopted a new environmental program for the period 2020–2023. The sustainability goals within Agenda 2030 have been a guide for the environmental program, and the purpose of the program is to manage and coordinate the city's operations to achieve the vision of a climate-smart and ecologically sustainable Stockholm. Almost two thirds of the period have passed, and the program is today well established within the city, however many questions still remain on how to implement the city’s environmental policies. With the environmental program, the city intends to advance its positions regarding climate work and its call to city officials is to take the lead and pave the way in the pursuit of a more resilient city. All relevant units are required to comply with these policies and to build consensus and synergies, in order to drive the environmental work forward. This study examines the interpretation of the city's environmental policies among the civil servants tasked with implementing them. The study assumes that humans do not automatically follow policies and change their behavior according to a written policy or documentation but assumes a more in-depth view of communication as multilateral, including all types of interactions, verbal and non-verbal. The study pays special attention to the social factors that affect people's behavior and aims to better understand how social representations affect city officials' responses and compliance with the City of Stockholm's environmental policies.

Social representation theory (SRT) is used as the main conceptual framework, as it explores rational understandings at individual and group levels and has been shown to be useful for analyzing social processes of climate change. A qualitative case study of city officials at three different units within the city was done to find out how these actors relate to the city's environmental policy, as well as their motivation, way of thinking and their attitudes around the concepts of climate adaptation, biodiversity, and green infrastructure. Empirical data collected through participant observations, a qualitative survey and open interviews, exploring the dynamics of the representations and negotiations taking place both at the individual and group level. Three main social representation dimensions were identified related to the concepts; the anthropocentric, the ecocentric and the technocentric dimensions. Using these three dimensions, the consequences of social values for green urban adaptation were examined. The thesis concludes that people's understanding of environmental policies, ie the reception of these messages based on values, beliefs attitudes and practices can hinder climate adaptation work and will continue to do so if we do not bring more clarity to the complex social processes that underlie our decisions.

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Appendix 1 Interview guide

Personal background / Role / Experience
- What is your role and professional background?
- What are your main responsibilities?
- Do you have any experience of including green elements in previous projects?
-Do you have any experience of working with climate adaptation?
- If yes, can you please tell me about this project?

Environmental awareness and personal relation to the concepts
- Overall, what are your thoughts on the city's environmental goals?
- What are your thoughts on how these goals can be achieved?
- What are your biggest concerns? What are the main barriers?
- How do you view your role in relation to the city's environmental policies and goals?
- Have you been using the city's environmental governance policies for biodiversity or climate adaptation in your work?
- Have you encountered climate change events or issues in your work, and if so in what context (e.g. warmer climates or troublesome water levels)?
- Have you had a dialogue with colleague or other part about more greenery, biodiversity, climate adaptation and/or ecosystem services? If so, in what context?
- Which (short and long term) adaptation measures do you think are important when it comes to climate adaptation?

Preconditions
- Do you have access to support groups or expertise in the field of green urban development or climate adaptation that you can get help from?
- Do you feel that you have the knowledge needed to implement these type of projects?

Mandate
-In your role, do you have the mandate and budget to include more green elements and build in more green solutions with regard to the existing climate adaptation strategy, such as ensuring efforts for biological diversity?

Appendix 2 Survey guide

1.What is your role?
2. What are your main tasks?
3. Do you have any previous experience of including green space * in the property portfolio?
- If yes; can you tell us a little about the project? Did you encounter any challenges?
4. Have you had any dialogue about the inclusion of green space with collagues and / or customer / tenants / other part or stakeholder?
If yes; what was the dialogue about?
5. What are your biggest concerns when it comes to creating increased green infrastructure in the property portfolio?
6. Do you feel that you have the mandate to develop more green elements in the properties you manage?

*by green space is meant all forms of vegetation e.g., trees, shrubs, flower beds, small meadow areas, green roofs and plant walls

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