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Unlocking the Potential of Small- and Medium-sized Enterprises through the Climate-neutral Cities Mission

A case study of Malmö and Lund in the Region Skåne, Sweden

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Abstract

Through the national innovation program Viable Cities, the City of Malmö and the City of Lund in the Region Skåne of southern Sweden have recently undertaken a mission to become climate-neutral by 2030, requiring the commitment and participation of the entire local, urban system in the pursuit and uptake of bottom-up, radical solutions. While small- and medium-sized enterprises make up the backbone of the region's economy, their importance to the mission's success has not been fully conceptualized, despite evidence indicating that some SMEs are suited for developing radical innovations while others will struggle to decarbonize their business. This thesis investigates their importance as well as how the government and intermediary organizations they rely upon can better engage SMEs through an exploratory case study of the two cities. Empirical data is collected from 20 semi-structured practitioner interviews and a range of documents (strategies, webinars, websites, conference recordings) and analyzed through a qualitative content analysis. In-depth analysis was informed by a conceptual framework which links the activities of the mission to the governance principles and perspectives of transition management. For practitioners, findings reveal that while mission-oriented policy may activate the potential of change-inclined SMEs, the diffusion of innovation will require a more blended policy approach. Furthermore, intermediaries and the government can help to develop niche, SME solutions and facilitate inter- and intra-sector collaboration to replicate and scale solutions. However, engagement with SMEs can be improved through coordinating activities and outreach, strengthening relationships, institutionalizing the mission, and communicating the business opportunities presented by the climate-neutral mission. For research, findings highlight a need for identifying new financing mechanisms and approaches to systems analysis, as well as critical review of the assumptions underlying mission-oriented innovation policy which may fail to capture the complexity involved in directing the bottom-up emergence of transformative urban change.

Keywords: SME; climate-neutral cities; mission-oriented innovation policy; Region Skåne; urban sustainability transition; intermediaries

Executive Summary

To address climate-change, radical, systemic transformation must occur, and some cities are at the forefront of this challenge. Through the national innovation program Viable Cities, the City of Malmö and City of Lund in the Region Skåne of southern Sweden have undertaken a mission to become climate-neutral by 2030. Private sector engagement will be key to the success of the mission, and as small- and medium-sized enterprises (SMEs) make up the backbone of the region's economy and often maintain close ties to the community, their importance to the mission should not be understated. However, while the literature has broadly identified several characteristics of SMEs and firm-level sustainability behavior, their broader potential for influencing urban sustainability transformation is limited. Furthermore, SMEs rely heavily on the government and intermediary organizations for support and broader engagement in urban systems, yet the literature has not outlined how these institutions might engage SMEs in the climate-neutral cities mission.

The **aim** of this research is to provide the government and intermediary practitioners leading and mobilizing the climate-neutral cities mission in the City of Malmö and City of Lund with a better informed, strategic perspective regarding the relative importance of SMEs. To achieve this aim, the following research questions were answered:

RQ1: What are the characteristics of SMEs which may influence the success of the climate-neutral cities missions in the City of Malmö and City of Lund?

RQ2: How can government and intermediary practitioners better engage SMEs in the climate-neutral cities missions in the City of Malmö and City of Lund?

The **research design** follows an exploratory case study approach, with the Region Skåne as the unit of analysis, and the City of Malmö and City of Lund as sub-units. Empirical data was collected specifically to answer the research questions through 17 semi-structured interviews with government and intermediary practitioners, 3 academics, as well as 4 email correspondence. This data was triangulated with a range of documents (statistical reports, government/practitioner webpages, strategy documents, and conference proceedings) related to the climate-neutral cities mission in Malmö and Lund. Qualitative content analysis in NVivo was first conducted, and then further analyzed using the conceptual framework outlined in Chapter 3.

In relation to RQ1, SMEs possesses several characteristics which make them uniquely suited for seeking the innovative solutions needed for the climate-neutral mission. While small, their organizational structure maintains the flexibility required to quickly make decisions and pivot to capture emerging market value, such as that presented within a rapidly decarbonizing economy. This flexibility extends to an ability to test out new products and services, or entire business plans which challenge the status quo; when coupled with the leadership of an intrinsically motivated owner, SMEs may even be inclined to embed the principles of sustainability into the core values of their business. Furthermore, as SMEs are integrated within the communities where they operate, they maintain important ties with citizens who also need to engage with the mission if it is to be successful. In the broader context of the urban transition to climate-neutrality, the innovations developed by SMEs have the potential to diffuse through peer-networks to other SMEs, or to be replicated by SMEs in other contexts. Solutions may also be scaled through acquisition and integration within larger businesses or in the urban infrastructural and institutional system. Further, as trends indicate that systems may become more decentralized in the future, citizen-focused solutions may also present a new market for niche, SME solutions.

Despite these positive characteristics, SMEs are constrained by a lack of resources such as time, money, personnel, and expertise. Many SMEs also lack the capacity for implementing significant process improvements called by the climate-neutral mission. For both change-inclined SMEs and those that may struggle with adjusting throughout the climate-neutral mission, support from the government and intermediary organizations is important for helping realize the full potential of the SMEs that comprise the region's economy. Thus, this study shows a need for policy which not only seeks the co-creation of radical solutions, but also methods of diffusing these innovations through complementary policy that addresses capacity needs of SMEs.

In relation to RQ2, while engagement with SMEs during the missions' development was limited, garnering early commitment through symbolic contracts with SMEs helped to develop an early sense of co-ownership. However, sustained and coordinated political outreach will be required to align disparate actors around mission-efforts and mitigate contestation throughout the mission. This will require the government to recognize the more nuanced ways that SMEs politically engage with sustainability-related issues. Also early in the mission, intermediaries provide SMEs a palate of services for the development of their innovative solutions, which is later translated into the broader, urban system through the inter- and intra-sector connections that intermediaries facilitate. Intermediaries link SMEs and their larger counterparts (i.e., large companies and the municipalities) who become end customers, scaling solutions. Intermediaries also connect SMEs with one another, leading to the formation of informal support networks, open-innovation clusters, and industry-driven agendas for climate-neutrality. The collaborative spaces created by intermediaries helps to establish trust between parities, account for power disparities between actors, and bridge communication divides between SMEs and the government. However, given the vast number of initiatives and actors in the urban network, intermediaries need to coordinate efforts within and between themselves to overcome initial barriers for engagement. Furthermore, interactions with SMEs should be efficient and communicate the value-added for SME engagement given that their time is a scarce resource.

Government policy and practices also engage SMEs in the climate-neutral mission. Regulations act to push SMEs toward climate-neutrality, whereas economic policies provide resources for innovation. City governments which lack direct control over national policies can control their assets (e.g., land) and devise competition schemes which incentivize collaboration among SMEs and big business, resulting in the development of consortia aligned with the climate-neutral mission. Furthermore, governments can devise public procurement measures that favor SME engagement, stipulating mission-oriented requirements. More directly, the government and intermediaries both establish testbeds, Urban Living Labs and shared community spaces through which SMEs are empowered to engage in urban experimentation. However, the government needs to address its own aversion to investing in experiments which often fail and take care when devising policy to not overly influence market dynamics which may have negative repercussions.

As the mission advances, learning and reflection must continually occur; repercussions of failing to adequately institutionalize the mission inevitably impacts SME engagement efforts. First, monitoring emission at scale will be challenging given the limited technical capacity of SMEs, and the city. Furthermore, the government must reform institutional structures and practices to coordinate its currently siloed departments and combat the challenges of political and funding cycles which limit investment in and learning derived from urban experimentation. Furthermore, for SME-developed solutions to be scaled and replicated, communication lines within and between cities needs to be formalized and strengthened. Finally, private financing channels need to be identified and strengthened for high-risk, high-reward SME solutions.

Given these findings, the following **recommendations** are suggested to improve SME engagement in the mission for government practitioners:

1. Complement mission-oriented innovation policy with diffusion-based policy to capture the full spectrum of SMEs which must engage in the climate-neutral mission.
2. Coordinate political outreach to SMEs for early and sustained engagement, creating policy feedback loops.
3. Create a repository of best-practices and SME solutions.
4. Follow-up with "market-tilting" policy mixes to recognize unintended consequences and that commitments of involved parties have been followed (e.g., builders' shared development plans).
5. Institutionalize the climate-neutral mission throughout departments by following an internal process like transition management (See Chapter 3).

For intermediary practitioners involved with the climate-neutral cities mission, SME engagement could be improved through the following actions:

1. Embed offices or meetings within SME-centric spaces, such as start-up incubators and science parks.
2. Coordinate the network of intermediaries functioning in a city. This can occur through meetings between practitioners leading intermediaries.
3. Develop a one-stop-shop of network resources for SMEs.
4. Appeal to SMEs by creating a business case for decarbonization.
5. Couple the development of collaborative space with capacity building for systems thinking and collaboration.

Several areas for **future research** were identified throughout the research. First, the systems analysis undertaken through the mission can be complemented by an analysis of existing SMEs, specifically in industries of importance to the climate-neutral cities mission. Furthermore, there is a significant need to identify new financial channels which are less risk-averse than the government (e.g., venture capital). Also, as the mission calls for city-wide digitalization, research on SME capacity (for solutions and uptake) is needed. Furthermore, theoretical debate regarding the assumptions made within mission-oriented innovation policy can be stimulated through more research which analyzes the climate-neutral cities mission through the perspectives established in transition studies.

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Abbreviations

EU – European Union

EUR – Euro

FP – Framework Program

MAP – Multi-actor Perspective

MIP – Mission-oriented Innovation Policy

MLP – Multi-level Perspective

MPP – Multi-phase Perspective

R&I – Research and Innovation

ROAR – Routes/directions, Organization, Assessment, Risks/rewards

SME – Small- and medium-sized Enterprises

VINNOVA - Verket För Innovationssystem (Swedish agency for innovation systems)

1 Introduction

1.1 Background

The mitigation of climate change and adaptation to its potential impacts requires unprecedented collaboration and creative action. To best ensure a livable future, net-zero emissions must be achieved by 2050 in order to decrease the global average temperature increase to 1.5 °C by 2100 (IPCC, 2018). Transitions from dominant industrial paradigms require identifying and testing ways of moving past systems of carbon lock-in (Unruh, 2000) to transformational systems rooted in sustainability (Köhler et al., 2019). In urban areas, this transition may be accelerated, but there are several inherent barriers to be addressed, requiring action at all levels and by all actors (European Environment Agency, 2017; Frantzeskaki et al., 2018; Oke et al., 2020; UNECE, 2011).

In Europe, the agenda for urban sustainable development has refined over the last three decades to a focus on seeking climate-neutral urban transition pathways (Clerici Maestosi et al., 2021) to ameliorate the nearly 80% of global greenhouse gas emissions produced in urban areas (Ahlers et al., 2016). With 55% of the world's population residing in cities, accounting for 85% of the EU's gross domestic product, these emissions are to be expected under the current socio-technical, fossil-fuel driven paradigm (Filho et al., 2019). Given that 83.7% of Europe's population is expected to live in cities by 2050 (UN Population Division, 2018) there is a clear need for systemic change both to quell the rising tide of emissions and also create livable, green cities that function within planetary boundaries (Hoornweg et al., 2016)

While cities are the source of many challenges for sustainability, the convergence of a myriad complex social, economic and ecological systems which co-exist and intersect within them provides a testbed for radical solutions (Frantzeskaki et al., 2018). The European Commission's trend of utilizing cities as innovation hubs to accelerate solutions to societal challenges, including climate change, has been reflected in its Research and Innovation Framework Programme for several decades, and its current iteration Horizon Europe has proposed a new approach to reaching its commitments through mission-oriented innovation policy (MIP). Among its five proposed missions, the "100 Climate-neutral Cities by 2030 – by and for citizens" mission aims to engage 100 European frontrunner cities to serve as innovation hubs and examples for other cities aiming to become climate-neutral by 2050 (European, Commission 2018; European Commission, 2020).

Ahead of the Commission's call for engagement with the mission, the Swedish agency for research and development VINNOVA funded a national innovation program, Viable Cities, which is structured to mirror the forthcoming mission (Viable Cities, 2021a). Through Viable Cities, Mayors of the City of Malmö and City of Lund, both located in the Region Skåne of Southern Sweden, have signed co-developed Climate Contracts which outline an ambitious agenda to reach climate-neutrality by 2030 (Viable Cities, 2021b). The contract will be implemented in coordination with the Swedish innovation program Viable Cities, the state research council for sustainable development, FORMAS, the Swedish Agency for Economic and Regional Growth, Tillavaxverket, the Swedish Energy Agency Energimyndigheten, private-sector, and civil society actors; and citizens. This contract serves several purposes, specifically it: denotes a high-level, symbolic commitment by cities; begins a process of identifying policy and implementation gaps; initiates coordination and empowerment of citizens and stakeholders; serves as a basis for national and regional legal, financial and governance frameworks; and creates a unified platform for multi-level negotiations for city action (Clerici Maestosi et al., 2021).

Whereas the government is tasked with leading the mission, no single-actor can drive the change required to become climate-neutral (Hasche et al., 2020). The mission's success will depend upon the bottom-up development and uptake of transformative solutions, which requires the commitment and participation of the entire local, urban system. In particular, climate-neutrality requires a greening of the economy, in-turn requiring transformation of the private sector and the many companies, big and small, within it (Hasche et al., 2020; Schaper, 2016). Viable Cities is a key example of mobilizing public-private partnerships, and relationships have been forged over time to better ensure collective action (Viable Cities, 2021b; Wojewnik-Filipkowska & Węgrzyn, 2019), yet the agency and the city government are presented an enormous coordination task of insuring commitment and engagement of all private-sector actors in order reach the climate-neutrality targets which have been established.

One set of actors key to the Region Skåne, and Europe as a whole, are small and medium-sized enterprises (SMEs) (Commission, 2020; Eriksson et al., 2020). SMEs comprise 97% of the region's economy and 66% of total employment (Eriksson et al., 2020); moreover, SMEs contribute to 70% of global pollution and 60% of total carbon emissions collectively creating more impact than their corporate counterparts (Martín-Tapia et al., 2010). Strategic engagement of SMEs inevitably underpins the success of the mission to achieve climate-neutrality by 2030, from the strategic visioning stage through to the transformation of urban systems (Sarah Burch et al., 2016; Westman et al., 2020, 2021). As such, their role within the mission as well as the ways in which mission leaders can engage them must be explored.

1.2 Problem definition

Despite recognizing the economic importance of SMEs at face value, as well as the environmental impact they collectively impart, the influence that this highly heterogenous segment of the local economy has on the climate-neutral cities mission (both advancing it and/or impeding its success) has not been fully conceptualized, and, by extension, strategic engagement with SMEs may not be reaching its fullest potential.

Firm-level characteristics of SMEs have been well documented and are broadly defined in comparison with large companies. For example, SMEs are highly flexible by nature, and often experiment with process and product improvements, or with their business plans entirely (Sarah Burch et al., 2016; Kundurpi et al., 2021). This flexibility is born from the need to operate under uncertainty (Branicki et al., 2018), pivot when required (Morgan et al., 2020), and maintain market niches. Furthermore, as SMEs are often owner-led and operated, they may be less beholden to stakeholder interests and have increasingly been seen to take-up socio-environmental issues as a core aspect of their business offerings (Burch et al., 2018). Within cities, SMEs maintain a relatively higher level of place-based embeddedness in comparison with larger companies, often being acutely attuned to local needs and adaptive to local circumstances (Shrivastava & Kennelly, 2013). Taken together, some SMEs may be an important source of eco-innovation needed within a rapidly decarbonizing economy.

Still, the majority of SMEs struggle with taking up sustainability innovations for process, product and operational improvements (Klewitz & Hansen, 2014). Furthermore, SMES common face a scarcity of time, finances, personnel and expertise which limit their potential for eco-innovation (Sarah Burch et al., 2016; Lepoutre & Heene, 2006). Given these limitations, SMEs rely heavily on the government and intermediary organizations (e.g. business networks, cluster organizations, NGOs, transition intermediaries) at multiple levels (Kivimaa, 2014b; Kivimaa et al., 2019; Kundurpi et al., 2021). These institutions provide valuable resources (e.g.

financial, capacity building, etc.) as well as opportunities for engagement in both networks and broader, city-based initiatives (Kundurpi et al., 2021; Westman et al., 2020).

Despite knowledge of their capacities (or lack thereof), few studies have considered the broader potential SMEs possess to influence urban sustainability transitions (Sarah Burch et al., 2016; Loorbach et al., 2010; Loorbach & Wijsman, 2013), and given the recency of its establishment as a new policy approach, no studies have addressed SMEs possible role in the climate-neutral cities mission. Furthermore, while the literature has explained how the government and intermediary organizations work with SMEs to advance eco-innovation at the firm-level (Kivimaa, 2014a; Kivimaa et al., 2019), few studies have considered how these organizations can engage SMEs to advance urban agendas for sustainability (Kundurpi et al., 2021), with none focusing on the specific context of the climate-neutral cities mission. As the city governments of the City of Malmö and City of Lund are working alongside intermediaries in the early implementation of their Climate Contracts, there is a pressing need to strategically consider the importance of SMEs and recognize ways in which their engagement with them may be improved.

1.3 Aim and research questions

The aim of this research is two-fold. The first aim is to provide the government and intermediary practitioners leading and mobilizing the climate-neutral cities mission in the City of Malmö and City of Lund with a better informed and strategic perspective regarding the relative importance of SMEs.

To achieve this aim, the following research question must be addressed:

RQ1: What are the characteristics of SMEs which may influence the success of the climate-neutral cities missions in the City of Malmö and City of Lund?

RQ2: How can government and intermediary practitioners better engage SMEs in the climate-neutral cities missions in the City of Malmö and City of Lund?

The second aim of this thesis is more centrally related to its academic contribution. This thesis aims to bridge a gap between the limited literature on the recently conceived mission-oriented innovation policy approach with a more established literature on transitions management through a conceptual framework. This provides an analytical foundation for not only answering the research questions with a deeper perspective on the complex dynamics of urban sustainability transitions, but also for critically examining the assumptions made by mission-oriented innovation policy. Both provide a basis for future research.

1.4 Scope and limitations

Researching sustainable urban transitions is challenging given that there are innumerable variables which influence the ways in which dynamic, complex systems change over time. However, as shown through the climate-neutral cities mission, practitioners seek agency in how to influence the direction of this change to reach an envisioned future. As such, the scope of this thesis is defined as to provide sufficient coverage and analytical depth to achieve its stated aims. Taking this into account, the thesis' focus is on (1) the characteristics of SMEs which impact their eco-innovation potential, (2) how this potential relates to the main governance principles and activities of the climate-neutral cities mission, and (3) government and intermediary practitioners who work to engage SMEs in the climate-neutral cities mission. By extension, academic literature was bound by the scope, specifically focusing on mission-oriented

innovation policy and SMEs in urban sustainability transitions with relation to their general characteristics and engagement with the government and intermediary bodies. The scope of this thesis' empirical study is related to government and intermediary practitioners in the Region Skåne, with the two sub-units of analysis as the City of Lund and City of Malmö. Furthermore, while discussions on characteristics of SMEs are naturally not geographically bound, analysis of their role within the climate-neutral cities mission is bound to the geographical context in which the mission is undertaken.

The central limitations in undertaking this research relate to the accessibility of practitioners, which was influenced by the Covid-19 pandemic. As such, interviews were limited to being conducted over the phone, rather than in person; furthermore, interviews were conducted in English, rather than Swedish (which is the native language of most interviewees). Furthermore, the socio-institutional analysis undertaken within this thesis looks beyond the firm-level, and as such may not capture a level of granularity that fully applies to the context of every SME, yet the broader perspective provided by through thesis' scope better equips practitioners with a means of formulating a salient strategy for SME engagement. Similarly, the single, exploratory case study (with two sub-units) may lack some generalizability to other contexts. However, as the aim of the thesis is to inform practitioners' perspectives for the strategic implementation of the mission within a specific context, this thesis' scope is suitable and provides a foundation for further research.

1.5 Ethical considerations

This research design has been reviewed against the criteria for research requiring an ethics board review at Lund University and has been found to not require a statement from the ethics committee. Participants were asked to review and provide consent for the interview both verbally and through a written form. A sample consent form can be found in Appendix I. Throughout the thesis, participants have only been identified based on their organization, and have been assigned a code which can also be found in Appendix II. The purpose of this anonymity is to best ensure that the information they provide will not adversely affect them and in-turn provides them the opportunity to freely speak about their perspective and experience without fear of repercussions. Furthermore, while this research may prove useful for several groups given the research aim, the design, data collection and analysis were not influenced by any external parties. No funding was provided to support the completion of this thesis.

1.6 Audience

This thesis generates important insights regarding the ways in which SMEs may influence the success of the climate-neutral cities mission, as well as the main drivers and barriers experienced by practitioners and the government in engaging SMEs in the mission. As such, findings will be most valuable to the government and intermediary practitioners who are leading (or involved in) the climate-neutral cities mission in Malmö and Lund. Findings specifically assist strategy development of the mission's leaders, Viable Cities and the government officers managing the city-based programs. However, as broad participation is required throughout the mission, findings are also relevant to other practitioners who both engage SMEs as well as mission-work. While not the intended audience, results may also be relevant within contexts outside of the stated scope of this thesis. As the forthcoming Horizon Europe program presents a chance for 100 cities across Europe to be selected as hubs of innovation, these findings may be relevant to their own city-based missions.

1.7 Disposition

As a guide to the reader, the remainder of the thesis is organized as follows:

Chapter 2 begins by describing the evolution of mission-oriented innovation policy as it has evolved from its earlier forms to its current focus on addressing societal challenges. It then provides details of the guiding principles of more recent mission-oriented innovation policy as defined through Mazzucato's (2018a) ROAR framework, which provided the basis for the European Commission's proposed missions within the 100 billion EUR Horizon Europe program. The chapter then draws focus to the importance of combatting climate change through innovation in cities as well as provides details of the Commission's "100 Climate-neutral Cities by 2030 – by and for citizens" mission which seeks to accomplish this. In **Section 2.2**, the characteristics of SMEs are defined in relation to large firms, thus informing a typology of SMEs in relation to the sustainability-oriented innovation, or eco-innovation. As SMEs rely heavily on the government and intermediary organizations for both innovating at the firm-level, as well as for influencing urban sustainability transitions, the ways in which these practitioners engage SMEs in urban sustainability-related governance and action is also explored.

Chapter 3 defines key concepts and perspectives from sustainability transitions literature, specifically the multi-level, multi-actor and multi-phase perspectives. This provides a set of concepts and terms for describing and analyzing the complex dynamics of sustainability transitions. The chapter then introduces the key governance principles and associated activities of transitions management and compares these with the principles outlined in the ROAR framework. Taken together, a conceptual framework is introduced at the end of the chapter which captures elements of the three perspectives of sustainability transitions literature, the transitions management framework, and the ROAR framework.

Chapter 4 outlines the research design of the thesis, as well as the methodology for data collection and analysis. Justifications for the author's choices are also provided.

Chapter 5 presents the empirical findings of the research, which present new knowledge related to respondents: 1) critical reflection of the potential impact of SMEs on the climate-neutral cities mission, 2) the main drivers of engaging SMEs in the mission, and 3) the main barriers facing practitioners for engaging SMEs. This data is synthesized and analyzed through the lens of the conceptual framework, the documents collected through a grey literature review were synthesized and then triangulated with participant responses. Findings are presented through a case study analysis which is framed within the guiding principles and activities of the transitions management and ROAR frameworks.

Chapter 6 discusses the findings' significance and relevance in relation to the current state of knowledge as outlined by the literature review in Chapter 2. The chapter also presents a critical reflection of the conceptual framework and the methodology used in the research and presents the academic and practical implications of the findings.

Chapter 7 presents the main conclusions of the thesis by answering the research questions. This informs recommendations for the targeted audience and presents pathways for future research.

2 Literature Review

The purpose of this chapter is first to provide the background and context of mission-oriented policy as it has informed the European Commissions' proposed missions. Second, the characteristics of SMEs that lead to or inhibit their eco-innovation are discussed, which provides context for reviewing literature on how the government and intermediary organizations engage SMEs in urban sustainability governance. The chapter ends with a summary drawing comparison between MIP and SME-related literature.

2.1 Climate-neutral Cities Mission

Mission-oriented innovation policies (MIP) have been presented as a bridge between problems and solutions (Mazzucato, 2018b). Through MIP, polycentric multi-actor arrangements, radical solutions are tested, scaled, and replicated for the sake of reaching a co-developed vision of the future. MIP requires leadership from the government yet relies upon broad participation of all actors in society (Kattel & Mazzucato, 2018). In Section 2.1, the evolution of MIP is explored, highlighting a shift in its approach, the problems it addresses, and its relative importance to society. Next, the main principles of recent MIP for tackling "grand societal challenges" are detailed through the ROAR framework developed by Mazzucato (2018a). Finally, the European Commission's proposed "100 Climate Neutral and Smart Cities" is introduced as a means of engaging cities as innovation hubs for addressing climate change.

2.1.1 Evolution of Mission-oriented Innovation Policy

The concept of mission-orientation was first applied to research and innovation (R&I) policy with the overarching aim of deploying "big science to meet big problems" (Weinberg, 1967, p. 8). One archetypical example, the Apollo program (Nelson, 1974), demonstrates how developing a common vision of the future (i.e. mission) such as landing the first man-on-the-moon, can catalyze accelerated innovation. The "moonshot" mission required large-scale, public investments to advance key technologies, which was justified given that the mission's broader objectives were rooted in national sovereignty and defense (Mowery et al., 2010; Schlenoff et al., 2010). This program's success hinged on its concentration in terms of governance and investments (OECD - STIP Compass, 2020). It was centrally controlled by a flexible government agency, which could maintain focus on a singular goal. Significant investments in high-capacity firms and specific technologies created bold, yet achievable innovation pathways that led to the mission's success (Ergas, 1987). Consequently, this decade-long initiative has led to over 60 space-related activities worldwide (Robinson & Mazzucato, 2019), the development of new markets (Larrue, 2019), and innumerable spillover technologies (e.g. GPS, the internet, etc.) (Mazzucato, 2013).

Beginning in the 1990s, mission-oriented innovation policy approach began to re-emerge as a policy paradigm, but with a gradually broadening aim. In his seminal work *The Moon and the Ghetto*, Nelson (1974) asked the important question of why our innovation policies allowed us to reach the moon in a decade whereas other "problems of poverty, illiteracy and the emergence of ghettos and slums" remain largely unsolved. Whereas "old" MIP were technology-focused, recent missions addresses systemic problems, such as sustainability, which requires broad, cross-sectoral commitment, and coordinated action through a portfolio of projects which collectively seek a unified goal (Lamperti et al., 2019; Mazzucato, 2016, 2017, 2018a). Whereas the "Moonshot" mission was motivated by national interests, recent MIP derives its underlying motives from movements built at the grassroots level (e.g. the Green Movement) which have enlightened mainstream social consciousness and pressured governments to make bold commitments to addressing climate change, among other issues (Mazzucato, 2018b;

Wanzenböck et al., 2020). International cooperation and MIP gradually matched this paradigm shift, in-turn reflecting an increased relevance to society (Figure 2-1). Core distinctions between "old" and recent MIP were outlined and politically legitimized in the Maastricht Memorandum in 1993 (Soete & Arundel, 1993). The Lund Declaration in 2009 also called for a unified agenda among European member states to focus on "grand challenges" rather than rigid thematic approaches. Principles distinguishing recent and "old" MIP can be found in Appendix III.

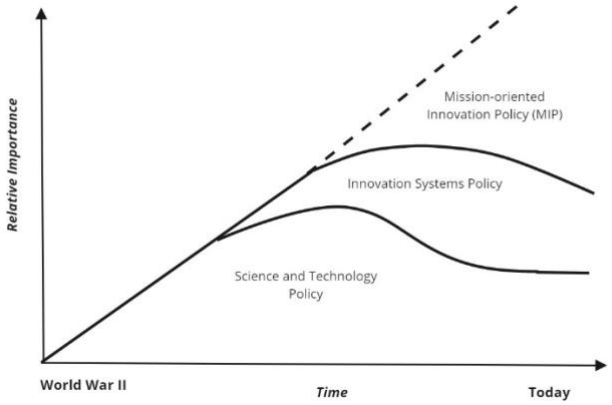


Figure 2-1 Evolution of policy paradigms and societal importance

Source: Adapted from Diercks et al. (2019)

An evolution toward mission-orientation mirrors the ongoing European Framework Programmes for Research and Innovation (FP 1 through 9). The most recent iteration, FP8, Horizon 2020, ran from 2014 to 2020 and focused on seven core "Societal Challenges" (constituting one of three main pillars) (European Commission, 2021a). In 2017, an interim evaluation of FP8 noted that its identification of "societal challenges" is insufficient impetus for re-orienting R&I to reach goals (European Commission, 2017). Wanzenböck et al. (2020) note that the gap between higher order, long-term goals and the prescribed, specific topics outlined in the framework's work programs creates a divide too broad to produce emergent, transformative solutions needed to solve grand challenges. Rather, an intermediate level of granularity through missions bridges this gap (Foray et al., 2012).

Embracing MIP, the European Commission outlined the FP9, Horizon Europe, in 2018 (European Commission, 2018a) and developed five mission boards including: adaptation to climate change (including societal transformation); cancer; healthy oceans, seas, coastal and inland waters; climate-neutral and smart cities; and soil health and food (European Commission, 2021b). For each proposed mission, clear targets and timelines were set in mid-2020 (Wanzenböck et al., 2020). Rationale and a framework for MIP is presented by Mazzucato (2018a), as explained in greater detail in the following section.

2.1.2 Recent Mission-oriented Innovation Policy in the European Union

MIP has the dual objective of delivering both prosperity (economic, environmental and social) as well as stimulating innovation for novel solutions (Jütting, 2020). Ultimately this requires a paradigm shift in innovation policy formation which addresses more than just economic growth (Gassler et al., 2008). Mazzucato (2018b) outlines central governance principles through the **R-O-A-R framework**, which is expanded upon in this section.

Routes and Directions

The first principle of MIP is that its activities aim to influence the pathway and rate of innovation along an established **Route or Direction.** This principle can be analyzed at three levels. First, determining this direction requires defining the problem the policy aims to address. Contemporary MIP aims to solve "wicked problems", such as sustainability, which are difficult to define and have no objective solution (Rittel & Webber, 1973). Furthermore, shared responsibility may detract from multiple actors "owning" the problem, inhibiting solutions and possibly inciting contestation (Coenen et al., 2015). Lastly, solutions to wicked problems may also result in new issues, such as rebound effects (Font Vivanco et al., 2016). To overcome these challenges, MIP must have clear, yet bold, vision which requires "complex, strategic choice processes" (Foray, 2018). From its inception, the mission's route and direction aims to secure democratic legitimization through stakeholder and citizen engagement and consensus (Grin et al., 2010). Without persuading the public of the normative value of the mission's existence, the bold technological and behavioral changes required to solve persistent problems may not be adopted (Lafont, 2015).

After the route and direction (i.e. shared future vision) has been set, it can then be extended to other actors to inspire cross-sectoral mission-engagement (Foray, 2018). MIP moves away from "picking the winners" to "picking the willing". Following the former, traditional industrial and innovation policy steers public investments through vertical, sector-specific channels, such as nationalizing industries (e.g. steel, coal, etc.) (Mazzucato, 2018b). This can lead to the development of monopolies which crowds out innovation of smaller firms, and also ultimately fails to create cohesion across sectors for the purpose of a unified goal. Alternatively, when policies are oriented around a grand challenge "willing" sectors and actors along the entire innovation chain become empowered to participate (Foray et al., 2012), given that every industry can add value to the mission. This approach was taken by the German *Energiewende* integrated strategy for reducing carbon emissions. In this case, policies rewarding "green renewal" led to the development of bottom-up solutions via experimentation, even in low-tech industries like steel (Kuittinen & Velte, 2018). This was also seen in the Apollo mission; the challenge of reaching the moon inspired innovation in both high-tech (e.g. aerospace) and low-tech (e.g. textile) industries, and both were pivotal to the mission's success (Mazzucato, 2018b).

Finally, the government must also assert its own agency by influencing the direction of markets in line with the route and direction of the mission; the policy thus pulls from the logic of evolutionary economics (Kattel & Mazzucato, 2018). While policy interventions have been justified in neo-classical economics to "fix" markets, effectively leveling the playing field, this approach is limited in is ability to address negative externalities that exacerbate grand challenges (Foray et al., 2012; Mazzucato & Penna, 2016). Alternatively, MIP seeks to co-create new market landscapes through carefully surveying for existing bottlenecks and missing links, and then "tilting" the market through strategic investment (Mazzucato & Perez, 2015). Mission-oriented policy instruments that may direct markets broadly include: direct financial support; indirect financial support; technology guidance and advisory services; collaborative platforms and infrastructure; and governance and regulatory frameworks (Miedzinski et al., 2019). Examples of market-tilting practices could include competitions and open funding calls for proposals that address specific challenges (Miedzinski et al., 2019), regulations and industry standards (Edquist & Zabala-Iturriagagoitia, 2012), investment in high-risk start-ups, etc.. These policies both "push" and "pull" markets in a direction needed for rapid, social transformation.

Organization

Mazzucato (2018b) also highlights the principle of **Organization,** which first refers to the organization of networks (and within specific organizations) for producing innovative solutions. Network configuration should first occur through purposive guidance by the public sector leading the mission (Yun & Liu, 2019), but will also naturally occur as the mission becomes valued by actors who must realign to seek and disseminate solutions (Hossain et al., 2019). A systems analysis is conducted to identify gaps and bottlenecks in society, although the ROAR framework does not clearly define this process (Mazzucato, 2018a). Jütting (2020) identifies a need for surveying the "mission-oriented, sustainable-transformation innovation ecosystem" (p. 12) to identify solution-seeking actors across sectors. Traditional innovation policy typically follows a bi-lateral, linear process with investments leading to research and innovation; however, the ROAR framework calls for non-linear collaboration across multiple sectors (Yaghmaie & Vanhaverbeke, 2019) for joint value creation (Scaringella & Radziwon, 2018; Tsujimoto et al., 2018). The "organization" principles calls for the development of heterogenous arrangements (both inter-/intra-organizationally, and inter-/intra-sector), which governance structures both horizontally (among departments or sectors) and vertically (among hierarchies of power) (Hossain et al., 2019). Missions aim to establish new actor constellations and may introduce new roles for traditional actors (Kuhlmann & Rip, 2014) as well as new partnerships (public-private, private-private, etc.) to achieve missions (Ciasullo et al., 2020). However, the ROAR framework lacks clear modalities for forming these networks and governance structures.

Second, the principle of organization also refers to how innovations are sought, and taken-up (Mazzucato, 2018a). Wanzenböck et al. (2020) reflected on the solution-seeking process of missions, identify the need for governance modalities which quell contestation (normative divergence among stakeholders), complexity (both institutional and situational) and uncertainty (insufficient or fragmented knowledge) (p. 477). Any innovative solution proposed is built upon highly contested assumptions about complex problems, and, as such, will always have a high degree of uncertainty regarding its success or unintended consequences (Wanzenböck & Frenken, 2020). In seeking convergence between problems and solutions, missions propose a co-learning and co-evolutionary logic through collaborative experimentation (Mazzucato, 2018b), which in theory tests solutions incrementally, allowing for insights to be gained about the problem itself, eventually leading to broader uptake within society (Wanzenböck et al., 2020). While the ROAR framework does not provide specific mechanisms for achieving this, governments have been able to and negotiate and balance interests through neutral, collaborative platforms (van Genuchten et al., 2019), and often extend the problem-solution discourse to the citizenry, enhancing prospects for co-production of public value (Wirth, 1991).

Assessment

A key principle of the ROAR framework is continual **Assessment**, which can only be achieved through clearly defined, intermediate targets, ideally monitored through tangible results (Mazzucato, 2018a). This requires a holistic interpretation of public-value, measuring both economic returns on investments (e.g. energy cost-savings) and co-benefits (e.g. improved public health) (Miedzinski et al., 2019). This requires innovative quantitative measures through AI and big-data combined with more nuanced measurements that may highlight aspects of citizen engagement, network-building and spillovers (Gomes et al., 2018). However, assessment of metrics should not be an end in itself, but a means for continual, institutional learning at all levels (Voß et al., 2006). This first poses a challenge for the public sector given that "learning" from projects often fails to materialize in more than the end-pages of project documents; the continual re-adjustment of approach and investment called for by Mazzucato (2018a) requires developing capacity for reflexive governance (Ison et al., 2015; Voß et al., 2006). Private- and

third-sector (e.g. NGOs, community groups, etc.) actors are also tasked with developing their absorptive capacity to "recognize the value of new information, assimilate it, and apply it to commercial" or social ends (Cohen & Levinthal, 1990). While process-driven assessment and reflexive governance are meant to trigger adjustments throughout the mission in the short-term, governments leading missions must maintain a long-term orientation toward the mission's goal (Mazzucato, 2017). However, past studies have shown that without consistent and coherent public-sector policy, there is a low uptake among citizens and the private sector (Uyarra et al., 2016).

Risk and Rewards

The final principle of the ROAR framework is **Risks and Rewards**. This first refers to the financial and reputational risk that must be assumed by the public and private sector. For the former, making "slow", long-term investments aligned with the mission's route and direction provides a sense of commitment and consistency that signals investors and activates private capital (Warner, 2014). Public-sector innovation investment in particular has led to the identification of new private-capital flows and innovative financial instruments (Mazzucato, 2015; Mazzucato & Semieniuk, 2017) all of which can realign markets and (dis)empower entire industries (Foray et al., 2012). In many cases, state-run banks (e.g. Germany, China, the European Investment Bank) have successfully financed large-scale transitions, particularly in the energy sector (Lamperti et al., 2019). Shorter-term project- and policy-based investments must also be utilized. To do this, the public-sector must overcome the risk aversion born from public scrutiny which always holds its stability and legitimacy in question. The entrepreneurial state requires acceptance of both failure and success (Mazzucato, 2013). To help it maintain a public-facing sense of reliability, transparency and predictability, a portfolio-approach allows for a mixing of both low- and high-risk projects as to hedge public sector 'bets" much like a venture capital firm (Mazzucato, 2018a).

The second aspect of this principle is that of rewards, which should be proportional to the risks taken. As mentioned, this requires holistically measuring the value created through missions (Mazzucato, 2017). However, this holistic calculation requires a departure from traditional protocol such as cost-benefit analysis and net-present value calculations; if these were undertaken, bold investments would never be made (Mazzucato, 2017). Missions, as such, present this challenge but realistically do not provide solutions for garnering the political will such investments require (Lamperti et al., 2019). However, looking to the past, examples of successful MIP (NASA, DARPA, NIH) demonstrate that if a direction is set, actors are organized, successes and failures are assessed and adequate risk is taken, surprising and important innovations can be advanced to reach mission objectives (Deleidi & Mazzucato, 2021; Schlenoff et al., 2010).

While these principles informed all the European Commission's mission proposals, the nature of their implementation is highly dependent upon the persistent problem they aim to address. The following section highlights one of the five missions proposed by the European Commission: 100 Climate-neutral Cities by 2030 – by and for citizens (European Commission, 2020).

2.1.3 100 Climate-neutral Cities by 2030 – By and For Citizens

Addressing climate change at the EU level has evolved over time; in 2008, the EU set a target of reducing greenhouse gas emissions (GHG) by 20% (from 1990 emission levels) by 2020, which was achieved in 2017. Ahead of the Paris Agreement in 2015, the EU increased its commitment to reducing GHG by 40% in 2030, which has subsequently been raised to 55% by

2030. In 2019, the long-term objective was set for the EU to "have a climate-neutral and competitive economy by 2050", requiring an 80% reduction in GHG and establishing viable means of compensating for any remaining emissions (European Commission, 2018b). Between 2021-2027, the EU has committed 30% of its overall budget to fight climate change and its effects (European Commission, 2021c).

While not capturing the entire problem, tackling climate change in urban areas is imperative for both addressing the largest challenges as well as identifying viable solutions. Worldwide, cities are responsible for nearly 75% of resource consumption (Madlener & Sunak, 2011), account for two-thirds of total energy consumption (World Bank, 2021) and emit around 70% of energy-related GHG (Bellucci et al., 2012). The European Union's Joint-Research Committee (2019) also estimates an increased energy demand by 54% in urban areas by 2050, whereas fossil fuels will decline by only 19%. Rapid urbanization exacerbates these problems. While there were fewer than 1 billion people in cities in 1950, this number is expected to reach 9 billion by 2100 (OECD, 2015). Likewise, European levels of urbanization are expected to rise to 83.7% by 2050 (UN Population Division, 2018), and it is anticipated that the built-environment will increase to 7% of the total European territory by 2030 (Perpina et al., 2019).

Cities are undoubtedly a source of many climate-related issues, but given their concentration of people and organizations, they may also be considered convergence hubs for developing solutions (Frantzeskaki et al., 2018). Indeed, as populations double in cities, their productivity increases by 5% (OECD, 2015) as labor is better allocated, ideas are spread and innovation is enabled. While our current economic paradigms lead us closer to reaching planetary boundaries, the fact that cities account for 80% of the world's economic growth (World Bank, 2021) may reflect an untapped potential if systems are transformed toward sustainability. Given effective leadership, municipal competences and adequate resources (Bulkeley et al., 2010), cities may be particularly equipped as sustainability action arenas (Bulkeley & Castán Broto, 2013); in some cases, GHG reductions at the city-level outpace national targets (Bulkeley & Betsill, 2005). Urban areas also present a promising space through which alternative paradigms to the status quo may emerge, particularly in waste management, the built environment, land use, transportation and energy (Bulkeley, 2015; Burch et al., 2014). Within dense community spaces (e.g. neighborhoods, districts), bottom-up solutions may emerge through experimentation (Westley et al., 2011), which can be furthered developed to be tested at the urban scale (Bulkeley et al., 2019).

Cities have long-been linked with European values and culture and are also pivotal to their productivity. Given this, and their potential for addressing climate change, the European Commission began to address urban sustainability more than 30 years ago through the Framework Programmes five through seven (Clerici Maestosi et al., 2021). Urban areas began to be utilized as "Actors of Open Innovation" to advance low-carbon solutions. In 2020, the EU's Smart and Sustainable Cities Mission board proposed a mission to "support, promote and showcase 100 European cities in their systemic transformation toward climate neutrality by 2030 and make these cities into experimentation and innovation hubs for all cities, thus leading on the European Green Deal and Europe's efforts to become climate neutral by 2050" (Kaźmierczak, 2020 p. 3). This mission also links with several other EU strategies (e.g. Digital Strategy, Smart Specialization Strategy, etc.), commitments (e.g. Agenda 2030, Paris Agreement, Just Transition, etc.), regulations (e.g. EU Climate Law, Climate Pact, etc.), initiatives (e.g. EIT Climate KIC, 100 Positive-Energy Districts, etc.), and stakeholders (e.g. Covenant of Mayors, CIVITAS, C40, etc.) (Clerici Maestosi et al., 2021; Foray, 2018; Granberg & Glover, 2021; Kaźmierczak, 2018; Lutzkendorf & Balouktsi, 2019; SMEUnited, 2020).

The mission board outlined a series of objectives within the "100 Climate-neutral Cities by 2030" mission proposal (hereafter called CNC mission or mission) as well as broadly defined activities to achieve them. These are outlined in Table 2-1 below. Furthermore, through public consultation between 2019-2020, citizens identified the priority areas of "mobility, energy, urban infrastructure and buildings, circular economy and behavioral change" (European Commission, 2020 p. 10). A more detailed overview of the CNC mission can be found in Appendix IV.

Table 2-1 100 Climate-neutral Cities Mission objectives and activities

Five Criteria for Mission-oriented Innovation Policies (Mazzucato, 2018a)**:**	**How the Climate-neutral Cities Mission Fits**
Bold and inspirational with societal relevance	A vision of a climate-neutral and competitive economy by 2050.
A clear direction: targeted, measurable, and time-bound	100 climate-neutral cities by 2030.
Ambitious but realistic research and innovation actions.	Basic and applied research coupled with social and entrepreneurial innovation.
Cross-disciplinary, cross-sector and cross-actor innovation.	Engagement across sectors while incorporating cross-disciplinary action.
Multiple bottom-up solutions	Experimentation, research, and civic engagement
Objective	**Activity/Approach**
Develop a multi-level and co-creative implementation process aligned with the mission.	Co-develop a Climate Contract between the city, national/regional authorities, and the European Commission.
Promote citizens (and all actors) as change-agents through bottom-up processes for innovation and new forms of governance.	Develop platforms for innovation through experimentation, including: testbeds, new districts, improving old districts, and Urban Living Labs (ULL). Invest in a portfolio of mission-projects.
Foster a just transition to improve citizens' wellbeing; bring co-benefits (e.g., improved air, healthier lifestyles, new mobility channels, etc.).	Align activities with Agenda 2030 and the Sustainable Development Goals; continually monitor progress holistically.
Identify policy gaps at the supra-national, national, regional, and local levels.	Work to fill these gaps to contribute to the European Green Deal priorities.
Help cities to access finance for mission implementation.	Link with the Horizon Europe, European Structural and Investment Funds, InvestEU, etc.
Support key drivers of transition. Develop five key enablers:	
1. Model for transformation (cities as innovation hubs). 2. New participative, city governance forms. 3. Funding/financial models. 4. Integrated urban planning model. 5. Interoperable data systems and smart systems (infrastructure, etc.)	

Source: Adapted from European Commission (2020) and Mazzucato, (2018a)

The implementation of the CNC mission has not yet occurred, although open calls for co-production of Climate Contracts and selection of cities is targeted to occur in 2021. As such, there is a dearth of literature to critically assess the policy and test its many assumptions (Brown, 2020). Furthermore, no literature on mission-oriented innovation policy directly reflects on the possible role of SMEs in missions. As such, this thesis aims to fill this gap, which first requires understanding SMEs' characteristics and eco-innovation, as well as how this influences urban sustainability transitions. Section 2.2 provides this foundational knowledge.

2.2 Small- and medium sized businesses in urban sustainability transitions

The role of SMEs in urban transitions has thus far been limited in the literature, although there is a wealth of knowledge related to firm-level eco-innovation and evidence of how SMEs work with the government and intermediary organizations. This chapter outlines the current state of knowledge regarding these concepts.

2.2.1 SME characteristics and eco-innovation

Small- and medium-sized enterprises are considered the backbone of the European economy; in 2018 there were 25.1 million SMEs in the EU, employing 97 million people, comprising 70% of the workforce (Eurostat, 2018). The European Commission's definition of SMEs is a based on both the staff headcount as well as annual turnover, as shown in Table 2-2 below.

Table 2-2. Definition of small and medium-sized enterprises in the EU

Company category	Staff headcount	Turnover	OR	Balance sheet total
Medium-sized	< 250	≤ € 50 m		≤ € 43 m
Small	< 50	≤ € 10 m		≤ € 50 m
Micro	< 10	≤ € 2 m		≤ € 10 m

Source: Adapted from European Commission (2016)

In 2018, the vast majority of the SME composition in the EU was micro-enterprises, with over 23 million firms employing less than 250 people. There were also 1.47 million small enterprises, and 236,000 medium-sized enterprises (Eurostat, 2018). Coupled with this economic contribution is an associated environmental harm. SMEs globally contribute to 70% of total pollution and 60% of emissions (Aragón-Correa et al., 2008; Martín-Tapia et al., 2010), and in the EU SMEs contribute to 64% of pollution (European Commission, 2010).

SME Characteristics

Literature typically highlights the unique characteristics, or peculiarities, of SMEs in relation with large firms (Del Brío & Junquera, 2003; Spence & Rutherfoord, 2003). For example, the average SME has a relatively high degree of flexibility, particularly in their ability to identify and quickly fit into niche markets or adapt to changing market conditions (Burch et al., 2016; Del Brío & Junquera, 2003; Hansen & Klewitz, 2012b). Whereas large firms are beholden to shareholder interests and can be mired by their complex organizational structure, the relatively informal organizational structure of SMEs (which are often owner owned and operated) affords its owner the freedom to lead based on personal visions and preference for business practice (Boiral et al., 2014; Lepoutre & Heene, 2006). This has increasingly led to the establishment of new institutional forms, such as social enterprises (Burch et al., 2016), circular business models, etc. SMEs can possibly move more quickly than large firms, experimenting and capitalizing on innovation to better compete in the niche markets for the sake of survival (Jenkins, 2006; Masurel, 2007). As new market entrants, SMEs are able to embed sustainability into the core of their business model, which is then brought to wider markets and actors in the urban system (Burch et al., 2016). However, unlike many large firms, SMEs' time, capital, personnel and expertise are often scarce (Granek & Hassanali, 2006). Furthermore, the risk of undertaking innovation and experimentation is much higher than large firms as a result of these deficiencies (Bos-Brouwers, 2010). A more elaborated list can be found in Appendix V.

Also unlike large businesses, some SMEs are highly social actors in many ways as they are deeply embedded within the communities where they operate (Westman et al., 2019). Several factors contribute to this. First, SMEs often have long-standing local orientation and proximity to customers (Bos-Brouwers, 2010). SMEs not only provide employment and local prosperity, but they also may become embedded in the social fabric of urban neighborhoods (Gomez et al., 2018; Westman et al., 2019). Furthermore, out of necessity SMEs have to collaborate, which often means that their local network ties are very strong (Burch et al., 2020). An SME's reputation is also critical as there is often a limited budget for customer acquisition (Loucks et al., 2010). Regarding new technologies, some studies have even identified that consumers may prefer services proposed by SMEs (e.g. decentralized energy grid providers) given their proximity to the business and perceived agency in influencing them when compared to larger companies (Schmid et al., 2016).

SME Eco-innovation

Firm-level eco-innovation has been widely documented in the literature; eco-innovation is defined as "any innovation resulting in significant progress toward the goal of sustainable development" (European Commission, 2014). Klewitz & Hansen (2014) synthesized the literature on sustainability-oriented innovation in SMEs and created a conceptual framework based on their findings (Figure 2-2). Discussing SMEs as a unitary actor in urban transformation is problematic (North, 2016), and the framework recognizes some key differences relevant to urban sustainability initiatives. SMEs can be broadly categorized by type, from "resistant" types focusing primarily on compliance with existing regulation to "sustainability-rooted" SMEs embedding deeper values of sustainability in the core values of their company (Burch et al., 2016; Klewitz et al., 2012). Innovations are made in either the process, organizational structure (e.g. business-model) and/or product innovation (Klewitz & Hansen, 2014).

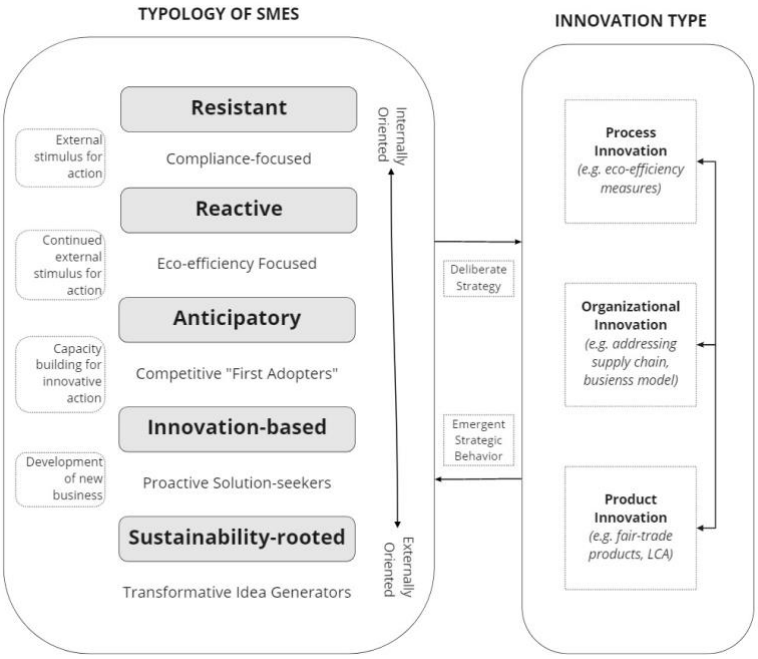


Figure 2-2 Typology and eco-innovation of SMEs

Source: Klewitz & Hansen (2014)

Given their economic importance, environmental impact and potential for creating disruptive, sustainability innovation, SMEs have been recognized for their importance in urban sustainability transitions (i.e. the movement from a fossil-fuel based system to one operating within planetary boundaries) (Hockerts & Wüstenhagen, 2010; Schaltegger & Wagner, 2011). However, academic literature has mostly focused on SMEs' sustainability impacts at the firm or industry level (Kearins et al., 2010; Zott et al., 2011), or through incremental process improvements to increase energy efficiency (Aragón-Correa et al., 2008; Clement & Hansen, 2003a; Gladwin et al., 1995; Hansen & Klewitz, 2012a). A broader systems perspective is lacking with regard to SME's influence on city-wide sustainability transitions (Sarah Burch et al., 2016; Loorbach & Wijsman, 2013; Westman et al., 2021). SMEs are highly dependent on both the government and intermediaries (e.g., business networks, etc.) for pursuing eco-innovation and engaging in city-wide sustainability initiatives. However, as noted by Burch et al. (2016), "involving SMEs needs to be an informed decision that considers their potential, characteristics and vulnerabilities as well as the caveats such as process may entail" (p. 28). Thus, with consideration of the spectrum of SME typologies identified by Klewitz & Hansen (2014), the following sections outline the ways in which the government and intermediaries engage with SMEs in urban sustainability transitions.

2.2.2 City governments, SMEs, and urban sustainability transitions

The following section explores aspects of how SMEs and the government engage with one another, specifically in relation to urban sustainability. First, SME engagement in urban sustainability governance (i.e., policy/political engagement) is addressed. Second, government policies and strategies which facilitate SME sustainability action are explored. Finally, platforms for collaboration and experimentation facilitated by the government are defined.

Urban sustainability governance has been defined as "a process whereby different actors interact in multiple, complex and sometimes conflictive ways for the definition of strategic issues on urban sustainability" (Blanes, 2008, p. 57). While broad engagement of the private sector in the political process is known to have positive benefits with regard to the sustainability-related outcomes of a city (Loorbach & Wijsman, 2013; Pattberg et al., 2012), literature primarily focuses on the influence of larger corporations (Barley, 2007). However, a recent study by Westman et al. (2020) of 76 SMEs in the greater Toronto area showed that "traditional political participation was the least common form of strategy employed by SMEs"; rather, activism and civic engagement (e.g. recycling, etc.) were more common. Furthermore, another common way that SMEs influence sustainability policy development is through coalition building around an issue (Lehmann, 2006), most often through formal and/or informal networks and public-private partnership and programs (Wickert, 2016). Some have noted a lack of capacity for SMEs to engage in urban politics, which can often be coupled with a lack of interest (Setzer & Biderman, 2013), or outright resistance to sustainability-related politics in general. Taken together, SMEs influence as political actors may be present, possibly most within networks, but their influence may not be captured or translated to the city-wide scale (Westman et al., 2020).

Conversely, governments also tend to struggle with engaging SMEs in urban governance. Some common forms of this engagement are through the establishment of working groups, advisory boards and benchmarking committees; while important, critics note that these initiatives may be seen more as administrative tasks rather than proactive engagement (Bulkeley & Kern, 2006). In a study of 130 sustainability-related initiatives of the greater Toronto area, only 11 were focused on SME engagement in policy-making, primarily through public-private networks (Westman et al., 2021). Low levels of participation in policy formulation has resulted in low policy uptake in past studies (Curran, 2000). SME-focused strategies are often marginalized in sustainability departments and documents, and public managers lack the knowledge and

capacity to engage in a hands-on approach required when working with SMEs (Westman et al., 2021). Furthermore, Westman et al.'s (2021) study showed there may be a normative barrier, given that cities' economic development departments typically handle SMEs, causing them to be seen solely as economic agents.

Policies which engage SMEs in city-wide, sustainability-related action have been classified as either economic, enabling, and regulatory policy (Westman et al., 2021). First, **economic** interventions involve both direct and indirect financial support. In a study of European financial support policies for SMEs, 60% of programs were for direct subsides most commonly utilized for incremental sustainability improvement (Clement & Hansen, 2003b). These incentive may help SMEs to overcome resource constraints for efficiency improvements (Clement & Hansen, 2003b), but the efficacy of these programs' ability to inspire innovation has been questioned (Triguero et al., 2013). Asheim and Isaksen (2003) note that "proactive investments" build SMEs capacity internally through subsides for hiring innovation managers and providing loans for competence development, although their study was more general than sustainability-focused. Indirect financial support from the public sector can come through "green" public procurement policies which serve a dual purpose of uplifting SMEs that provide innovative green products and services while also aligning public-sector operations with the community and broader sustainability strategies (Kundurpi et al., 2021; Walker & Preuss, 2008). For less "resistant" SMEs, prize schemes and competitions catalyze innovative activity and address seed finance gaps needed for proof of concept (Owen et al., 2018).

The city government can also prompt eco-innovation through **regulatory policy**. These regulations are very context and/or sector-specific, involving standards, reporting requirements, compliance measures, energy efficiency requirements, etc. (Westman et al., 2021). These policies are said to disproportionately affect SMEs, given their relative "resource poverty", and often complementary programs are implemented to lessen this burden (Hansen & Klewitz, 2012b).

Enabling interventions which target SMEs offer technology guidance and advisory services for more "resistant" firms (Klewitz & Hansen, 2014) whereas the development of collaborative platforms and infrastructure work to empowers and support radical innovations of "sustainability rooted" firms (Miedzinski et al., 2019). For SMEs struggling with eco-innovation, city-governments may implement diffusion-based innovation policies which focus on relational and interactive approaches that develop intra-firm knowledge through "doing, using and interacting" (Brown, 2020). The benefit of this network-reinforced bricolage approach was demonstrated in the differentiated success of the Danish and US turbine industry (Brown, 2020). Whereas the US focused on radical technological advancement and rapid deployment, Denmark focused on establishing strong networks for the technology's incremental diffusion, ultimately leading to a more successful system (Garud & Karnøe, 2003). However, the government is often dependent on intermediary organizations for the implementation of these programs (as discussed in Section 2.2.3). Alternatively, innovation policy (like MIP) focuses on ways which support the development of more radical SME eco-innovations. For this, the government establishes collaborative platforms such as innovation hubs, proactive technology centers, and innovation accelerators. These provide collaborative workspace, shared tools and expert guidance (Asheim & Isaksen, 2003; Mitev et al., 2019). For micro- and small-sized firms, these spaces allow for decreased overhead expenses. Additionally, through cluster policies and pro-active matchmaking, the government works to strategically bring together SMEs with other network actors, often centered around a thematic area of strategic importance for the city's innovation strategy (Ojaghi et al., 2019). Again, the government depends on intermediary organizations, and often establishes arms-length agencies to coordinate these policies (Kivimaa et al., 2019).

In a more directed fashion, city-governments have worked to coordinate the activities of promising SMEs through **urban experimentation**. Urban experimentation is widely discussed in the literature, taking many forms such as Living Labs (Pieter Ballon & Schuurman, 2015), testbeds (Dupont et al., 2018), etc., as which serve as platforms for testing and experimenting ideas (Ballon et al., 2005), at times in collaboration with citizens. While these sites take many forms, as outlined in Figure 2-3 below, city governments often promote "Open Innovation Platforms" for knowledge exchange and innovation development.

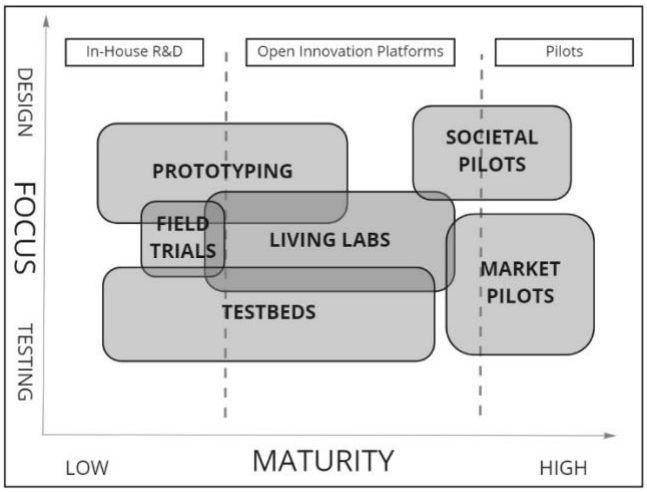


Figure 2-3 Test and experimentation platforms

Source: Adapted from Ballon et al., (2005)

Through Urban Living Labs, for example, stakeholders are able to both develop and test products and services that address sustainability-oriented (and other) issues (Bulkeley & Castán Broto, 2013). The ULL is geographically embedded at a manageable scale within the city (e.g. a neighborhood or district) where it is possible to "identify and empower discrete actors who can directly address specific challenges" (Voytenko et al., 2016). These spaces make eco-innovations highly visible, and they also facilitate new governance forms through co-production of innovation solutions (Nesti, 2018). Burch et al. (2018) explains that SMEs are particularly suited for these spaces as they operate at the community-scale of the ULL, can leverage existing networks, and are flexible enough to innovate. This is particularly true for the sustainably-rooted SMEs, often led by "post-conventional" leaders who see their business as agents of change rather than just of commerce (Parrish & Foxon, 2006).

2.2.3 Intermediaries, SMEs, and urban sustainability transitions

The process of eco-innovation presents challenges to SMEs, such as a lack of competencies and resources required to eco-innovate, as well as challenges in bringing solutions into the wider urban system (Kanda et al., 2018; Rennings, 2000). This section introduces the role of intermediaries as it relates to engaging SMEs in urban sustainability transitions.

For SMEs, collaboration with external agents is a strategic imperative (Rennings, 2000); as such, a bridging organization is needed to connect SMEs with competencies, resources and other actors (Klewitz et al., 2012). An intermediary can be defined as "an organization or body that acts as an agent or broker in the innovation process" (Kanda et al., 2018, p. 1007). This can include a variety of different organizations, but commonly refers to arms-length government

established organizations, traditional business networks, sustainability-oriented business networks, NGOs, community organizations and even other firms (Kundurpi et al., 2021). Using the language of transitions studies literature (see Chapter 3 for details of terminology), two key intermediaries which facilitate the "transition agenda" are systemic intermediaries (i.e. systems level coordination of a set transition agenda for regime-level change) and regime-based intermediaries (i.e. established within a quasi-governmental organization, also aiming to advance sustainability but may operate slightly outside of the specific transition agenda) (Kivimaa et al., 2019).

One of the primary functions of intermediaries is **building social networks**. This can occur at several levels with regard to the type of connections established, including: between individual entities; between entities in a network; between networks of different entities; and in-between actors and their networks, and institutions (Kivimaa, 2014a). Intermediaries serve as gatekeepers of network knowledge, and may strategically matchmake between parties in networks (Gliedt et al., 2018). They may also serve a brokering function as to negotiate between SMEs and other actors as they can act as neutral third-parties (Mattes et al., 2015).

Intermediaries also help to **build capacity** of SMEs in many ways. For example, sustainability-focused business networks may work directly with SMEs to provided targeted guidance for their sustainability innovations, which is useful for more "resistant" SMEs (Klewitz & Hansen, 2014; Kundurpi et al., 2021). They also provide forecasting and road mapping, coupled with monitoring of progress among network actors, as well as mobilize resources both from other network actors and through channeling finances to the SMEs (Kanda et al., 2018). For SMEs seeking to develop radical innovations, intermediaries first provide a space for open **collaboration** among network actors; this in-turn addresses SMEs lack of economies of scale (Kanda et al., 2018; Kivimaa et al., 2020) while also helping inter-firm knowledge sharing and co-learning. With regard to city-wide initiatives, intermediaries help advance the city's overall climate program through knowledge gathering, processing, generation and combination, and coordination of the SMEs and other actors in their networks strategically (Kivimaa et al., 2020).

Intermediaries also assist SMEs by providing them with connections for **new business opportunities**. Intermediaries provide resources for product commercialization, prototyping and piloting, branding and legitimization, which brings the SMEs' innovation to a standard ready for the marketplace (Kanda et al., 2018). They may also proactively advocate for the uptake of SME developed innovations within broader city-systems or by larger corporations through facilitating direct lines of communication (Gliedt et al., 2018). Intermediaries such as innovation hubs and start-up accelerators bring in new market entrants altogether (Kundurpi et al., 2021), by providing a swath of services from resources, to funding, to product development, all of which shield start-ups in their early stages and prepare them for market entry (R. Brown et al., 2019).

Summary of Literature Review

Overall, as the mission-oriented innovation policy is in its infancy, there is limited articulation of how the principles it envisages will be realized, let-alone the specific role of certain actors. There is a similar lack in sustainability transitions literature, which, as described in Chapter 3, works to direct systemic change in urban settings. However, as Section 2.2 illuminates, there are several characteristics of SMEs which may be of incredible importance for urban sustainability transitions, particularly if they are engaged with the government and intermediaries. Taken together, this thesis asks two important research questions which begin to fill the gaps in the literature while also providing practical knowledge for practitioners.

3 Theoretical Framework

This Chapter begins by presenting the underlying theory of transition studies, and then explores three analytical lenses it deploys: the multi-phase perspective, multi-level perspective, and multi-actor perspective. Key concepts and terms are defined. In section 3.2, transitions management is outlined, which presents a set of governance principles and associated activities which describe a prescriptive, systems-based method for directing change in urban (and other) settings. Both sections 3.1 and 3.2 are examined in relation to the literature on mission-oriented innovation policy. Section 3.3 presents the theoretical framework and justifies its usefulness for analyzing empirical data and answering the research questions.

3.1 Describing Urban Sustainability Transition

The notion of sustainability transitions (also referred to as transitions) refer to "large-scale societal changes deemed necessary to solve grand societal challenges" (Loorbach et al., 2017, p. 600). The study of transitions is a highly inter- and trans-disciplinary field that rapidly developed in the late 1990s when tasked by the Brundtland Report to accelerate sustainable development (WCED, 1987). Research in this field first aims to understand the dynamics of changing, complex systems (transition dynamics), and then builds from this learning to influence the rate and direction of transitions (transition governance) (Loorbach, 2010).

A rich body of literature which analyzes the nature of persistent problems in cities stems from systems theory, which broadly refers to a "universal language to address complex patterns of interaction between different components in complex adaptive systems" (Loorbach, 2010 p. 164). This breaks away from a long-tradition of Newtonian analytical approaches which views the system as separate, stable units of the urban "machine" (Capra, 1983), but instead embraces complexity through the lens of co-evolution between observed parts (Rotmans et al., 2001). Systems theory (and "systems thinking") has broad application in different disciplines studying ecological, political, economic and sociological systems, and since the late 1990s has been adopted within the inter- and trans-disciplinary field of transition studies to analyze urban sustainability transition (Grin et al., 2010; Kemp et al., 2007). The theory acknowledges that change is non-linear and occurs in a shock-wise rather than gradual manner. At any point, the urban system will be in a state of equilibria, but a shock may push it past tipping points leading to transformation and the emergence of a fundamentally new state of equilibrium (Holling & Gunderson, 2002; Loorbach et al., 2017; Olsson et al., 2004). These state-changes occur through co-evolution across different scales and domains (e.g., temporal, spatial, technological, institutional, etc.) and emergence of new states is naturally coincidental (Loorbach et al., 2017).

Sustainability transitions studies have examined transitions of energy systems, water management systems, and many other areas (R. R. Brown et al., 2013; Cherp et al., 2018), but has not yet been applied to mission-oriented innovation policy (Hekkert et al., 2020) and the city-wide transition to climate-neutrality. Both MIP and the field of transition governance seeks agency through envisioning a new state and directing its emergence (Loorbach et al., 2017; Mazzucato, 2018b). An obvious prerequisite for undertaking such a difficult feat is to first understand the dynamics of the urban system in question which impact its transition. Three interconnected perspectives have been well-established in the literature which provide a useful set of heuristics for understanding the complex nature of urban transition, including: the multi-level perspective, multi-phase perspective and multi-actor perspective.

Multi-level perspective

The **multi-level perspective** was first applied to socio-technical transitions (Frank W. Geels, 2002; Rip, 1995; Rip & Kemp, 1998), but has since been used for socio-institutional analysis as well (Hölscher et al., 2018). The perspective identifies three main "levels" within a complex system. These include the macro-level landscape, meso-level regime, and micro-level niches, as shown in Figure 3-1.

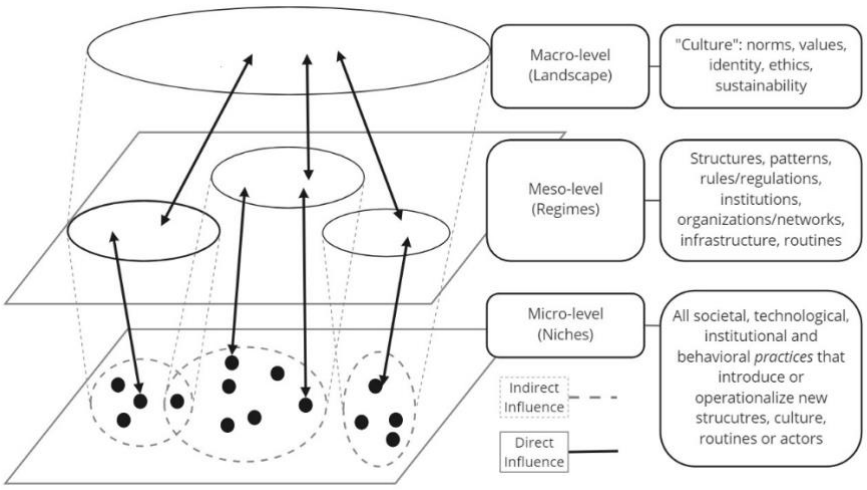


Figure 3-1. The multi-level perspective of transition studies

Source: Adapted from Geels and Schot (2007, p. 406) and Loorbach (2010)

The macro-level **landscape** refers to the broader context within which cities are found; relevant to the mission, this constitutes regional, national and European institutional pressures (Lamperti et al., 2019), as well as relevant pressure-inducing trends (e.g. urbanization, social movements, etc.) (Adrian Smith et al., 2010). The meso-level is comprised of **regimes**, or the dominant structures (e.g., infrastructure), rules/regulations, institutions (e.g., government), routines (i.e., behavioral patterns), etc. of the status-quo which society gradually became locked into over time (i.e. dependent upon). At the micro-level, niches are formed which present alternatives to the regime (e.g. new business models and technologies), thus challenging the existing system (Frank W. Geels & Schot, 2007), although push-back is expected from the vested interests operating within the regime (Loorbach, 2010).

Multi-phase perspective

The **multi-phase perspective (MPP)** complements the multi-level perspective to demonstrate how the alternative transition pathways established in the niche influence the regime over time. Through a co-evolutionary transition, urban systems may undergo change over four phases, termed: **predevelopment, take-off, acceleration** and **stabilization** (Rotmans et al., 2001).

Using the construction sector as an illustrative example of a combined multi-level and multi-phase model (Figure 3-2), in the **pre-development phase**, regimes which have historically co-evolved (e.g., building regulations, carbon-intensive material use, consumer expectations, etc.) face lock-in and path dependence, leaving little room for innovation uptake. During the **take-**

off phase, new regimes are triggered through system shocks (e.g. MIP, new regulation, increased price of carbon-intense materials) and innovation networks are empowered to develop within the niche to produce alternatives (e.g. bio-based building materials, circular-business design) to the regime (Van der Brugge & Rotmans, 2007). This leads to the **acceleration phase**, during which time niche alternatives accumulate, presenting selection options for the re-development of the regime (e.g. consumer-selection of "green buildings") (Rotmans et al., 2001). The final stage of **stabilization** represents a new dynamic equilibrium that is fundamentally different from before (e.g., climate-neutral construction sector). To be clear, not all pathways (indeed few) lead to stabilization at new equilibrium. Instead, regimes may be too locked-in or path dependent, there may be significant backlash that destabilizes the regime, or complete system-breakdown may occur (Van der Brugge & Rotmans, 2007); critical tipping-points must be overcome for transformation (Loorbach et al., 2017). Conversely, as social systems change, an opposite flow of destabilization occurs within existing regimes along the phases of destabilization, chaos, breakdown and phase-out (Turnheim et al., 2015).

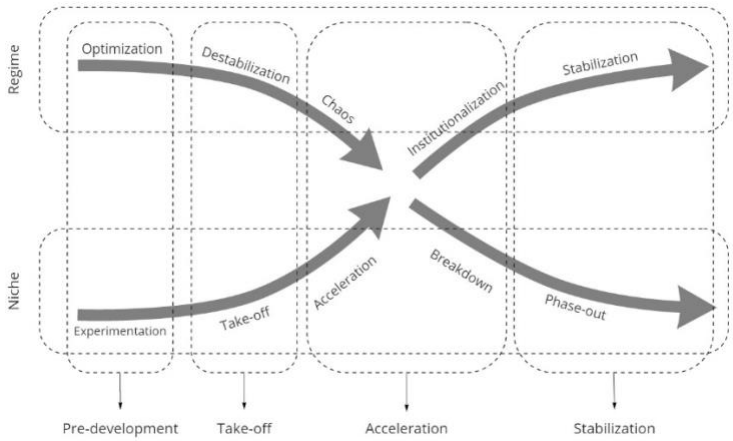


Figure 3-2. Multi-phase Model of regime transition

Source: Author's own illustration, adapted from Loorbach et al. (2017, p. 607), Geels & Schot (2007)

Multi-actor perspective

While the two mentioned perspectives are particularly helpful for addressing socio-technical change relevant to the MIP (including how innovation is developed and adopted), they also may be applied through a socio-institutional systems analysis. The socio-institutional lens takes a broader focus on "institutions, agency, power, analysis of networks, social innovation and governance" (Loorbach et al., 2017 p. 612). One final perspective useful in this analysis and which complements the previous two is the **multi-actor perspective (MAP)** (Avelino & Wittmayer, 2016). The multi-actor perspective considers actors' roles, agency (i.e. actions), and power (i.e. ability to act) throughout the process of transition (Avelino, 2009; Hölscher et al., 2019). There are three levels of abstraction to describe actors in an urban system. The first is by **sectors**, which includes the state, market, community and third sector (NGOs, civil society, community groups, associations), which are illustrated in Figure 3-3 below. At a second level there are **organizations**, which fall within sectors, and at a third level there are actors, who can be included in multiple sectors (e.g., an actor can be considered an entrepreneur, but also a resident). Furthermore, through (dis)empowerment, both organizational and individual actors' function or role may be re-defined (e.g. from "business" to "change-agent") (Hölscher et al., 2018).

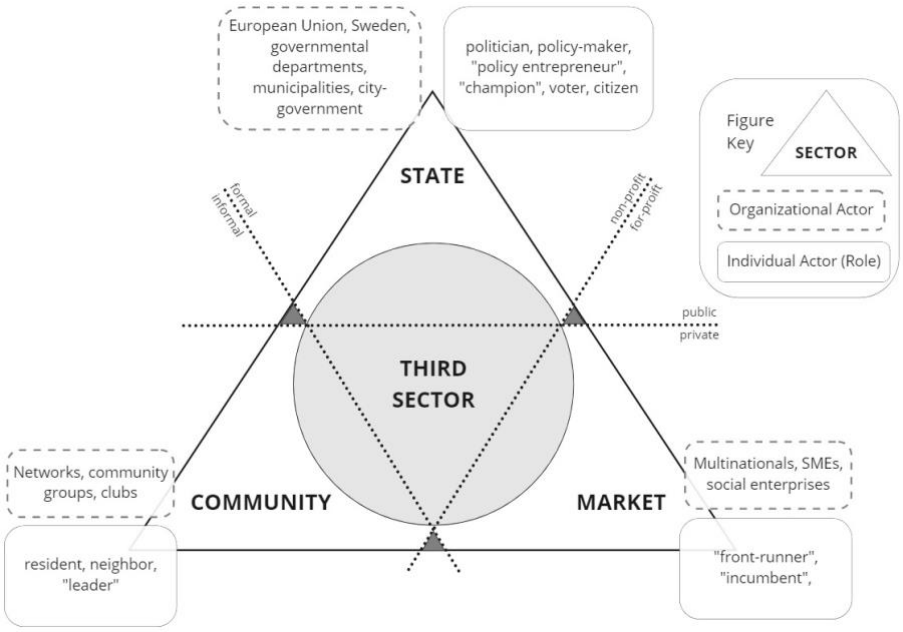


Figure 3-3 Multi-actor perspective

Source: Adapted from Avelino & Wittmayer, 2016a

When applied to the multi-level perspective, actors who are aligned with the vested interests of the regime are considered **incumbents** (Raven & Geels, 2010), although within the regime there may be those that are change inclined. For example, among firms in the market sector, there may be **frontrunners** who take-up the radical innovations of the niche and translate it to the regime context (Loorbach, 2010). For the state sector, **"policy entrepreneurs"** may challenge the regime of the government institution (e.g. bureaucracy, siloed departments, political cycle) from within (Brown et al., 2013). Incumbents' act to either reinforce the regime, or incrementally innovate within it. However, while niche actors have relatively less power than incumbents, if the niche is properly developed and empowered, it has the potential for transformative change (Adrian Smith & Raven, 2012). Taken together, these perspectives help to articulate relations between actors/organizations/sectors (MAP), through describing their relative power, or proximity to the regime (MLP), which changes at different phases of urban transition (MPP).

These perspectives present a narrative of how the transformative change envisioned through the mission may occur over time as radical, niche ideas generated through experimentation make their way into the broader regime. The perspectives also highlight the dynamics between sectors, organizations, and actors, which informs how some inherent barriers may be overcome through empowerment of the niche. Equipped with this foundation of systems thinking, the following section presents transition management (TM) as a method for utilizing this knowledge to direct change to combat "wicked problems"; these processes draw parallels with MIP.

3.2 Governing Urban Sustainability Transition

Whereas section 3.1 presents terminology and perspectives for describing transition, **transition management (TM)** seeks ways in which transition can be governed. Much like the MIP, transition management starts from a normative stance with an aim of addressing grand societal problems (e.g., climate change). Also, like MIP, transition management seeks solutions to grand societal problems through experimentation, co-learning, and co-evolution. Again, as in MIP,

this management requires broad participation and multi-level governance (Loorbach et al., 2017; Mazzucato, 2018a).

TM is a practical tool which was developed to align "natural" governance principles with specific interventions in an attempt to direct complex systems to reach a collectively determined goal (e.g. climate-neutrality) (Kemp et al., 2007; Loorbach, 2010). The four governance principles of the framework include: **strategic, tactical, operational, and reflexive.** These principles reinforce four key activities of the "transition cycle" developed by Loorbach (2004; 2010). The combined activities and framework are shown in Figure 3-4 below. The following sections draw comparisons between the two approaches. As a caveat, the form of MIP discussed specifically relates to that outlined through Mazzucato's (2018a) ROAR framework.

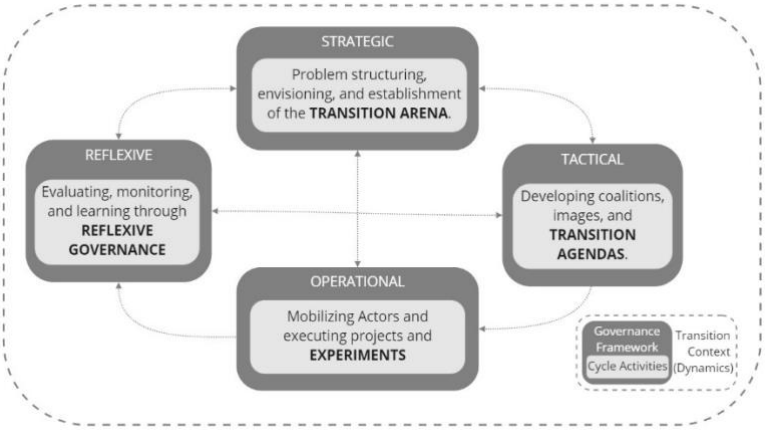


Figure 3-4 Transition Management Combined Framework and Cycle

Source: Adapted from Loorbach (2010, p. 173)

Strategic (TM) – Routes & Direction (MIP)

Strategic governance considers broad landscape-level aspects (i.e., culture) of urban systems, with anticipated outcomes of interventions expected to occur over 25+ years. Strategic activities are undertaken by a small, heterogenous group of representative frontrunners (10-15), each with their individual perspectives, who are selected by the transition leader to join a "**transition arena**" within which they collectively develop a long-term vision, for example, toward climate-neutrality in cities. Actors selected to join the transition arena should be able to: interpret the problem with a high-degree of abstraction; think past disciplinary/perspective boundaries; maintain authority within their network; translate visions within the context of their network; collaborate; and enable space for innovation rather than prescribing solutions (Loorbach, 2010 p.173-174). This group is kept intentionally small as to establish trust between actors (Hölscher et al., 2018) which allows for more stimulated debate. The output of this process is a "**transition agenda**" which includes a shared problem statement, a novel future perspective and transition pathways (Hölscher et al., 2018). This process has been criticized as the group may have an "elite" perspective (Smith & Sterling, 2010), which can cause dis-empowerment of some actors as the transition agenda is carried out, in-turn limiting the potential for reaching the agenda's vision (Hölscher et al., 2019). In the past, the City of Ludwigsburg complemented this process with consultative, citizen input, which led to the broader uptake of the transition agenda and more relative success (Frantzeskaki et al., 2018) than examples like the City of Ghent, which kept the process and subsequent activities relatively controlled (Roorda & Wittmayer, 2014).

A clear link can be made to the "routes and direction" pillar of the ROAR framework in that both establish a vision of the future (e.g., climate-neutrality in 100 cities). However, a clear distinction can be drawn given that TM emphasizes a need for a small group to develop this vision (which is then translated into broader networks), whereas the ROAR framework seeks democratic legitimization upfront, specifically through broad citizen engagement (Mazzucato & Mazzucato, 2017). Another difference is that Loorbach's strategic activities aim at a longer time-horizon of 25 years for providing the basis of short-term goals, whereas the ROAR framework takes a more truncated approach, with missions occurring over the course of a shorter period of time (e.g. a decade) (Mazzucato, 2018a). This ambition is justified by the expectation for democratic legitimization which leads to broad uptake of the mission among societal actors.

The transition agenda also mirrors the Climate Contracts as defined by through the European Commission's climate-neutral cities mission. These contracts are co-developed between national/regional authorities, the European Commission, and key actors at the city level (including the private and public sectors, academia, and civil society), serving as an expression of commitment, a means of identifying policy and implementation gaps within city's strategies, a "one-stop-shop" for negotiations, and a link to multi-level legal and financial systems. Further, stakeholder engagement may manifest through sub-contracts (European Commission, 2020 p. 11-12). The development of relevant "roadmaps" (similar to the "transition paths" of TM framework) has also been discussed, both on a sectoral and cross-sectoral basis (Miedzinski et al., 2019). While Mazzucato's (2018) ROAR framework does not specify these governance mechanisms, as the Commission's programme was developed in direct consultation with Mazzucato, this connection is justified.

Tactical (TM) – Organization (MIP)

As the transition agenda is disseminated throughout the urban system, **tactical governance** is needed to translate it within the context of a broader "transition network" of actors identified at the sub-system level whose role involves regulating institutions, coalition and network building, and program development (Loorbach, 2010 p. 170). These activities address established "patterns and structures, such as rules and regulations, institutions, organizations and networks, infrastructure, and routines" (Loorbach, 2010 p. 169), to ignite co-evolving transition pathways, all of which share a common vision of the future (Loorbach, 2010). The tactical activities of the transition network are still strategic, but at a lower level with the aim of creating change over 5-15 years (Loorbach, 2010).

Translating the transition agenda into broader networks is notably challenging in practice (Frantzeskaki et al., 2014). Actors at the sub-system level may be face barriers of "regime inertia", or a slow adjustment to change; transition network leaders will have to address the inherently disparate nature of many subsystems such as the siloed departments of institutions each with competing agendas (Frantzeskaki et al., 2014; Nevens & Roorda, 2014). At this stage intermediaries engaged in the transition management process become increasingly relevant for creating space for collaboration, alignment of the transition agenda within the context of their network, establish protocol for monitoring progress, and connecting actors with one another (Frantzeskaki et al., 2014; Hölscher et al., 2018). A product of this is the establishment of a sense of "togetherness, pooling resources and knowledge sharing" (Loorbach & Rotmans, 2010).

During this portion of the cycle, the lines between what is "on the ground" and the more formalized transitions agenda become blurred (Hölscher et al., 2018). As new perspectives are included in the transition discourse, the transition arena may be re-configured and/or reconvened for the purpose of re-imagining the vision itself (Loorbach, 2010 p.169). Furthermore, the "transition area" process is recursive; for example, while a broader

conversation may have established a vision for a sustainable future at the landscape level, a similar group of sub-system frontrunners could gather to debate the specific transition pathways involved in reaching this goal (e.g., is biomass a better fuel, or hydrogen?) (Loorbach, 2010, p. 170). The City of Montreuil institutionalized this process through re-convening continually; this created a new routine among network actors that smoothed the transition process (Hölscher et al., 2018).

The tactical activities of Loorbach's (2010) framework reflects the organizational pillar of MIP as it calls for re-configuration of actor constellations within cross-sectoral, "sustainable transformation innovation ecosystems" comprised of "willing" actors (Mazzucato, 2017). However, there is a notable gap in the literature with regard to operationalizing this process (Hekkert et al., 2020), leaving policy-makers with an incredibly heavy burden when formulating MIP.

Operational (TM) – Routes and Direction, Organization (MIP)

At the niche-level, solutions are developed from the bottom-up through project-based **operational** activities that follow a shorter timeline (0-5 years). These activities are defined as experiments which seek innovation, or "alternatives to the regime" (Hölscher et al., 2018). This includes both tangible results (e.g., new technologies) as well as new practices that may mobilize actors, structures, etc. In the transition cycle, experiments (iconic projects) are undertaken which aim to "broaden, deepen and scale up existing and planned activities and actions" (Loorbach, 2010 p. 176). Experiments can also be linked with other projects already taking place, overall creating a portfolio of related experiments (Loorbach, 2010). Successful projects help further advance transition through replication and scaling (Loorbach, 2010). One limitation of the TM is that, in practice, experiments may lack the connectivity required for large-scale, prescriptive transformation (Loorbach et al., 2017), and they are very costly (Loorbach, 2010)

The "organization" pillar of the ROAR framework also calls for experimentation and development of a portfolio of ideally cross-sectoral mission-based projects, although a mix of both risky and non-risky investments is emphasized under the "risk and reward" pillar of the framework. Additionally, both frameworks mobilize experimental activities by creating urban innovation spaces, such as testbeds and urban living labs (Eneqvist & Karvonen, 2021). However, the ROAR framework differs from TM as it calls for policy-instruments to "tilt the market" (Mazzucato, 2018a). Whereas the ROAR framework utilizes the leadership of the government to tilt markets, TM would see this as a product of a shifting regime, realized only in later phases of transition. This presents cities with an arsenal of policy-instruments for tilting the market itself which, in the language of the MLP, helps it to overcome barriers for niche-solutions to enter the regime (Hendriks & Grin, 2007; Nevens et al., 2013).

Reflexive (TM) – Assessment (MIP)

Reflexive governance activities are those that are related to "monitoring, assessment and evaluation of ongoing policies and ongoing societal change" (Loorbach, 2010, p. 170). Both the transition management process itself and unfolding dynamics at all levels (e.g., niche projects, regime reconfiguration, landscape macro-developments) should be monitored. Quantitative and qualitative evaluations reflect the success of the transition agenda, and new insights should be captured and scaled from experiments (Loorbach, 2010 p. 177). Collective reflection among involved actors enables co-learning; when brought to respective networks, this learning in-turn empowers co-evolution, or the ability of disparate sectors to adapt independently, but work towards a common goal. These processes should be continual through the transition cycle (Rosa et al., 2021). Similarly, MIP calls for reflexive governance throughout the mission as co-

benefits and public-value is measured, and direction-setting approaches are adjusted (or, if failing, abandoned). This will be aided by inter-operable networks of data sharing, big-data analytics, and qualitative measures of public-value creation (e.g. cross-sectoral spill-overs) (European Commission, 2020).

3.3 Theoretical framework

Pulling from complexity theory which underlies transition studies, a theoretical framework is proposed using the governance principles of transition management (Loorbach, 2010), the multi-level perspective (Frank W. Geels, 2002), and multi-actor perspective (Avelino & Wittmayer, 2016) (Figure 3-5).

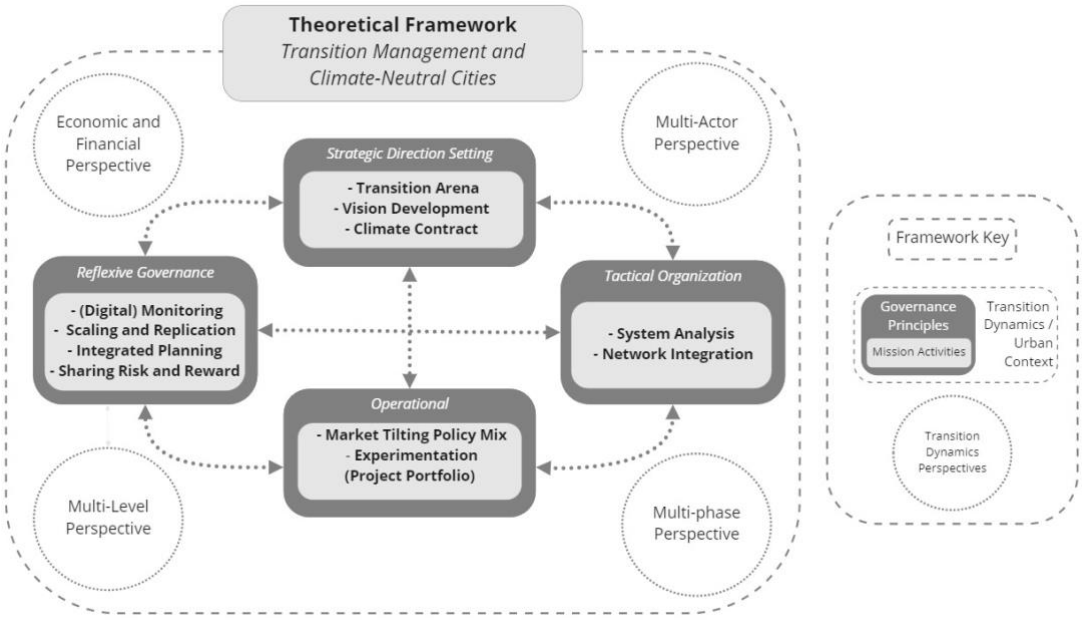


Figure 3-5 Theoretical framework

Source: Author's own illustration based on Loorbach (2010), Mazzucato (2017), European Commission (2020), Avelino (2009), and Geels & Schot (2007).

Missions have increasingly been used as a paradigm for approaching innovation, yet what is missing is a way to map out and tactfully navigate the dynamics of transition (Hekkert et al., 2020). As noted by Hekkert et al. (2020), "the focus on tackling actual societal challenges, rather than on pushing innovaitons, is precisely what makes the concpet of MIP so relevant for the transitions research community". In both the ROAR framework and MIP in general there is a gap related to the tactical governance requried for widespread, societal engagement around a social mission. For TM, a similar problem exists, yet there is a breadth of empirical studies for reference with regard to the struggles faced when engaging broader networks with the transition agenda(s) (Frantzeskaki et al., 2018; Hendriks & Grin, 2007; Hoekstra et al., 2017; Hölscher et al., 2018; Rotmans et al., 2001; Van der Brugge & Rotmans, 2007). Conversely, the ROAR framework provides a level of agency to the government through "market-tilting policy" not typically afforded to transition management leaders. Taken together, new areas for research open up for both research communities and practitioners. This is further elaborated upon in Chapter 6.

4 Research design, materials, and methods

This Chapter is outlined as follows: in Section 4.1, the overall research design and logic is presented and justified (Figure 4-1). Next, in section 4.2 data collection methods are discussed (2) in Figure 4-1. In Section 4.3, the conceptual framework and data analysis methods are discussed and justified, (3) in in Figure 4-1 below.

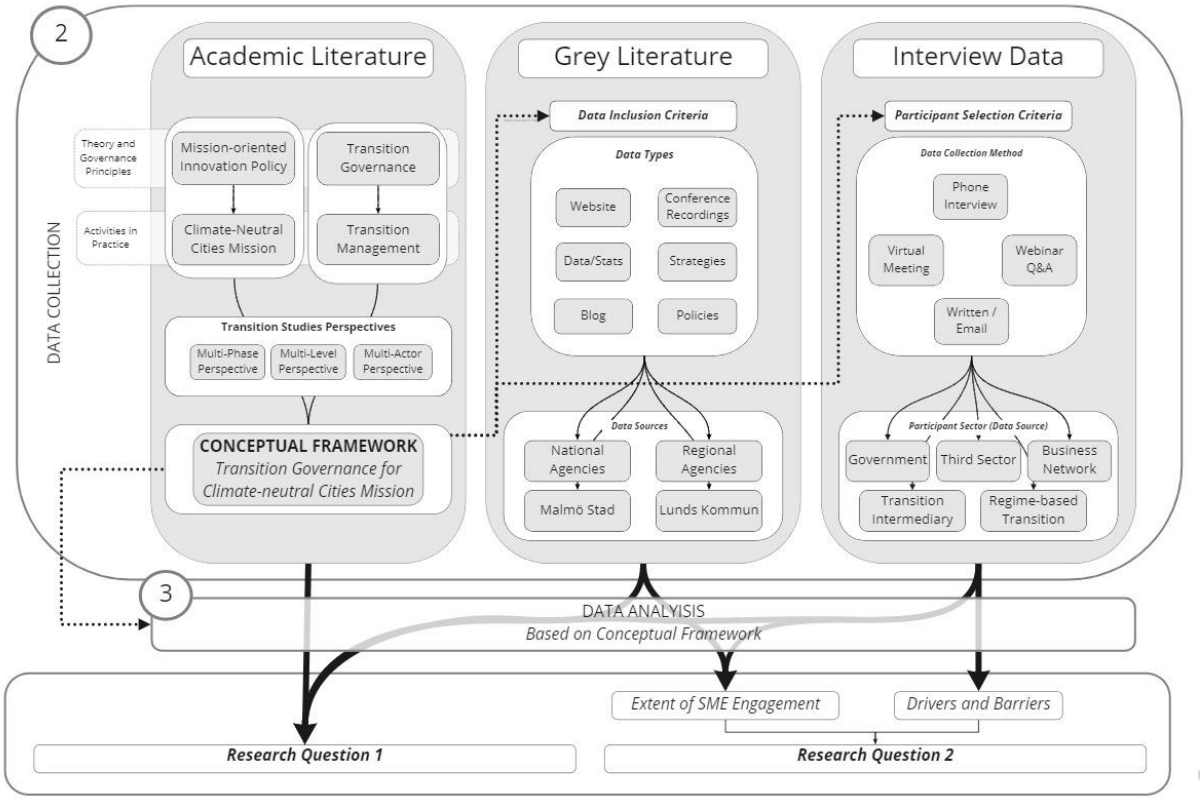


Figure 4-1 Research design overview

Source: Author's own illustration.

4.1 Research design

Upon conducting a literature review, a research gap emerged between the firm-level sustainability characteristics of SMEs, the role of intermediary and government practitioners engaging with SMEs, and SMEs broader potential for influencing urban sustainability transitions. Second, while mission-oriented-innovation policy has experienced a recent renewal of interest, there is limited literature which addresses its recent re-conceptualization as having potential for addressing "grand societal challenges". However, through Sweden's national innovation program Viable Cities, practitioners from the government, and intermediary organizations, (all of which work with SMEs), together have begun to take on the mission of reaching climate-neutrality by 2030. As such, their insights regarding the potential role of SMEs as well as the drivers and barriers to engaging SMEs they have experienced is valuable informing an early, strategic assessment of the mission. Thus, to fill the research gap exposed through the literature review, a single, exploratory case study was selected to gather data on what is occurring in practice for the purpose of proposing a hypothesis which inspires future areas of research and practical improvements.

An exploratory case study methodology provides the in-depth, context-specific analysis required to capture the level of detail which is useful for practitioners (Baškarada, 2014). Similarly, case studies are useful for capturing complexity within systems (Flyvbjerg, 2006). Finally, this methodological choice reflects similar case-study approaches have been used to study complex, systemic problems (Anderson et al., 2005), urban transitions (Loorbach et al., 2009, 2020; Loorbach & Rotmans, 2010; Nevens et al., 2013), and mission-oriented innovation policy (Fisher et al., 2018).

The unit of analysis for the single, exploratory case study selected was the Region Skåne, with the two sub-units of analysis being the City of Malmö and City of Lund. The justification of this selection is threefold. First, as the research aims to inform practitioners involved in climate-neutral cities missions developed by Viable Cities, the sub-units of Lund and Malmö were selected as they are two of only 9 cities in Sweden which have committed to the program for over six months (Viable Cities, 2021a). Second, among the potential cities for selection, these two are both located in the Region Skåne. From a regional standpoint, this can be justified as 97% of the region's businesses are SMEs (Eriksson et al., 2020) and there is a thriving innovation ecosystem strategically aligned to sustainable growth (FIRS, 2020). Furthermore, as both cities are only 20 kilometers away from each other, there is overlap in SME's market base as well as shared systems relevant to the mission (e.g. waste) (G4, 2021). Overall, as the mission is a city-based initiative, having two sub-units as cities provides an additional level of detail for analysis; for example, whereas results may occur in one city, they may also impact the other city as both share a region. However, some findings may only be relevant to a single sub-unit, as is the case with some government-related findings; however, as the SMEs in question would be impacted regardless as they are not jurisdictionally bound, these findings are worth reporting, albeit qualified in relation to one sub-unit. Overall, this case study can be considered an exemplary case study (Baškarada, 2014) given that through the climate-neutral mission 2030 program, selected cities are intended to be innovation hubs and examples for other cities in the future.

4.2 Data collection

4.2.1 Grey literature

Grey literature was reviewed via the internet (primarily using source websites and search engines) to collect documents relevant to the climate-neutral cities mission in the Region Skåne. Data was collected for the purposes of triangulation as to reduce bias in the results, thereby increasing the overall validity of the research findings (Yin, 2003). Data was collected from relevant national, regional and city organizations outlined in the Climate Contracts of both Lund and Malmö, or those related to the identified intermediaries. Only data that directly related to intermediary organizations and the climate-neutral mission were included. A full list of collected documents can be found in Appendix VI. Documents identified for analysis include: 3 statistical reports; 17 government/practitioner websites; 13 strategy documents; and 3 conference proceedings.

4.2.2 Practitioner interviews and email correspondence

In order to gain a more in-depth analysis of the case study (Yin, 2003), 17 semi-structured interviews were conducted with practitioners, along with 4 email correspondences. An additional 3 interviews were conducted with academics whose work focuses on transitions studies, and who have specifically published papers related to SMEs in relation to urban sustainability transitions. For a full list of participants, see Appendix II. Within the scope of the

study, the following selection criteria were utilized: 1) participants had to be practitioners involved in the climate-neutral cities mission; 2) participants at each organization were selected who had knowledge of and/or worked directly with the climate-neutral cities mission already, and 3) either worked with SMEs themselves or had a working knowledge of how their organization engaged with SMEs. Based on a review of the Climate Contracts and associated documents gathered, an initial list of 61 potential interviewees were contacted and asked for interviews. From this, 17 were not available for interviews or did not meet the criteria and 20 did not reply.

To avoid possible bias regarding the organizations selected, a variety of organizational types were selected. This first helped to provide a broader systems perspective required for socio-institutional analysis (Yin, 2003), which can only be provided through a variety of perspectives. Second, by selecting a variety of organizational types, this in-turn presents a variety of approaches to SME engagement. For example, whereas transition intermediaries and the government have a broad network and coordinate the mission at a city-wide (or national) level, business networks maintain closer ties to SMEs. By interviewing a variety of organizations, an "ecosystem" of actors who support both the mission and SMEs within the mission is portrayed (See Chapter 5 for further explanation). Participants were either from: the city government; academia; NGOs "third sector" organizations; transition intermediaries; cluster organizations; business networks; and regime-based intermediaries. To avoid bias, each organizational type was relatively equally represented. Additionally, relatively equal geographic distribution regarding the organizations' operations was sought, with most selected organizations working in both Malmö and Lund.

Interviews were semi-structured as to maintain a level of flexibility that allowed for the author to "better understand the perspective of the interviewees" (Daymon & Holloway, 2010). Thus, while a pre-established interview guide was established and tailored per participant to maintain focus on the topic (Baškarada, 2014), flexibility allowed for additional questions to be asked when relevant to the research. Furthermore, documents (see above) were reviewed pertaining to the participant's organization prior to the interview so that further clarification could be retrieved through the interview process regarding relevant topics (e.g. programs, etc.) (Baškarada, 2014). A sample interview guide can be found in Appendix VII.

Given that the mission is in its early stages, care was taken during interviews to clarify any uncertainties as to whether what was being reported was a participant's reflection on past events, or if it was speculation (e.g., as to the role of SMEs in the future stages of the mission). Prior to the interviews being conducted, consent and information sheets were sent to the participants (see Appendix I), and the information it contained was addressed before the interviews began. Interviews followed a process as outlined by Kasunic (2010), which begins with an "orientation" that familiarized the participant with the study and its aims; time was provided for any clarification. This was followed by the semi-structured interview, and then concluding with closing remarks through which the author provided an overview of the key points covered.

4.3 Data analysis

Interviews were recorded and then transcribed virtually using Otter.ai software. Transcriptions were checked for accuracy prior to being imported to NVivo (version 12) for analysis. A conventional, qualitative content analysis was conducted, which followed the following process, as outlined by Hsieh & Shannon (2005). First, an initial set of codes were deductively drawn from a review of the literature. These directly aligned with the governance principles and associated activities of the theoretical framework outlined in Chapter 3, Section 3.3. The coding structure can be found in Appendix VIII. The documents collected were analyzed using these

codes first, and then tested during the initial analysis of transcribed interviews to determine their suitability. Several new codes were inductively identified from the analysis and were added to the coding structure; redundant codes were combined as needed. After the data was initially analyzed and formatted through this coding framework, the "drivers" and "barriers" to engagement were identified under each of the codes. Data was triangulated with documents, and a case study analysis was presented (Chapter 5). Following the initial case-study analysis, findings were compared with what was known in the literature or explained through the theoretical framework; this is presented in Chapter 3.

4.4 Limitations

One limitation to the method is that, as the mission is in its early stages, there is somewhat limited activity directly related to the mission. However, through the theoretical framework, some activities which are key to the mission's implementation, such as experimentation, "market-tilting" policy, vision development, etc., either have already occurred in relation the mission, or have occurred in the past through the intermediary's programs/services or through the city government's environmental program. Thus, while there is a certain degree of speculation as to the drivers and barriers identified in the analysis, there is also justification to the inclusion of these empirical findings given that these activities are reflective of governance principles which can be applied to the mission in the future. For example, seeing that the government has established testbeds for engaging SMEs in the past through the environment program demonstrates a competence for this "operational" governance principles to occur in the future as well as the mission is being undertaken; drivers and barriers should persist, although the reader should consider this limitation in the method. Findings were qualified as being speculative as needed. Additionally, respondents may not have a comprehensive systems perspective regarding the questions being asked; for example, they may have limited knowledge of regional innovation policy, etc. Documents collected through the grey literature helped for triangulation of findings, both to position responses in a broader context and to verify respondents' accounts. Furthermore, participants in interviews are always subject to personal and cognitive bias (e.g., hindsight bias); to best account for this, a variety of interviewees were selected, and questions focused on recent events. A further discussion of limitations and how they were accounted for is elaborated in Chapter 6.

5 Case study analysis

This chapter provides a case study analysis of results derived from a qualitative content analysis of interviews (and other forms of communication) with practitioners from the governments of the City of Malmö and City of Lund, intermediary organizations, and academics (See Appendix II for a full list of respondents). In addition, grey literature was collected from a variety of sources relevant to the climate-neutral cities mission (See Appendix VI for a full list). All data collected was triangulated to build the case study analysis.

This chapter begins by examining SMEs prevalence in the Region Skåne and the characteristics which influence their role in either developing innovative solutions for the climate-neutral mission, or characteristics that are constraining their engagement in undertaking eco-innovation. This understanding builds a case for their relevance within the mission, which is, in part, facilitated through engagement with the governments of Malmö and Lund as well as intermediaries operating in both cities (e.g., transition intermediaries, regime-embedded transition intermediaries, cluster organizations, business networks and third sector actors such NGOs). After Section 5.1, subsequent sections are outlined in accordance with the governance principles (e.g., Section 5.2), and associated activities (e.g., Section 5.2.1) defined through the theoretical framework (see Chapter 3 for full description). Analyzed data is presented as *drivers* and *barriers* in each section, and the extent to which mission-related activities have occurred to date is described throughout.

5.1 SMEs in the Region Skåne

In the Region Skåne, SMEs comprise 97% of firms, employing every two out of three people (Eriksson et al., 2020). Of these firms, 98.3% of SMEs had below 20 employees (Kachlami & Yazdanfar, 2016), and the average Swedish SME employs 3 people (European Commission, 2019). Furthermore, in Sweden SMEs generated 61.2% of the value added in the non-financial business economy in 2018, which then grew at a 6.2% growth rate between 2018-2020, accounting for over 151 billion EUR in total value added (European Commission, 2019). Contributions of SMEs to the problem of emissions "are really quite small in Lund and Malmö. [The region] does not have many intensive production processes" (G3, 2021); specific data on SMEs has not been aggregated. Furthermore, within the Region Skåne, there has been nearly a 160% increase of energy efficiency between 2008-2018 (Statistics Sweden, 2018). The main industries and energy efficiency statistics can be found in Figure 5-1 below.

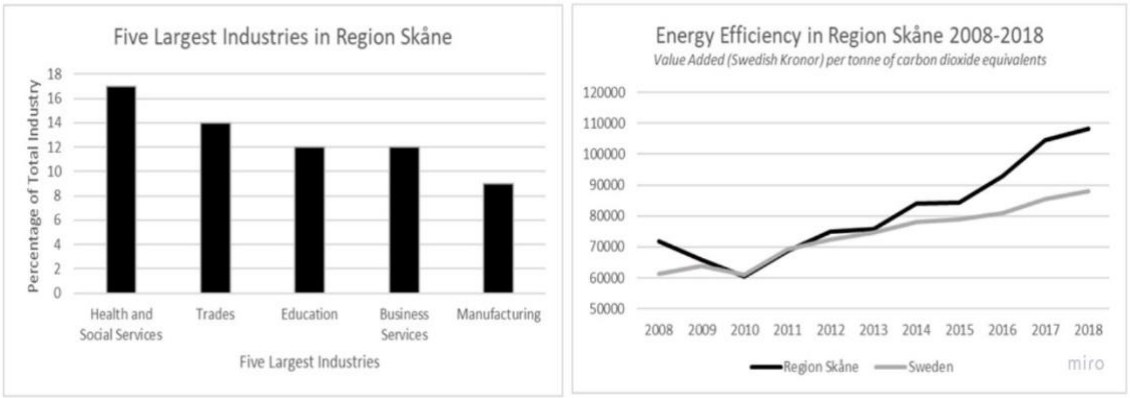


Figure 5-1. Five largest industries and energy efficiency in Region Skåne

Source: Adapted from Statistics Sweden (2018) and Statistics Sweden (2020)

All respondents noted that SMEs are a very heterogenous group, which presents a challenge when considering them strategically (B2, 2021). For example, a manufacturing SME and a retail SME have "processes that are different… different waste concerns… different employee concerns" (A1, 2021). As respondent G3 (2021) explained, one element linking all SMEs is that the core of their business needs to be economically viable, lest the support and collaborations envisaged by the mission equate to "stealing from society to meet business needs" (G3, 2021). This same respondent continued, noting that if an SME is contributing to collective problems of society, they also need to be a part of the collective solutions that are sought (G3, 2021). Among all respondents, SMEs were seen as being important for climate-neutrality, either for identifying solutions for climate-neutrality, or for addressing their own emissions.

SMEs as drivers of the urban transition to climate-neutrality

At the firm level, all respondents noted that many SMEs (both existing and start-ups) have characteristics which provide them a unique advantage for generating innovative solutions for climate-neutrality. **SMEs maintain flexibility,** which allows them to test alternatives to city-systems and existing business models (A1, 2021; A3, 2020; G1, 2021). Additionally, some SMEs are changing the core of their business to align with sustainability, even defining this term in a deeper context of justice and social equity (A3, 2020). SMEs are often led by an owner who can be driven **by intrinsic motivation** to take on climate-neutrality given both intrinsic and extrinsic motivation (B2, 2021). Additionally, SMEs which have sustainability at the core of their operations were said to continue sustainable practices despite the resource limitations they may face, as has occurred during the ongoing Covid-19 pandemic (A3, 2020). SMEs are seen as being faster to **notice and adapt** to new trends than their larger counterparts (L1, 2021; T1, 2021), and were said to typically be quicker than larger companies in **making decisions** (B1, 2021). SMEs **entrepreneurial drive** allows them to capture value through new product and service innovation, with start-ups playing a key role in the region (L2, 2021).

At the city-level, SMEs present opportunities for "market-making for climate-neutrality, which needs a suitable business model or deployment model [for new solutions]. Small businesses are better at tailoring themselves in that kind of space" (T2, 2021). Respondents' views of SMEs' strategic importance for innovation mirror the Region Skåne Development Strategy (Region Skåne, 2021), and Innovation Strategy for Sustainable Development (FIRS, 2020), with specific importance placed on CleanTech solutions for domestic application and export (L3, 2021). Furthermore, the existing innovation ecosystem provides a strong support system for start-up innovation, particularly in areas of: tech; life science and health; food; advanced materials and manufacturing; and smart, sustainable cities (FIRS, 2020). Taken together, SMEs were perceived as having potential to offer innovative solutions for systems change, as well as business-to-business solutions (L2, 2021; T2, 2021).

For example, while climate-neutrality calls for systems-innovation for water, energy, mobility, etc. respondent T1 (2021) speculates that the transition to climate-neutrality will involve both centralized and decentralized systems. Respondent L2 elaborates:

> *There are a lot of interesting innovations that are more 'software-oriented', and knowledge based that are aimed at customers, citizens and business-to-business solutions that are much more integrated into daily life. In the energy sector over the last 5-10 years in Malmö and Lund, you redesign your energy system starting from your own needs and then connect to the grid. This is also starting to happen with water. Look at Covid-19… most people are wanting to work 2-3 days per week from home… which puts pressure on the public transportation system that is built on predictability. Any option to disconnect*

from the infrastructure, you have an interesting field for SMEs who can provide the opportunity for flexibility and drive the change.

Using the tramway recently established in Lund as an example, while heavy, upfront investment was needed for central connectivity to newly established Brunshög district, SMEs provide solutions for the surrounding decentralized mobility networks (e.g. self-driving, shared vehicles, etc.) (T1, 2021). Similar trends were noted regarding localized wind and solar farms (e.g. rooftop solar) (G4, 2021; T1, 2021) and potentially energy communities (L1, 2021). To unlock the innovative potential of SMEs "the role of local governments, large NGOs and large companies that are more stable is not to innovate, but to work with the innovators to find a space for their ideas, and supporting the good ones" (N1, 2021).

In addition to their potential as innovators, respondents noted that in comparison with large businesses, SMEs are very **embedded within communities** (A1, 2021; A3, 2020). Citizen engagement with the mission has been a challenge to date for the municipalities (T1, 2021), and as "businesses have to become experts in the wants and needs of their community… they are experts at community engagement" (A1, 2021); it was speculated that this knowledge could be leveraged throughout the mission for improved community relations, such as through hosting meetings (A1, 2021). At one level, as respondent L3 (2021) explains "SMEs will become a centerpiece in more local contexts because [citizen] engagement with them is very hands-on". Whether it is through seeking out a local farmer (L3, 2021) or using a mobile app geared toward citizen engagement that have been developed by SMEs (T1, 2021), SMEs provide **citizens an outlet for engagement** with the mission via their purchasing power as consumers. At a second level, in combination with other factors (e.g. architecture, green space, etc.) it is the "collective of small businesses that give a feeling for a neighborhood" (A1, 2021). When combined with strategic place-making (e.g., functioning as a community hub, knowing neighbors, etc.) SMEs can **collectively act to shape the broader landscape of a community** (A3, 2020).

Constraints facing SMEs contribution to urban sustainability transition

While their environmental impact is speculated as being small (B3, 2021) to reach the target of 80% reduction in emissions, all SMEs will inevitably need to make changes (B3, 2021). One constraint is that society and **SME operations are established upon a logic of incremental change**, whereas the mission fundamentally calls for transformative change in business and society (B3, 2021). Furthermore, sustainability-goals may be overshadowed by SMEs primary focus on survival in challenging markets (A1, 2021). By extension, the identified barriers facing SMEs for reaching transformative potential focused primarily on their **lack of resources** of time, money, personnel and expertise (G1, 2021; G4, 2021; L3, 2021; L4, 2020; N2, 2021; N3, 2021; T1, 2021; T3, 2021; T4, 2021). **Skills and capacity limitations** were also a notable barrier (B2, 2021), creating challenges for uptake of innovation (B1, 2021) and adherence to regulations and monitoring programs (G1, 2021; G5, 2021). SMEs also **depend on external relations**, with the government and intermediary organizations specifically mentioned (A3, 2020). Given these constraints, respondents noted a need for coordinated outreach to SMEs (G1, 2021; G3, 2021; G4, 2021; T1, 2021).

Taken together, as the mission unfolds over the coming decade, natural emergence and self-organization among actors was speculated as a possible eventuality (L1, 2021). Others note the importance of government leadership in directing the mission (T1, 2021). Whether through market- or state-driven pressure, SMEs will inevitably play a role in the climate-neutral mission. As respondent (B3, 2021) notes:

> *For businesses to survive in the coming decade, they are going to need to make sure that their business is compatible with a carbon constrained world. There is a great opportunity for SMEs to be at the front end of this change. Those that can offer sustainable, low-carbon solutions and products are going to find themselves at a more attractive position. The risk is that if they do not, then they may go out of business.*

To summarize, SMEs were said to have several characteristics which afford them a unique advantage for generating innovative solutions, including: **flexibility** for testing new solutions; led by owners who may be **intrinsically motivated** to challenge the status quo; **faster** to notice and adapt to trends; **quick at making decisions**; maintain **drive for capturing value** in the market; deeply **embedded in communities**; and are able to **collectively shape the community** landscape. This translates into SMEs having potential for generating new solutions relevant to the climate-neutral mission for other firms, the government, citizens, and communities. Conversely, SMEs are also constrained by a **lack of resources** (time, money, personnel, expertise); lack **skills and capacity** for innovation uptake; and are **reliant on external support**.

The following sections identify the extent to which different mission-oriented activities have occurred, as well as the drivers and barriers facing government and intermediaries for engagement with SMEs. Some of the activities are drivers themselves and are bolded in the analysis for clarity.

5.2 Strategic direction setting

The need for climate-neutrality was universally acknowledged among respondents, as was the need for radical solutions if this vision is to be realized. A broader landscape of support for action can be observed in cultural shifts (e.g. more value placed on nature) (L3, 2021), knowledge of climate impacts (B4, 2020), and multi-level political will for action (particularly in Sweden) (G1, 2021; G4, 2021). Some evidence also indicates that sustainability measures are becoming an expectation among newly developed businesses (B4, 2020). Respondent B3 (2021) reflected that Covid-19 showed the magnitude of the problem of emissions given that only a 7% reduction in GHG was recorded globally despite widespread lockdowns; however, Covid-19 also helped governments realize their (spending) power for addressing collective threats (N2, 2021). Still, as climate change is complex, solutions equate to "experimentation on our planet… and there are a lot of unintended consequences that we do not know yet" (N1, 2021). Taken together, there is an impetus for action, but solutions must involve a co-creation process which includes SMEs (N1, 2021; T2, 2021).

5.2.1 Transition arena

Barrier

The "Climate-neutral Cities by 2030" program's vision was initially developed centrally by Viable Cities (T1, 2021). As noted during the organization's Strategy Day, multiple-perspectives should influence vision-development, especially those which understand "the dignity of everyday survival over grand projects" (Viable Cities, 2019b); however, Viable Cities Director Olga Kordas noted that institution "need to learn how to work with small entities and citizens" (Viable Cities, 2019a). As such, their **capacity for outreach** is a barrier for SME engagement. The resulting vision was developed with limited external contact.

5.2.2 Climate Contract

Driver

In coordination with several national-level agencies, Viable Cities and the cities of Lund and Malmö (along with 7 other Swedish cities) signed Climate Contracts in December 2020 to demonstrate a unified commitment to becoming climate-neutral by 2030 (Lunds Kommun, 2020; Malmö Stad, 2020; Viable Cities, 2021a). The process brought together actors from the public and private sectors and civil society, and was signed by the mayors of each city to establish top-level commitment that, when working with other public managers, extends this political mandate and connects them with the contract (T1, 2021). The contract is considered a process and will be updated annually (T1, 2021). Emphasis is placed on commitment and "getting started as aggressively as possible… working with the data year to year to learn" (T1, 2021). One driver of engagement in Lund was **early SME commitment through developing sub-contracts** signed by 20 member companies (including several SMEs) of Lund Climate Alliance (G1, 2021). In practice, companies also lack a clear action plan, but they have committed to the process nonetheless (B2, 2021). This extends to an overall lack of implementation strategy of the envisaged projects' outcomes, how they fit together, or the purpose of collaborations (G3, 2021). Instead, the contracts denote commitment to both a goal, and an uncertain, evolving process.

Barriers

More recently the vision of climate-neutrality has been incorporated into the newly updated environmental programs of both Lund and Malmö (LundaEkoIII and Miljöprogram för Malmö Stad 2021-2030, respectively) (G1, 2021; G4, 2021). In Lund, the municipal government's strategic plan for addressing climate spans over 20 years, and has maintained sufficient political will to see a 2% annual decline in emissions per year (compared with 1990 emissions levels) over that time-frame (G1, 2021); however, to reach climate-neutrality by 2030, this will need to increase to 8% per year (G3, 2021). Similarly, Malmö has also benefitted from having a long history of investment and a relatively large environment team (B3, 2021); the city has seen similar CO_2 reductions. Visions and strategies at the city-level were developed "without much [external] interaction at all" (G2, 2021) and, internally, required significant political coordination (G4, 2021). Additionally, these strategies do not explicitly mention SMEs (Lunds Kommun, 2017; Malmö Stad, 2021a).

In addition to the lack of observed engagement in vision development, another barrier is a **lack of internal, government coordination** regarding the vision of climate-neutrality (G2, 2021; G4, 2021; G5, 2021). Commitment from top city leadership was seen as necessary for motivating action (T1, 2021), however in Malmö the sustainability agenda is a department-based initiative, rather than centered around cross-departmental task force (G5, 2021); as a result, while departments are aware of the city's environmental goals, these compete with other departmental priorities (G4, 2021). In Lund, similar inter-departmental silos and subsequent problems exist (L3, 2021). By extension, this internal lack of coordination extends to and reflects a broader barrier: **a lack of a unified sustainability agenda** among external actors, including SMEs (G2, 2021). As a result, sustainability actions of companies and funding agencies may be toward similar goals, but not necessarily together (T1, 2021).

To reach climate-neutrality, investments will be needed not only from municipalities, but also from the private sector (i.e. real estate owners, those owning mobility solutions, etc.) (T1, 2021). However, municipalities "have not been appealed in involving SMEs in their work. They are good at working with big companies that might be strategically important" (e.g. for employment) (T1, 2021). For example, as respondent G4 (2021) from Malmö notes, the city has

maintained good relations with E.ON (Malmö's primary energy provider) which has resulted in the company investing in infrastructure (i.e. deep geo-thermal energy) to align with the city's climate goals, but, generally there is a lack of coordinated SME outreach during project (and vision) development and implementation. Taken together, **SMEs may be politically overshadowed by larger businesses** (G4, 2021), and the collaboration with large business may "become a paradise for the incumbents" (G3, 2021).

Finally, a more nuanced constraint was noted by respondent A1 (2021):

> *From a small business perspective, the term "sustainability" is not something that is malleable. It creates more of a burden on small businesses… and has already been co-opted by large corporations. Credibility is extremely important because they really stand for the business they operate. They do not get behind something that they cannot back up, and sustainability may be one of those terms. The climate-neutrality mission the cities are putting out does not actually speak the language of small business.*

Thus, one barrier to political engagement is that the **rhetoric of "sustainability" may be challenging for SMEs to adopt**. In practice, this same respondent noted that SME activity may actually be "sustainable" (e.g. resource and waste efficiency, community engagement, etc.), but the firm may remain less politically vocal regarding support of missions to avoid added pressure to the brand's credibility (A1, 2021). Additionally, while respondents noted that SMEs may be politically vocal regarding some contested issues (e.g. urban planning) (G4, 2021; L3, 2021), they may **lack the knowledge of how to engage** in policy-making (A1, 2021). Conversely, while SMEs often politically engage in more subtle ways (e.g. hosting events, online forums, etc.) which supports the mission indirectly (and particularly at the community-level), public officials are less equipped to engage in these ways (A3, 2020).

5.3 Tactical organization

The following section addresses the mission activities of systems analysis and network integration. The extent of SME engagement in these processes is explained, as well as relevant intermediary actors who facilitate network integration and engagement of SMEs, including: transition intermediaries, regime-based transition intermediaries, cluster organizations, business networks, and third sector actors (e.g., NGOs). Drivers and barriers are identified throughout.

5.3.1 Systems analysis

As a first step in the climate-neutral cities programs of Lund and Malmö, systems analysis began in 2019 and has been ongoing for both cities (G1, 2021; T2, 2021). The aim of the analysis is to highlight gaps in the system, and from this basis focus efforts to address those gaps through startups, existing businesses or other collaborations (T2, 2021). To clarify, respondent L1 (2021) explained that analysis includes "key flows" in the city, including: people, goods, services, money, energy and information. To date, there has not been a coordinated effort of identifying existing SMEs to address identified system gaps (T2, 2021).

The primary *barrier* is that the process is a very high-level exercise, and capturing SMEs in analysis was **logistically challenging** (given their number and heterogeneity) (G1, 2021; T2, 2021). The implications of missing SMEs in the analysis is that key interdependencies and actors may be overlooked (L1, 2021). Thus, the process is primarily useful for upfront mission commitment based around the investment needs outlined in the analysis, rather than providing details of existing solutions (T2, 2021).

5.3.2 Network integration through intermediaries

Typology of intermediaries and direct drivers

System Intermediaries: are established by the national or EU government as an arms-length organization working to smooth communication and coordination to advance the climate-neutral cities mission (B3, 2021). This "fills the gap between the public-, private- and [third] sectors" around mission efforts (T2, 2021), resulting in multi-actor, multi-sector project consortia, both large and small (T1, 2021).

Through a program called "Healthy Clean Cities", the **European Institute of Innovation and Technology's Climate Knowledge and Innovation Community** (EIT Climate KIC) has engaged Malmö as one of ten cities across Europe to help accelerate the transition to a "climate-resilient, zero-carbon city of the future" (EIT Climate-KIC, 2021b). The program is the product of conversations at the European-level regarding Mazzucato's (2018a) ROAR framework for mission-oriented innovation policy which led to the development of a logic model "Deep Demonstrations" which follows a similar, non-linear process for transformation of the city-system. This model is outlined in Figure 5-2. The process begins with garnering high-level commitment from city mayors and other key actors, which is followed by a systems analysis (see above). Investments are then made in a **portfolio of projects** (i.e., testbeds and experimentation, start-up acceleration). SMEs can respond to **open calls** for participation these projects; if selected, they receive **hands-on guidance and resources** (e.g. facilities, start-up capital, etc.) (EIT Climate-KIC, 2021b). These projects are implemented in Malmö and are situated in a broader network of initiatives coordinated by Climate-KIC and the city government. The "Healthy Clean Cities Program" is still in its early stages in Malmö (T2, 2021). Complementing this program, EIT Climate-KIC also hosts an open, international, **24-hour hackathon** for climate innovation called Climathon; in 2018, 5000 international participants engaged, including many SMEs located in Malmö (EIT Climate-KIC, 2018).

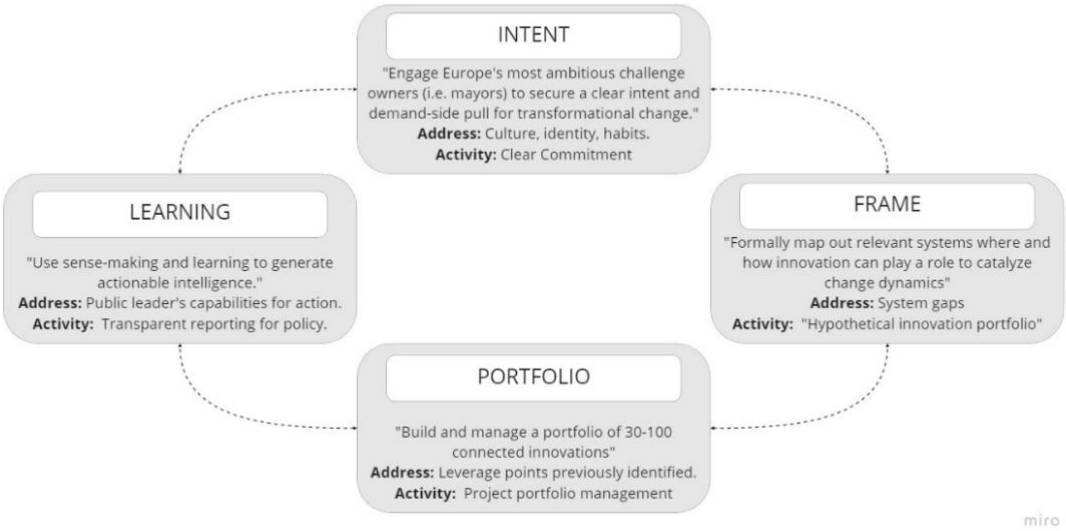
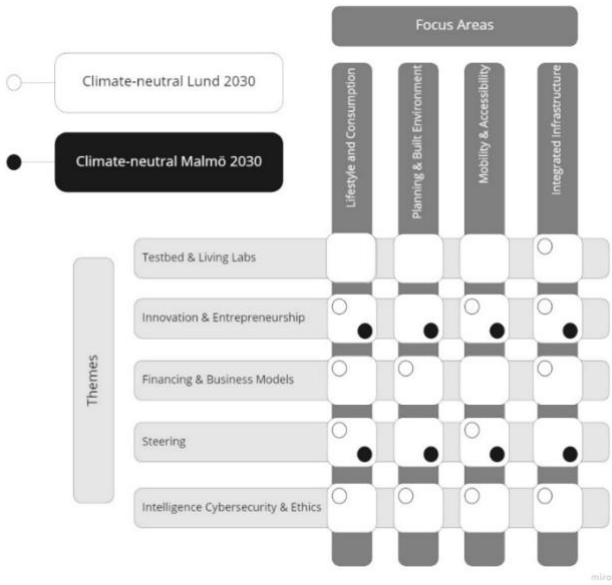


Figure 5-2. EIT Climate-KIC Deep Demonstration Model

Source: Author's own illustration based on EIT Climate-KIC (2021a)

At the national level, the innovation program **Viable Cities** works on behalf of the Swedish Energy Agency, VINNOVA and FORMAS and acts as a system intermediary for several cities;

both Lund and Malmö engage with this program. Viable Cities' model as applied to the climate-neutral programs for Lund and Malmö can be found in Figure 5-3. The program was designed to align directly with the EU's forthcoming "100 Climate-neutral Cities" mission; Viable Cities' chairman Allan Larsson also serves as chairman of the EU's Mission Board on Climate-neutral Cities 2030 (Larsson, 2021; T1, 2021). As such, the program serves as a test-case which prepares interested cities for the more complicated, international call for mission engagement. Viable Cities takes an exploratory approach, noting that they "do not have the answers, and probably [the SMEs] do not either, but by working together and meeting regularly to discuss issues we can take the right steps " toward climate-neutrality. (T1, 2021).



** Climate-neutral projects for Lund and Malmö are included to show the related Focus Areas and Themes.*

Figure 5-3. Viable Cities model

Source: Adapted from Viable Cities (2020a, 2020b)

In addition to its direct engagement with city government to create Climate Contracts, the program also maintains a **portfolio of over 40 innovation projects** for climate-neutrality, many of which directly engage with SMEs through project consortium (Viable Cities, 2018). SMEs may join as members of Viable Cities **free of charge** where they get a palate of different activities to get their hands on and also the possibility of applying for funding (T1, 2021). Viable Cities also established a **Transition Lab** which convenes monthly to provide a venue for open discussion around a thematic topic relevant the mission. This serve as an arena for SMEs (and other actors) to pitch their ideas to the municipalities as well as voice any issues they have with the city government (T1, 2021).

Government-embedded transition intermediaries: serve a similar purpose to system intermediaries but are not established for the specific and sole purpose of driving the climate-neutral mission. Themes and focus may be more broadly defined, or work in parallel to the mission (L2, 2021). One such institution is **Future by Lund**—an innovation platform funded by VINNOVA which has a mandate from the City of Lund to bridge the public sector with external actors through multi-stakeholder projects to drive transformational city development(L3, 2021). The platform has run for almost 7 years and has involved over 100

organizations (L4, 2020). Future by Lund is based in IDEON Science Park which hosts over 400 different companies (IDEON Science Park, 2021; T1, 2021), despite being a joint-program of the environmental and business departments of the City of Lund (L2, 2021). Future by Lund takes a blended form of innovation management. In addition to a MIP approach, the program also addresses: "anticipatory innovation" which is research-driven and seeks innovation for expected challenges that are not yet fully understood; "adaptive innovation" which says that "there are new needs and new behavior which call for new, grassroots-developed solutions"; and "enhancement innovation" which addresses day to day operational innovation (L2, 2021). These components are outlined in Figure 5-4 below.

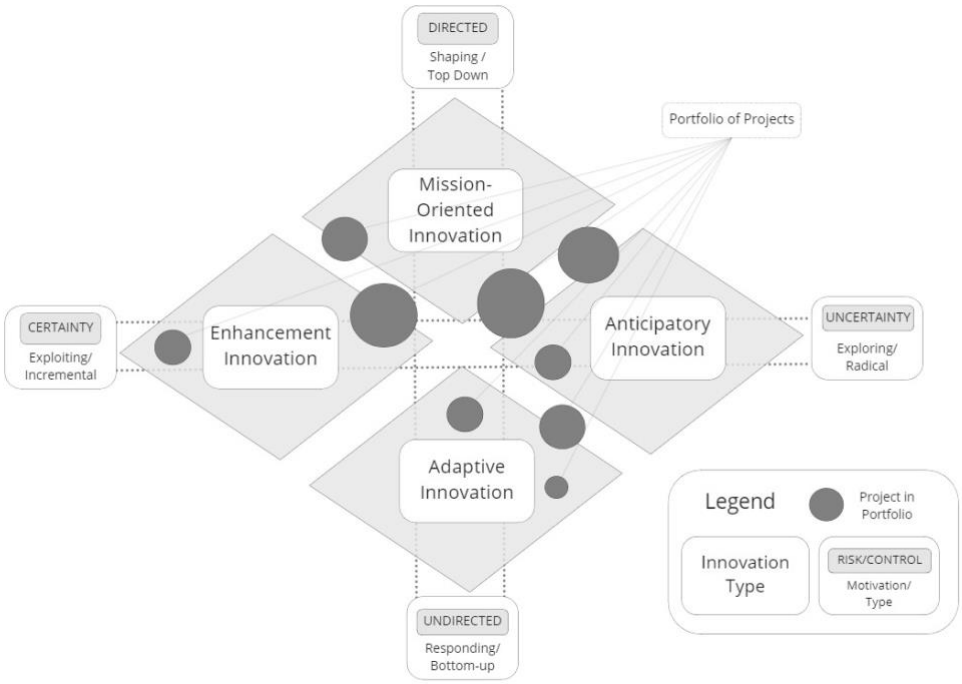


Figure 5-4. Future by Lund innovation portfolio model

Source: Author's own illustration based on Wise (2021)

Future by Lund asks the fundamental question of whether SMEs are equipped and organized to actually solve the mission; as such, "the interesting thing is not that there is a climate-neutral mission, but how all component approaches to innovation interconnect… collaborate, or fail to collaborate… drive ambition or hold it back" (L2, 2021). Future by Lund brings together **"partner constellations"** of 10-15 players, including SMEs, around a specific theme, like climate change, which fall between different organizations. Through its "by-proxy" approach, solutions are not prescribed but co-created to solve a selected issue in an "open playing field" (L3, 2021); staff provide **tools for capacity development in "transformation thinking"** to facilitate co-creation and collaboration. Additionally, open-innovation **testbeds** are established through which SMEs can develop products for commercialization. Future by Lund also works to **showcase solutions** to key "challenge owners" (i.e. the municipal government, real-estate developers, large companies) (L2, 2021; L3, 2021). The overall project portfolio contains projects of varying size which fall on a spectrum with regard to the certainty of outcomes and the level of direction given to the solution's development (Figure 5-4) (Wise, 2021). In addition to its project portfolio, **a broad resource network** called Lundasupport was established to serve as a one-stop-shop for SME-specific support (L4, 2020).

Cluster Organizations in Sweden maintain a special legal status as a neutral collaboration platform comprised of members from the "triple helix" (i.e., government, academia/knowledge-based institutions, and businesses). Operating in both Lund and Malmö, the **Sustainable Business Hub** is a cluster organization that brings together over 60 members under the theme of "Smart and Sustainable Cities". The organization's projects are linked to 8 of the 17 global Sustainable Development Goals (17 sub-goals identified) (B1, 2021). Most members are larger organizations, but often work directly with SMEs; specifically, SME engagement is monitored as a **key performance indicator** for the cluster (B1, 2021). SMEs can join one of the hub's 12 projects, each of which is managed by inter-sectoral consortia focused on either: establishing **test-beds** for innovative solutions; establishing **export markets** among members; **demonstration** of solutions; **start-up accelerators**; innovation-based **research**; and **match-making** programs (Sustainable Business Hub, 2021). The cluster provides a variety of resources to SMEs. For example, **human-resource assistance** (i.e., identifying consultants or providing capacity-building tools) is provided for SMEs that lack internal capacity for process improvements or innovation. On an ad-hoc basis, staff also link SMEs with **members who can provide targeted resources** (B1, 2021); for example, RI.SE, (Sweden's Research Institute and innovation partner) is a member that provides dedicated coaching to SMEs for **product development**, **production processes**, **commercialization**, **demonstration**, etc. (RI.SE, 2021). Legal assistance is also provided to SMEs (B1, 2021). In addition to project engagement and capacity building, SMEs are linked with "challenge owners" (i.e. the government or large companies) through smaller meetings of 2-3 people to demonstrate products and services; SMEs are also invited to cross-sector, regional round-table forums to discuss systemic issues such as the future of renewable energy in the Region Skåne (B1, 2021).

Business networks may arise around a specific industry (e.g., manufacturing) or for a specific purpose (e.g., climate-neutrality). While serving a variety of purposes, focus is not solely on innovation or project implementation, but, rather, on knowledge sharing and network building, both of which assist with SME capacity development (B2, 2021). For example, the Lund Climate Alliance is a network of 20 businesses from in and around Lund; businesses are from a variety of sectors and the alliance is comprised of both larger businesses and SMEs (B2, 2021). Additionally the network maintains neutrality as it is member-funded (B2, 2021). The network is also closely linked with Lund University as well as the City of Lund (KlimatAllians Lund, 2021). Through quarterly meetings which are frequently hosted at member companies, members engage in informal capacity building sessions about climate-change and the role of business. Often guest speakers are invited to share **technical knowledge to members** (B2, 2021)**.** One key role of the network is to **facilitate members' efforts of monitoring emissions**, which is reported annually (B2, 2021). To assist SMEs, a **tool for monitoring** was developed to track emissions; still, as this proved challenging to SMEs, so a story-telling approach was adopted through which members were able to reflect on their successes and struggles relative to one another. Meetings maintain a level of informality and are kept short to allow for resource-restricted businesses to join. On an ad-hoc basis, the network's facilitator links businesses to an **informal resource network** as needed (B2, 2021).

Third-sector actors include NGOs, formal and informal community groups, academia, etc. These institutions may help with some network integration, but more often provide direct support to SMEs to meet specific needs. Some NGOs assist SMEs with **development of innovative business plans** and address capacity needs (e.g. Lunds NyföretagarCentrum) (B5, 2020). Other NGOs work indirectly with SMEs by **advocating** for their inclusion in municipal outreach efforts for climate-neutrality (e.g. Klimat Kommunerna) (N3, 2021) or through **monitoring programs** that include SME input for city-wide progress indicators that can then be showcased internationally (e.g. World Wildlife Fund, Sweden) (N1, 2021; N2, 2021). NGOs also provide space for SME innovation development through **start-up accelerators and**

innovation spaces (e.g. IDEON Science Park, Medicon Village, Medeon, Cleantech Scandinavia, SmiLe Incubator, etc.) (G1, 2021; G4, 2021). Universities in the region engage SMEs through **action research projects** (G1, 2021; G2, 2021). These are just a sampling of a much broader network existing in the case study.

Taken together, the services provided by intermediaries can be broadly categorized as:

- Engagement opportunities for the climate-neutral mission
- Technical support and capacity building
- Advocacy
- Business promotion
- Collaboration and experimentation spaces

Through these services, SMEs are enabled and empowered to engage in the climate-neutral mission.

Underlying drivers

In addition to these services, there are several underlying drivers which were reported as important elements for engaging SMEs. One underlying driver provided through intermediaries is that they provide **trusted spaces.** Intermediaries help establish spaces where SMEs can meet like-minded people (A1, 2021), which helps to establish trust (T2, 2021) and drive **inter-personal** connection (A1, 2021; B1, 2021; B2, 2021; L1, 2021; L2, 2021; L3, 2021; L4, 2020; T1, 2021; T3, 2021). Furthermore, for SMEs in particular, there may be hesitancy in working with groups such as academia or the government; intermediaries provide an approachable platform for all parties (A1, 2021). Inter-personal connection inspires collaboration, which in-turn leads to co-creation of solutions for system change (L3, 2021).

Intermediaries may proactively seek out information about SMEs and develop deeper knowledge of the SMEs operations and needs; this can occur through **opening channels of communication**, as occurred with Future by Lund who embedded their offices among SMEs and were able to make connection "over a cup of coffee" (L2, 2021). For SMEs with limited time, this **efficiency of engagement** is of critical importance (A1, 2021). Furthermore, for SMEs that may struggle with decarbonization, **patient, targeted, hands-on guidance** also serves as a driver, which was seen in the case of Lund Climate Alliance (B2, 2021). By focusing on specific measures and then following through with them for a long time-period, SMEs are able to make meaningful changes at a pace that is not overburdensome (A1, 2021).

Another underlying driver is the power of **neutrality** maintained by some intermediaries. SMEs face a power differential when dealing with larger actors (e.g. the government, big-business) that is often difficult to overcome, but a neutral platform provides space for negotiation (B1, 2021). As respondent B1 (2021) explains, "when [SMEs] meet one-to-one in a sales pitch, [they] may be locked into that format. The [cluster organization] provides a platform for more open discussions". Cluster organizations may help with advocacy as well, both in terms of commercialization and exportation of products, but also for helping negotiate some legal barriers (B1, 2021). This also may occur through advocacy between SMEs and the city around issues such as public-procurement protocol (B1, 2021). Furthermore, neutrality allows for all sectors to be held accountable which will become increasingly relevant as the mission advances (B3, 2021).

Indirect Drivers

In addition to the direct and underlying drivers, intermediaries serve an important function of establishing new inter- and intra-network connections between the state, market, community and "third sector". These serve as drivers for SME engagement with the mission. Using the multi-actor perspective, Figure 5-5 identifies where intermediaries are positioned within the "intermediary space" (dashed lines denote formal connections made with different sectors through membership). For example, Viable Cities/Climate-KIC (1) are closely aligned with the state, and by extension, with the mission itself, but maintain a relative distance from other sectors (T1, 2021). Future by Lund (2) is also embedded within the state, but is able to closely align with markets given that their offices are located within the IDEON science park; this facilitates more targeted match-making (L2, 2021; L3, 2021). Sustainable Business Hub is centrally located as it maintains neutrality, although its membership base is primarily comprised of businesses (B2, 2021). Lund Climate Alliance only has business members, which affords it the ability to provided services specific to business needs; it also maintains a level of informality (e.g. hosting meetings at members' offices), which facilitates the creation of informal peer-networks (B2, 2021).

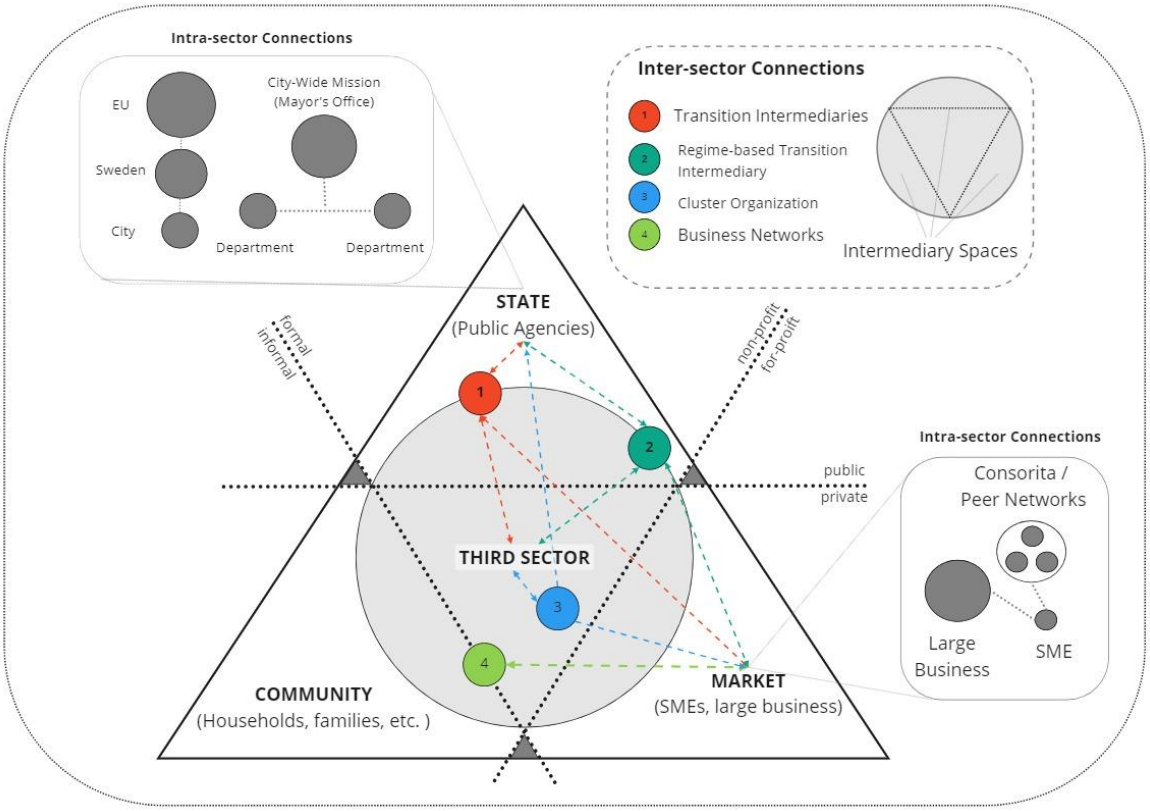


Figure 5-5 Inter- and intra-sector connections created by intermediaries

Source: Author's own illustration based on Avelino & Wittmayer (2016b) and responses from (B1, 2021; B2, 2021; L2, 2021; L3, 2021; T1, 2021; T2, 2021)

Inter-sector connections serve as drivers for SME engagement in the mission. Respondents identified the connections forged between the "state" and "market" sectors as particularly important (L2, 2021; L3, 2021). Systemic intermediaries coordinate swaths of otherwise disparate actors around the government-led mission-oriented activities; this may eventually result in a unified agenda for climate-neutrality among sectors, but in the meantime has proven important for articulating the vision and expectations of the Climate Contract (T2, 2021). Given the breadth of their activities and the scale of their networks, systemic intermediaries are also

able to pull SMEs in at the right time in the mission's progress in order to see the most effect of their engagement (T3, 2021). For SMEs, platforms such as Viable Cities' Transition Labs also help to overcome the challenge of getting a first critical meeting with the municipalities (T1, 2021), and also helps them to learn what the municipality wants as an end customer (T2, 2021). By vocalizing their own solutions, they may also reach new markets in other municipalities as well. Furthermore, all intermediaries provide important linkages to a broad network of "third sector" organizations which often provide very targeted assistance (B2, 2021); organizations like Sustainable Business Hub and Future by Lund maintain a broad member base and thus serve as gatekeepers for services which can be provided in a coordinated fashion, proactively or upon request (L4, 2020).

Furthermore, network integration results in **intra-sector connections** at several levels. First, multi-level governance is supported through systemic intermediaries who link the mission from the EU to national to city-levels for coordination of projects, resources (e.g. financial, best-practices, etc.) (T2, 2021); this helps build capacity for Lund and Malmö for the forthcoming EU mission by establishing governance frameworks that can be further utilized. Second, by sitting between the environment and business departments, Future by Lund has been able to negotiate between otherwise competing agendas, which assists with governance efforts but also idea generation (L3, 2021); furthermore, this helps to conceptualize SMEs as being more than simply drivers of business growth, but as multi-faceted vehicles for socio-environmental change (L2, 2021).

Second, connections are made between large businesses and SMEs, which is important for first identifying the potential of innovation, and then scaling it (N1, 2021). Large institutions are burdened by the inertia of bureaucracy, making them both slow and risk averse when compared with SMEs (N1, 2021; T1, 2021; T2, 2021). SMEs are able to engage with experiments through intermediaries, or develop solutions independently, and the high-profile and relationships maintained by the intermediary provides an important linkage to new clients which SMEs may otherwise lack (L1, 2021). SMEs may either then provide solutions a large firm's internal research and design teams missed entirely (T1, 2021) or provide a niche service or product important within the larger firm's supply chain (B1, 2021). For example, a bio-based construction material developed by an SME based in Malmö was taken up by construction firms in the region; however, there are still some barriers facing such interactions, such as regulations which hold these large companies liable for this new product for 12 years (B3, 2021). Similar examples exist with solar companies which partner with SMEs to become more holistic energy services or building retrofit businesses who implement SME-developed behavioral programs (L2, 2021). Other SMEs may be bought outright by a large firm (L2, 2021).

Intermediaries also connect SMEs with other SMEs. First, this is helpful for sharing knowledge; as was the case in Lund Climate Alliance, SMEs are able to seek assistance from their peers who have taken on the challenge of de-carbonization to learn about their struggles (B2, 2021). This peer exchange may serve to fill existing resource and support gaps (A1, 2021), or may be a more approachable means of seeking process improvements than formalized alternatives given that SMEs rely heavily on inter-personal capital (A1, 2021). Furthermore, an element of peer-pressure may also result through integration in networks, particularly as the mission advances and many SMEs are faced with a "fear of missing out of business opportunities presented by decarbonization" (B3, 2021). SMEs have also joined together through clusters around a certain theme in order to advance a collective aim (L2, 2021); this has been the case in the Region Skåne with regard to clean-tech SMEs (FIRS, 2020), resulting in increased, international competitiveness of the industry. Open innovation promotes a team-like mentality for collective gains which, when aligned with the mission, provides a powerful tool for advancing solutions at scale (L2, 2021). By extension, SMEs may partner with larger networks to drive the mission

at the industry level. This has been the case in Malmö where one CEO who was inspired by the national Fossil-Free Sweden road-mapping project for climate-neutrality garnered the support of over 200 companies and 150 other actors through an effort called LFM30 (LFM30, 2021a). The local roadmap this group developed for the construction and civil engineering sector has not been supported by the city government (G4, 2021) and is being adapted for broader, regional application (B1, 2021). An overview of this program can be found in Appendix IX.

Barriers

One barrier identified was that there were **too many different programs and initiatives** for SMEs to engage with (B1, 2021). As many initiatives are short-lived, there is a hesitation among SMEs to invest their time (B1, 2021). This was made acutely evident during the Covid-19 pandemic when a flood of SME support entered the region; many SMEs "simply chose not to engage because they did not know where to turn and what was worthwhile" (B4, 2020). Similarly, even when SMEs know where to turn, the **costs of engagement (i.e. their time, membership dues) may not outweigh the perceived value gained** from the interaction (A1, 2021; B1, 2021). Engagement with intermediaries, and particularly with innovation projects in their portfolios, is a heavy, hands-on investment (B1, 2021; L2, 2021; N1, 2021; N3, 2021; T1, 2021). Whereas micro- and small-sized enterprises were said to be very active, medium-sized enterprises were more difficult to engage. This is attributed to a lack of time and personnel, as small- and micro- enterprises are relatively more flexible and often owner-led, and larger businesses can send ambassadors (B1, 2021). This is not to say that medium-sized businesses are not interested (B1, 2021; T1, 2021).

After an SME has taken the first step of engaging with an intermediary, additional barriers may also exist. First, while well intentioned, **resources may not be developed with SMEs' needs in mind** (B3, 2021); as such, misalignment may lead to inactivity. Furthermore, given the number of SMEs and actors that exist within any given system, staff of intermediary organizations may face a **coordination challenge**, or fail to understand the underlying power dynamics between the actors they aim to connect (L3, 2021); as a result SMEs may disengage before the intermediary knows how they might be best utilized. Also, several respondents noted that SMEs work at a **different time-scale** than the other actors that intermediaries connect them with (B1, 2021; B3, 2021; G1, 2021; N1, 2021; N2, 2021; T2, 2021). While cities and academics may be comfortable with things taking months or years, SMEs work on a quarterly basis (B3, 2021), or "want something done by tomorrow" (L3, 2021). Engagement in government projects around the mission, for example, may require a level of documentation and formality which is misaligned with SMEs' drive for action (L2, 2021). This may result in frustration between parties.

5.4 Operations

The following section provides details of two mission activities: market-tilting policy mixes as well as bottom-up solution seeking through experimentation. The extent to which these practices have occurred in Lund and Malmö (specifically for engaging SMEs in the mission) are outlined, as well as the existing drivers and barriers for SME engagement.

5.4.1 Market-tilting Policy Mixes

Policy practices undertaken by the government broadly include regulative, economic, and enabling policies. As one of the first steps in adopting Climate Contracts, coordination between cities and the national government is occurring to review existing legislation and highlight any

gaps which may impede the mission (G3, 2021). This process is currently being conducted (T1, 2021).

Drivers

Two regulatory policies were identified by respondents. First, there is now a mandate that buildings with energy consumption over a certain limit must create an **energy reduction plan** or install their own metering system (G1, 2021). For businesses not creating such plans, expensive, independent metering has to be installed, which incentivizes early investment in energy efficiency improvements (G1, 2021). Second, forthcoming EU legislation aims to **mandate financial disclosures of banks' climate risk**; while indirect, this may lead banks to provide more favorable loans to firms with lower carbon footprints so their own investment portfolio is less risky (B3, 2021). While speculative, these measures may incentivize startups to address climate-neutrality within business plan proposals (B3, 2021).

There are several economic policies supporting SMEs' efforts to become climate-neutral. For example, development banks such as Almi have established **dedicated loans for SMEs that are working toward improving their sustainability**, although these loans primarily focus on economic aspects of sustainability (i.e. long-term financial promise) (B5, 2020). The city can work to align its efforts to **complement (rather than duplicate) support from the national and EU level,** or work to make sure finances are absorbed (G2, 2021). For example, the EU structural program for "Investment for Growth and Jobs" has a directive within the Region Skåne that 40% of funds will be for smart growth of SMEs (i.e. start-up support), 16% for innovation funding, 17% for sustainable urban and community development, and 14% for the growth of low-carbon economy (Tillväxtverket, 2021). Similarly, an influx of SME-related support funds for Covid-19 recovery may be leveraged for a **"green recovery"** which aligns with the mission (Government Offices of Sweden, 2020).

One enabling policy which can be partially controlled by the city is their **public procurement practices** (G1, 2021). For example, in both Lund and Malmö there are public-procurement measures that follow Fair-trade standards (G4, 2021). Respondent G1 (2021) explained that City of Lund can work to be more inclusive of SMEs be creating less complicated contracts and integrating some standards that reflect the overall targets of the climate-neutral mission. Another enabling policy identified was the **land-allocation practices** of the city (B3, 2021; G1, 2021; L2, 2021; N1, 2021). In the City of Lund, the new district of Brunshög presents an opportunity to influence climate-neutral elements within the development of 2,250,000 square meters of previously underdeveloped land (Lunds Kommun, 2021). Land is allocated through competitions may have selection criteria crafted to favor strategic government initiatives such as climate-neutrality. This incentivizes large businesses to align with innovative SMEs to improve their chances of being selected (B3, 2021; G1, 2021). A matchmaking event was held which invited 20 SMEs and start-ups to present their ideas or solutions for energy, water, technology, etc. (G1, 2021). These SMEs were matched with the 24 builders that were chosen for the project with projects spanning water management, green roofs, shared cars, electricity systems, etc. (Lunds Kommun, 2021).

Similar practices have occurred in the City of Malmö. For example, the environment department has for many years held **builders dialogues**, through which any firm that is interested in building must spend time learning from external experts with regard to issues such as soil health, climate adaptation, noise pollution, etc. (N1, 2021). In Malmö's Western Harbour, builders were asked to present their development plans to the city alongside peers as a visioning exercise for the development of the area (N1, 2021). This was followed by a competition which resulted in several larger firms developing consortia with SMEs whose innovations made their own bids

more attractive (N1, 2021). Subsequently, these dialogues also indirectly inspired some community members to develop grassroots solutions which aligned with the co-conceived problems facing the community – specifically regarding flooding. As a result, an SME was formed between citizens which implemented nature-based landscaping to address flooding (N1, 2021). Similar dialogues may inspire co-creation processes which lead to the development of community-based SMEs addressing the climate-neutral mission.

More recently, land allocation through a competition occurred for the re-development of a new district in Sege Park of Malmö – a housing and district under construction at a former mental hospital site (Malmö Stad, 2021b). Bids from potential builders had to indicate how they planned to contribute to the city reaching its goals "for sustainable and smart city development, with the sharing economy as a main theme" (G5, 2021). A heterogenous mix of 13 builders were selected, including SMEs. Indirectly, this policy led to collaborative relationships among selected builders as there was a joint incentive to collectively invest in infrastructural improvements (i.e. energy systems) as an individual builders' divergence would be too costly (G5, 2021). However, some businesses did pursue investment above the initial plans, serving as "flagships within the flagship program… going above the initial sustainability plans" (G5, 2021). Although speculative, this may inspire action of other builders. Through a complementary program of the environment department called "Malmo Innovation Arena", the **initial dialogues held with builders were supplemented with follow-ups**. Builders were able to share their struggles with regard to their sustainability and climate plans, weak spots were collectively identified, and the builders were asked what they would do with additional funding if it was provided (G5, 2021). The talks are now in their third iteration, and the builders are asked to reflect on their stated goals and the actions they have taken to achieve them; builders are pressured to follow-through with their plans as their success may impact future prospects for land allocation (G5, 2021). Thus, land allocation practices present an important window of opportunity for SMEs to be selected despite limitations in competitiveness, incentivizing inter-firm collaboration. Further, it presents the city an opportunity to direct market activities toward its strategic goals.

Another driver regarding enabling policy occurs through **public-private partnerships for service delivery** (G4, 2021). For example, the City of Malmö works with an SME who supplies electric bicycles for residents (G4, 2021). In this arrangement, the city covers human resource and legal aspects of procurement and supplies bicycles to residents pre-tax; this provides a new market for the SME while subsequently nudging citizen behavior which, when implemented, may lead to urban emissions reductions (G4, 2021). Another form of public-private partnership has been proposed in Malmö to procure, install and insure solar panels on buildings of private businesses, so long as those businesses agree to purchase this clean energy (G4, 2021).

Barriers

One barrier facing the government is their **limited agency in enacting market-tilting legislation** (G1, 2021; G2, 2021; G3, 2021). For example, respondent G5 (2021) explained that national legislation restricts the city's ability to dictate technical specification in newly constructed buildings . This legislation was passed in 2015 (in-part) as a result of push-back from municipalities who claimed that mandating technical solutions presented too high a burden for them (G5, 2021). Similarly, respondent T2 (2021) explained that the city cannot mandate rapid building retrofits pivotal for reaching climate-neutrality by 2030. Another barrier results from regulative measures for **energy efficiency** which disproportionately burdens SMEs (G1, 2021). The city government helps to address the burden facing SMEs through its Municipal Energy Advisors who have targeted outreach programs to meet the specific needs of SMEs (G1, 2021). Additionally, **subsidy programs may be misaligned** with SME needs, resulting in low policy uptake (A1, 2021). Conversely, SMEs may become over reliant on subsides; as

such, support aimed at shielding SMEs transitioning to carbon-neutrality or in start-up spaces may leave them exposed when facing the realities of the market (G3, 2021).

Regarding enabling policies, one barrier during public procurement is that SMEs may be **unable to meet demand of pubic contracts** (G1, 2021). An associated barrier is that SMEs may lack the capacity to navigate legal challenges related to public procurement (T1, 2021). As mentioned, intermediaries may quell this concern through development of consortia to meet SMEs capacity for fulfillment of contracts, as well as provide legal assistance and a neutral platform for contract development and negotiation (B1, 2021). Furthermore, SMEs (and other businesses) may be **reluctant to share their business plans** with competition (N1, 2021); however, by building interpersonal connections through sustained dialogue, a "team" mentality is developed through which co-creation of ideas and collaborative business arrangements becomes an asset for competitiveness (N1, 2021).

5.4.2 Experimentation

Experimentation can occur both formally and informally (G3, 2021); for reference to the specific opportunities provided to SMEs through intermediaries, see Section 5.2.2. The following section provides some examples of experimentation processes that have occurred.

Drivers

Prior to the signing of Climate Contracts, both Viable Cities and the governments of Malmö and Lund were actively working with urban experiments that included SMEs (G1, 2021; G5, 2021; T1, 2021). There are several mechanisms that have been utilized by the City of Lund and the City of Malmö for the sake of inspiring SMEs to participate in the process of open innovation. As respondent G1 (2021) explains, governments can "open up to be a **testbed** for new ideas by making public buildings, public streets and public parks testing grounds for new technologies and new business models". Such endeavors may either formally or informally be considered Urban Living Labs. For example, in newly developed areas such as Sege Park in Malmö, builders have been encouraged through continual dialogues with the city to integrate a testbed for the sharing economy. For the 2000 residents who will live in the area by 2025, builders have integrated means of sharing household items, vehicles and knowledge between residents (Malmö Stad, 2021b); not only does this create a collaboration space for the SME construction companies involved, but also a platform for other SMEs to plug-into and develop solutions to a newly established, mission-oriented customer-base. Furthermore, it is a direct way for residents to become involved in urban experimentation as well.

The City of Lund and City of Malmö have also **provided public buildings as co-learning and resource hubs** where solutions of SMEs can be developed and tested alongside community members. For example, the City of Lund provided a public building, Stenkrossen, through which 30 "players" that consist of associations, freelancers, artists, professionals, private individuals, etc. can become involved in a variety of activities and businesses that address issues related to the climate-neutral mission such as cycling, urban agriculture, climate-innovation projects, smart textiles, circular economy and many more (Stenkrossen, 2021). The City of Malmö provides a building and financial support for a similar space called Stapeln Open Maker-Space (STPLN) which provides a "play-fessional meeting place, maker space and incubator for creative projects" (STPLN, 2021). This space, located in a former industrial area where "large ships were once repaired", has projects (i.e. social-innovation SMEs) focused on cycling, art, and start-up incubation (among many other projects) (STPLN, 2021). Both spaces provide resources for start-ups, such as an "library of things" that can be borrowed, machines for prototyping products, skill-sharing sessions and co-working space (Stenkrossen, 2021;

STPLN, 2021). Thus, not only are SMEs able to freely experiment, but they in turn also are embedded in a space shared by the community. Through this, SMEs are afforded an "ear to the ground" with regard to community needs (L1, 2021) and supported ideas can link SME activity and the community to the climate-neutral mission (G1, 2021).

Experimentation has also been enabled through development of **shared infrastructure for open-innovation test areas** in real living environment (L3, 2021). For example, Future by Lund has developed an open-sensor network that enables SMEs and students to test their own "internet of things" (IoT) products at a scale that would otherwise be challenging. Through this proof of concept, the ideas may then be adopted by the municipality (or other customers) on a large-scale basis. As these IoT solutions are software focused, SMEs can develop solutions without accruing heavy investment costs associated with hardware (i.e. sensor network) (G1, 2021). Some notable examples include SMEs that have worked to develop applications for efficient water use in landscaping, reduced traffic congestion and parking, power shortages, smart offices, and several others (L2, 2021; L3, 2021; Lunds Kommun, 2018). In another example, one passionate entrepreneur developed the idea to embed charging rails within roads which are able to charge electric vehicles while they drive; Future by Lund worked with the municipality to secure a kilometer of road, the Swedish Transport Administration to secure funding, and other companies (e.g. manufacturing, etc.) so the idea could be developed and tested at scale (Innovation Skåne, 2019; L3, 2021). This proof of concept of Evolution Road has led to the SME's product/service to be integrated into the longer-term strategy within their plan for climate-neutrality in the area (Viable Cities, 2020a), and potential for much broader applications.

Barriers

All stakeholders interviewed from the government noted that experimentation does occur, that the government struggles with fully integrating the risk associated with large-scale investment in experimentation (G1, 2021; G2, 2021; G3, 2021; G4, 2021; G5, 2021). Thus, one barrier to seeking bottom-up solutions is that it is fundamentally **misaligned with the government's institutional logic** (T2, 2021). The government is tasked with "keeping the lights on, the garbage collected, the water flowing, the roads in tact… this leads to institutions that are quite stable and operate in a risk averse environment" (T2, 2021). Policy instruments and programs are typically prescriptive, but "when it comes to climate change, it is an issue that embraces everything, and the government cannot dictate those details" (L2, 2021). Taken together, cities are very risk averse in their action, which may stifle SME-led experimentation – particularly those that require significant investment (L2, 2021).

One barrier regarding SMEs engagement in experimentation is that the process must present a **value worthy of significant investment**. In one sense, SMEs are in a constant state of internal experimentation. As respondent G3 (2021) explains, to survive, SMEs have to test themselves versus the market, asking whether what they are doing is actually working with regard to pricing, processes, advertising, etc. Formal experimentation (e.g. with meetings from project inception through formal documentation of learning) may be too institutionalized for SMEs that are quick to learn and pivot (A1, 2021). On one hand, this tenacity makes SMEs ideal experimentation partners, but SMEs need to be convinced of the value of the endeavor (A1, 2021). Again, an issue of time and resources are limiting factors (G5, 2021)

5.5 Reflexive governance

As the mission is in its early stages, respondents' reflections regarding the ability for undertaking the principle of reflexive governance are speculative. Aspects of reflexive governance important

to the mission including monitoring and reporting, integrated planning, assessing risks, and sharing rewards, and are addressed below.

5.5.1 Monitoring

Barriers

Climate Contracts' ambitious targets will require inventive ways of systemically changing how GHG emissions are monitored by the public-and private-sectors (T2, 2021). To date, the extent of emissions monitoring for SMEs is limited, with only some scope-1 emissions accounted (G1, 2021). In Lund, both ex-ante analysis and ex-post review of the environmental program is undertaken by the Lund Climate Policy Council (a mix of external actors), although both respondents from this council noted that the exercise lacks resources of time and money (G2, 2021; G3, 2021). This process, and larger monitoring programs of the city, do not formally include monitoring of firm-level emissions (G2, 2021; N1, 2021; N2, 2021).

There are several barriers for monitoring SME emissions. First, the number of SMEs makes **monitoring logistically challenging** (regarding data aggregation) (T2, 2021). Second, SMEs' technical capacity for monitoring may be limited (B2, 2021). At the city level, capacity issues are also identified for aggregating data and implementing the "interoperable data sharing networks" envisaged by the European Commission (European Commission, 2020). As noted by respondent L2 (2021):

> *If we would introduce a truly digital, connected system… this will have an implication on how the municipality is organized today. We will have to have an open data unit that would work with regional transport, shop owners…. We will need a different kind of skill set and organizational set up and the public sector is not equipped to make these fast, organizational changes.*

Implications for the mission are well understood by Viable Cities, which is currently working on creating monitoring software systems that are adapted to the needs of city governments and which are tailored for engagement of citizens and the private sector (T1, 2021). Digitalization is one of the main mechanisms identified by Viable Cities critical to the mission's success (Viable Cities, 2020a). Targeted, technical assistance for SMEs was said to be of importance as these systems are further developed (G1, 2021).

5.5.2 Scaling and Replicating Solutions

Drivers

As the mission advances, one potential driver for SME engagement is through **partnerships with large corporations**. As large businesses take-up SME solutions, "big companies that have more market domination, more mature [distribution channels] and potential for longer-term contracts are able to deliver at volume to customers" (L2, 2021). Providing an example, respondent L2 (2021) says to "think of AstraZeneca or Pfizer… they are big brands selling medicines and having good logistical systems, but they rarely are the ones inventing new drugs".

Barriers

In addition to scaling solutions, another mechanism for accelerating the transition to climate-neutrality is through replication of solutions, which may occur by taking an emergent, radical

solution and SMEs (and other actors) adapting this to local context (T2, 2021). However, one barrier for SME engagement in this process is that there are **no formal mechanisms for replication** within and outside of the city. As respondent T2 (2021) elaborates:

> *Getting to scale is going to be more about replication and less about making things big. What is important is to duplicate successful solutions quickly. That means that [the city] must be better at doing this because there is no real system to move a solution from one city to another. There is often an over-emphasis on innovation, and we often fail to duplicate or scale-up the interesting SME solutions that we actually know are working.*

Another barrier for scaling and replicating SME solutions is that, given the nature of project cycles, there is **limited long-term evaluation** of identified "solutions" (G5, 2021). Project cycles incorporate periods during which formalized learning processes occur, but at this stage those involved are typically moving on to another project (G5, 2021). Current funding mechanisms for innovation programs may not leave adequate room for follow-up (G5, 2021) and as scaling solutions quickly may present unintended consequences (e.g. as seen when tram systems were removed to make room for personal vehicles after their initial commercialization) (Viable Cities, 2019b), this results in the city seeking implementation at a more gradual pace. Furthermore, as adoption of new approaches takes time "to test, to adjust, to make relevant in a certain context… it is easy to underestimate the [barrier of] institutional inertia to change" (L2, 2021). Thus, a main barrier for scaling and/or replicating solutions is the **incremental nature of change.**

5.5.3 Integrated Planning

Barriers

All government stakeholders interviewed recognized a need for continued improvement of governance processes, particularly regarding a cross-departmental issues such as climate-neutrality. For example, the City of Malmö has an environment department that "does more than typical environment departments that only focus on following laws and international agreements" (G5, 2021). The department also works with externally financed innovation projects to steer activities among departments (G5, 2021). In the City of Lund, the Sustainability Unit takes a similar approach (G1, 2021). However, one barrier for effective mission leadership which subsequently has impacts on SME engagement is that **departments operate in a fairly siloed manner** which results in conflicting priorities (G5, 2021). To combat this, the City of Malmö is attempting to integrate planning efforts; the Sege Park development provides a recent example of this effort.

During the development of the Sege Park project a core team of "project owners" were first determined (i.e., the Parks Department, Environment Department, Housing Department), and then 12 "intrapreneurs" were identified from other departments who could carry the vision of the project into their own domains. This serves a dual purpose of familiarizing other departments of the strategy, but also embeds a project advocate within departments who are responsible for translating the overall vision into their department's context. While not yet occurring, the aim is for different project clusters to meet quarterly for the purpose of integrating the planning of different project clusters along a single "sustainability spearhead" (G5, 2021). This model of moving from siloed government departments, to integrated project clusters, to integrated city-wide planning is illustrated in Figure 5-6 below.

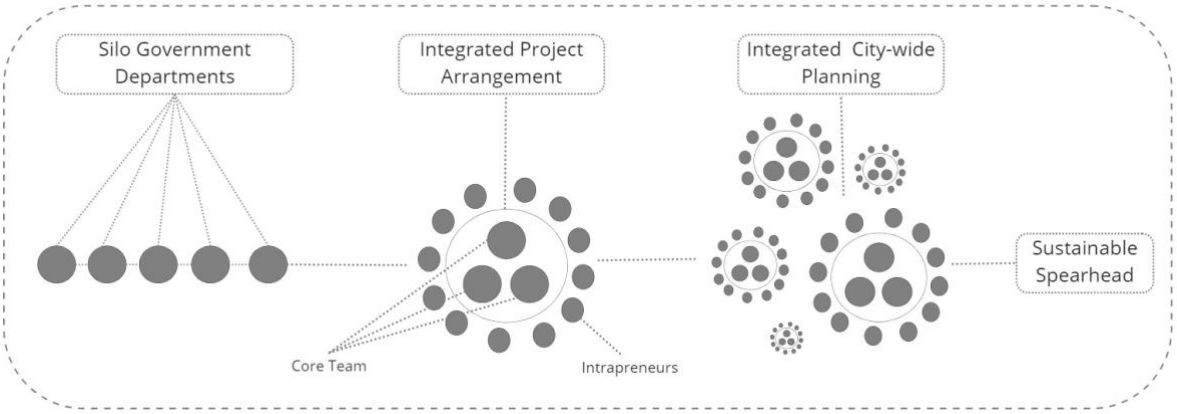


Figure 5-6. Intra-governmental Organization for Mission-focus

Source: Author's own elaboration based on interview with G5 (2021).

While not yet occurring, integrated planning has the potential of addressing the barrier of having **only one (or few) people in charge of maintaining relational ties** and knowledge across sectors, departments and involved actors (including SMEs). At present, if a project leader leaves Malmö's environmental strategy department and a project is not integrated, progress may significantly be set-back (G5, 2021). By extension, a similar barrier is that **large-scale projects can fail to be institutionalized**, which creates setbacks impacting continued engagement with SMEs. Respondent T2 (2021) used the Rockefeller Foundation-funded "100 Resilient Cities" program as an example: while the program in many cities achieved its aim of creating a roadmap for integrating climate-resilience at the city level, after two years funding was pulled from the program. As the program was not fully integrated and externally funded staff were pulled, many governments failed to institutionalize the role and it was instead subsumed within other programs, resulting in the program losing some weight of importance (T2, 2021).

The implications of integrated planning for the mission's success are understood by Viable Cities and the governments of Lund and Malmö who acknowledge current shortcomings (G1, 2021; G5, 2021; T1, 2021). The mission has a long-term orientation, which is different from traditional project cycles (Viable Cities, 2019c) which is important for shifting innovation focus toward bottom-up solution-seeking (T4, 2021). This has emerged as a trend within VINNOVA-funded innovation platforms, with Future by Lund being an earlier example (T3, 2021). On a broader scale, funding agencies (e.g. the Asian Development Bank and Inter-American Development Bank) are now requiring integrated planning and holistic program approaches as a pre-requisite for receiving funds (N1, 2021). Taken together, internal, and external orientation is focusing on developing capacity for program integration.

5.5.4 Risk and Reward

Barrier

Considerations of risk and reward underpin calculations for government investment in the mission; this was first performed through the systems analysis which provided some indication as to the level of investment need for the mission's success (T2, 2021). However, respondents acknowledge that under purely economic logic, these investments will not be paid back through

traditional calculations (T1, 2021; T2, 2021). As such, recognition of co-benefits of risk-taking is needed for mission implementation.

However, as respondent G4 (2021) emphasized, in practice the barrier to engagement of SMEs through "risky" investment this is a **lack of political will and budgetary constraints**. Two examples were provided. First, one SME in Malmö which provides restaurant ventilation equipment that captures and redirects heat into buildings was brought by political leaders to different departments as a solution that could be integrated in public buildings such as hospitals and schools; however, while public officials could calculate the eventual payback of this initial investment, budgetary constraints limited investment potential (G4, 2021). Furthermore, the aforementioned arrangement for solar panels faced a similar challenge; while officials in city government knew the need for investment in clean energy, as they were not directly responsible for providing energy and would not capture the savings accrued, the investment again faced pushback (G4, 2021).

At the SME-level, the challenge of capturing value is one of "life or death" (A1, 2021) and, as such, every investment made needs to be carefully calculated (B1, 2021). Furthermore, start-ups and other SMEs that seek out solutions but need start-up capital face the barrier of a **lack of access to risk capital** (B1, 2021; L2, 2021). While there are some private funders who can be accessed by SMEs in both the City of Malmö as well as the City of Lund, among the government and intermediary respondents questioned, it is unknown if there is a significant funding gap (B1, 2021; G1, 2021; L3, 2021). The question is easier to assess at the city-level, as respondent L2 (2021) explained that risk money for establishing more testing-grounds and support for innovation is lacking for SME engagement. For both SMEs and the government, the implications of investment and sharing rewards for the mission are reflected in Viable Cities push to establish secondary city sub-contract with cities which focuses on building broad, multi-actor financial commitments (T1, 2021).

6 Discussion

The following chapter first reflects upon the results of the case study analysis in comparison to what is known in the literature and then situates these findings in a broader context of the climate-neutral cities mission. Perspectives derived from transition studies literature—the multi-phase perspective, the multi-level perspective, and the multi-actor perspective—provide a theoretical grounding for the findings and provide a tentative explanation for some drivers and barriers identified. Second, the conceptual framework is reflected open regarding the usefulness of transition governance principles for addressing the assumptions underlying mission-oriented innovation policy (ROAR framework). Third, research methodologies utilized in the thesis are scrutinized by examining their design, generalizability, validity, and reliability. Finally, implications are drawn from the literature for research and practice, informing future pathways for research and application.

6.1 Findings' significance and practical implications

RQ1: What are the characteristics of SMEs which may influence the success of the climate-neutral cities missions in the City of Malmö and City of Lund?

In addressing the first question, the characteristics and potential role of SMEs in the transition to climate-neutrality in Lund and Malmö was explored. Empirical findings were congruent with the characteristics of SMEs and related typologies identified in business and innovation studies literature (Bos-Brouwers, 2010; Klewitz & Hansen, 2014) regarding their flexibility, capacity to pivot, leadership by owners, community-embeddedness and ability to capture value in niche markets. Similarly, results indicating their resource constraints of time, money, personnel and expertise, as well as general reliance on external support were also aligned with the literature (Bos-Brouwers, 2010). Important to the mission, this indicates that SMEs can develop bottom-up solutions for climate-neutrality (Mazzucato, 2018a).

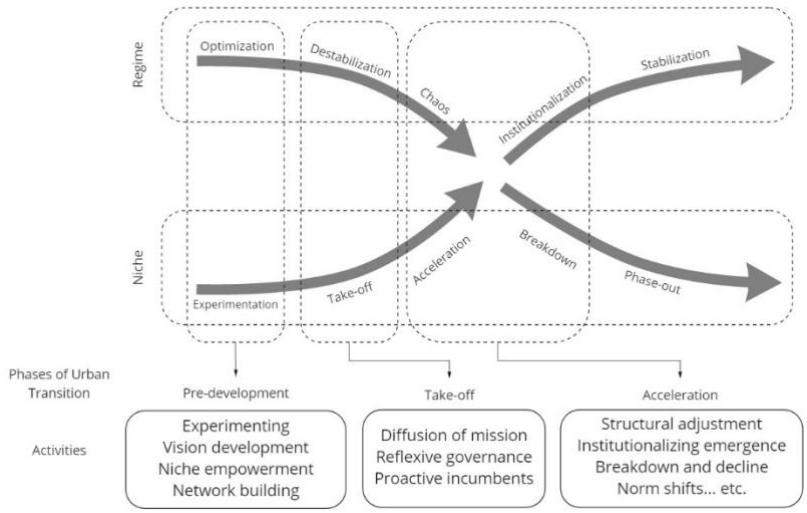


Figure 6-1 Phases of urban transition and associated activities.

Source: Author's own illustration adapted from A2 (2021), Loorbach (2010) and Schot & Geels (2008)

Findings hypothesized several pathways through which SMEs may influence systemic change in the urban systems, which can be explained though the transitions studies literature. As explained through the multi-level perspective, the characteristics of SMEs identified in results

positions SMEs as niche actors as they have less power (i.e. resources) than their regime counterparts (i.e. the government and large companies), but are uniquely positioned "to develop and advance alternatives to existing structures, cultures and practices" (Hölscher et al., 2018), particularly during the pre-development phase (Figure 6-1). Findings identified that one possible pathway toward systemic change is through large businesses (i.e. incumbents) which currently face lock-in in the fossil-fuel based economy selectively adopting niche solutions as pressure is put upon them; this transition pathway is defined in the literature as "selective translation" (Smith, 2007). Furthermore, findings speculate that as systems become more decentralized and market niches open during the take-off phase (Figure 6-1), SMEs will become more relevant, particularly to niche citizen-oriented product offerings. This is congruent with the multi-actor perspective which would explain that in shifting power to communities (Figure 6-2) new spaces are created for inter-sector arrangements, including new business models that the literature and respondents both indicate SMEs are more suitable to pivot toward and fill (Burch et al., 2016; L2, 2021) than their regime-based counterparts encumbered by the lock-in of their large-scale, service delivery capacities (Geels & Schot, 2007), particularly given that SMEs are deeply embedded within communities and can identify emerging needs quickly (A1, 2021; L3, 2021; Westman et al., 2019).

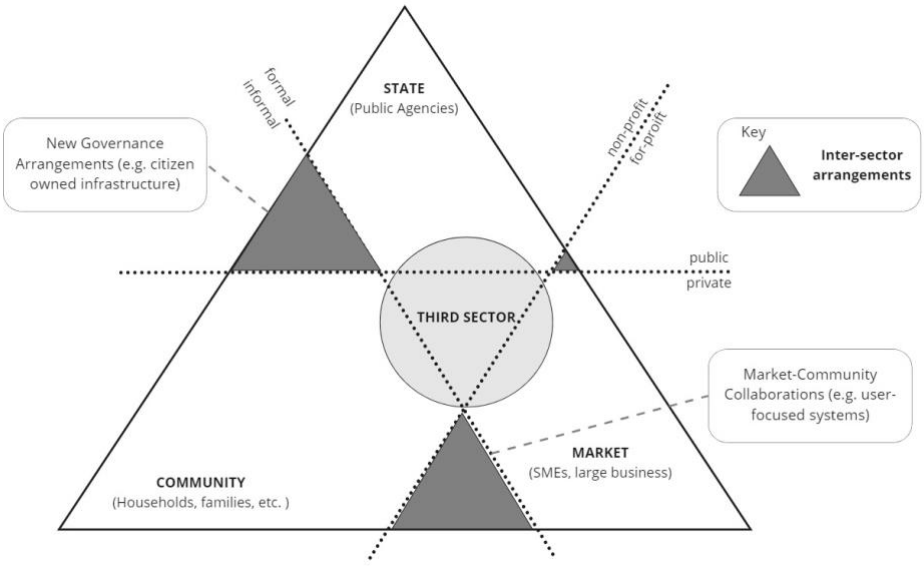


Figure 6-2 Multi-actor perspective on shifting power relations.

Source: Author's own illustration based on Avelino & Wittmayer (2016)

Still, as the results indicate several barriers (e.g., time, money, personnel, capacity) facing SMEs, a second pathway of towards climate-neutrality must come through firm-level incremental process improvement of more "resistant" SMEs. These SMEs may face similar regime lock-in as big business but are less equipped to manage transition to climate-neutrality. Taken together, while the MIP may present an important mechanism for niche empowerment through experimentation and support of radical innovation (Mazzucato, 2018b; Rob Raven et al., 2016), it fails to address the challenge of innovation uptake through developing SMEs' absorptive capacity (Brown, 2020; Cohen & Levinthal, 1990). Practical **implications** thus denote a need for complementary policy which incorporates all SMEs in the urban systems. This is discussed further in Section 6.2.

RQ2: How can government and intermediary actors better engage SMEs in the climate-neutral cities missions in the City of Malmö and City of Lund?

Given these characteristics and the potential roles of SMEs in the climate-neutral cities mission, new knowledge was gained regarding the drivers and barriers to SME engagement in the climate-neutral cities mission. Again, the following sections are aligned with the conceptual framework outlined in Chapter 3.

Strategic Direction Setting

Transition Arena

Viable Cities' vision development mirrors the process outlined in TM literature in that it was envisioned within an exclusive, small group of leaders (Loorbach, 2010). This is at odds with the democratic legitimization and bottom-up development process of MIP (Mazzucato, 2018a). A barrier identified for SME empowerment was the limited perspective gained throughout this process. This barrier has also been highlighted as a criticism of the TM process in literature (Hölscher et al., 2019; Smith & Sterling, 2010). While the lack of inclusion of SMEs is understandable given the need for holistic, systems thinking and group cohesion (Loorbach, 2010), resulting visions may lack a fundamental grasp on how the regime operates. Literature also highlights a failure of early engagement in mission development as a source of contestation during mission implementation (Wanzenböck et al., 2020).

Climate Contract (and continued political engagement)

Viable Cities co-development of Climate Contracts (or "transition agendas") with Lund and Malmö directly mirrors both TM and MIP processes (Loorbach, 2010; Mazzucato, 2018a), and in a sense mirror a secondary process of a more localized transition arena. Similar barriers were also experienced at the city-level, resulting in a lack of SME inclusion in vision development and subsequent strategies, despite a call for radical changes over the coming decade which impact SMEs. One driver of empowering SMEs as co-owners of the mission was through the development of sub-contract with local businesses; examples from transitions management literature provide empirical evidence that similar practices resulted in broader uptake throughout the transition process (Krauz, 2016). Thus, early engagement creates a pivotal feedback loop informing leaders of the mission while also securing broader commitment; as explained in the multi-actor perspective, co-ownership shifts the sense of responsibility of an SMEs which in-turn inspires action (Hölscher et al., 2018).

Several barriers were identified, including a lack of both internal and external mission coordination. Given that the transition to climate-neutrality is only in pre-development phase (Figure 6-1), these limitations are expected given that the regime (i.e. siloed government departments, disparate network actors) need to be gradually integrated through tactical organization as the mission advances (Loorbach, 2010). Another barrier was that SMEs may be politically overshadowed by large business, which reflects literature from the multi-level perspective (Schot & Geels, 2007) and literature regarding the potential for politics to undermine urban missions (Bloom et al., 2019). While important for inspiring needed infrastructural investments, the mission-collaborations with big business (e.g., energy companies) could become a paradise for the incumbents who may sway policy in favor of maintaining the regime. Finally, results indicate that SMEs and the government are constrained by a lack of knowledge on how to engage one another, which is congruent with the literature (Westman et al., 2020). However, while SMEs might be hesitant to promote the mission directly, results speculate that indirectly they may serve as vehicles for translating the mission within community-settings by hosting meetings at local businesses (e.g. coffee shops) rather than less inviting, institutional spaces; this also aligns with the literature, although past studies have not

emphasized the importance of this action for broader sustainability transitions (Westman et al., 2020)

Taken together, the vision was developed with limited perspective, which could lead to future contestation during the implementation of the mission. Regarding **implications** for practitioners, alignment may come through improved political outreach with SMEs, which requires a level of tact and nuance in realizing the forms of political engagement most relevant to them. If leveraged, this could be an important mechanism for overcoming the state-community barrier inhibiting citizen engagement in the mission that was also highlighted in the results.

Tactical Organization

Systems Analysis

The systems analysis undertaken by Lund and Malmö follow the logic of both TM and MIP processes. Findings showed that there is a logistical barrier for including SMEs in this analysis. While this is not reflected in literature, it is not surprising. However, as supporting start-ups is the proposed solution, there is a missed opportunity for engaging *existing* SMEs which may provide a co-benefit of connecting the mission with their networks.

Network Integration through Intermediaries

The functions and typologies of the intermediaries identified in the results mirror those expected from the literature (Gliedt et al., 2018; Kanda et al., 2020; Kivimaa, 2014a; Kivimaa et al., 2019; Kundurpi et al., 2021), particularly in the services they provide to: engage SMEs in directly in the mission; provide capacity building support; advocate for SMEs; and establish collaboration and experimentation spaces (Kundurpi et al., 2021)

Findings highlighted the importance of inter-sector connection for engaging SMEs in the mission, specifically by linking SMEs with the government, and with third-sector organizations. This resulted in articulation of the mission and expectations of actors, and provided avenues for engagement (e.g. project portfolios, open calls) (Kivimaa, 2014b) as well as provided mechanisms for niche development via linkages to resource networks (e.g. start-up incubators, training, capital, etc.) (Adrian Smith & Raven, 2012), which are particularly important during the pre-development phase of urban transition (Figure 6-1). Results add to the literature by highlighting the importance of providing open, cross-sector platforms (which convene regularly) to facilitate communication between the government and SMEs, as occurs through Viable Cities' "Transition Lab". For the government, this creates an important feedback-loop between SMEs and the government to identify solutions and learn how the mission is being translated within the city system. For SMEs, this shifts their role in the mission from passive "clients" of government initiatives to "suppliers" of solutions. Also missing from the literature, results showed that the physical location of intermediaries was important. By embedding Future by Lund's offices among SMEs in a science park, both SMEs and the municipality learned about the others' needs and ambitions, and collaboration could "begin with a conversation over coffee" instead of through typical institutional channels (T1, 2021). These novel findings are congruent with the "tactical" activities of Loorbach's TM framework (2010) in that collaboration begets "togetherness and knowledge sharing" (Kemp et al., 2007).

Results also highlighted the importance of intra-sector connections for promoting multi-level governance of the mission (coordinating objectives, resources, etc. from the EU to city-level), connecting big business and SMEs, and connecting SMEs with one another. These findings are

consistent with the literature (Kivimaa et al., 2019; Kundurpi et al., 2021; Martiskainen & Kivimaa, 2018), although some novel insights were identified. First, while the neutral role of some intermediaries is discussed in literature (Martiskainen & Kivimaa, 2018), results also indicate that neutral intermediaries like Sustainable Business Hub proactively champion SMEs within networks by advocating for policy change and including SMEs in high-level meetings regarding system change to stimulate debate. Consistent with the logic of the multi-actor and multi-level perspectives, this engagement with SMEs addresses inherent power disparities between actors (Avelino & Wittmayer, 2016) which is important for blurring the niche-regime divide and combatting resistance to change (Geels, 2014). Furthermore, results confirm Kundurpi et al.'s (2020) study regarding the importance of SME-to-SME connection, particularly for transferring knowledge and consortia building, but also present new evidence demonstrating how these initial connections create a ripple effect of sustained peer-activity among SMEs. This was evident in the informal peer consultation for emissions monitoring among members of the Lund Climate Alliance as well as in the industry-led formation of a climate-neutrality roadmap.

Results indicate that intermediaries face a coordination barrier, given that the number of relationships which they manage; this is coupled by a challenge of coordinating expectations for engagement, which is particularly challenging for SMEs which expect fast action that intermediaries may be unable to provide; neither of these findings were directly reflected in the reviewed literature. Further, another identified barrier was in appealing to SMEs; given their lack of time and a perceived lack of value added through engagement, SMEs may be inclined not to participate within networks. These findings only somewhat align with Kundurpi et al.'s (2020) study, but may be expected given the wealth of knowledge known about SMEs "resource poverty" (Bos-Brouwers, 2010). Regarding **practical implications**, these findings highlight a need for appealing to the logic of SMEs. Engagement needs to be streamlined, which comes through learning about the potential contributions of SMEs, and then making the investment of their limited time worthwhile; furthermore, as findings showed an emerging business opportunity for SMEs, an appeal for eco-innovation can be communicated through a market-driven logic of capturing emerging value in the decarbonizing economy.

Interestingly, the literature has limited discussion as to the interdependencies of intermediaries in the overall landscape of urban transition (Hölscher et al., 2018). Results showed that while intermediaries like Viable Cities and Climate-KIC might be adept at coordinating swaths of actors around a unified mission to co-develop radical solutions, it takes an intimate network like Lund Climate Alliance to translate these innovations into the operations of a resource-strapped SME and monitor their progress. Furthermore, a regime-based intermediary like Future by Lund is needed to collaborate between government departments for joint, strategic outreach into the region's innovation ecosystem. Taken together, these activities of the Region Skåne's network of intermediaries reflect actions of tactical governance outlined by Loorbach (2010) and the "organization" Mazzucato (2018) says is necessary for the climate-neutral mission to be realized within a transitioning, urban system. **Practical implications** highlight a need for strategically coordinating intermediaries at a higher-level, as services and approaches unique to each intermediary complements others in the larger scheme of the mission.

Overall, the services provided by intermediaries help foster niche development by providing collaborative spaces and opportunities for SMEs, coupled with targeted resources. While speculative, as the mission advances, the inter- and intra-sector networks developed by intermediaries may facilitate the diffusion of niche solutions both among SMEs and larger businesses, as well as within urban systems and communities. Intermediaries address inherent power disparities between actors, as well as perceptual boundaries (such as the divide between

the government and businesses), and establish trusted spaces for co-creation of solutions, as well as clusters of SMEs who can create deeper impact in the mission.

Operations

Market-tilting government activities

Several market-tilting government activities were identified in results as drivers of SME engagement, in line with Mazzucato's framework (2018). Regulatory policies (e.g., energy efficiency mandates) push SMEs to engage with the climate-neutral mission whereas most economic policies strategically pull SMEs into the mission linking financial resources (e.g., grants, loans) with the mission. These findings are congruent with the literature (Asheim & Isaksen, 2003; Clement & Hansen, 2003b; Miedzinski et al., 2019; Owen et al., 2018; Westman et al., 2021). Enabling policies were also identified as drivers in the results. Whereas public procurement has been discussed in the literature (Walker & Preuss, 2008), the land allocation practices such as steering constructor bids by favoring those aligned with the mission and mandating builder dialogues to facilitate collaboration were not identified in the literature analyzed. This driver is particularly relevant to the case study, given that 20% of emissions are from construction (G5, 2021) and that this sector and the cities themselves are rapidly expanding (Region Skåne, 2021).

One of the barriers identified in the literature was the limited agency of city governments to enact regulatory measures; this was not explicitly mentioned in the literature but does provide context as to why city-government respondents focused on the policies which they could control, namely the assets they own (e.g., land) and their purchasing power (i.e., public procurement). Other barriers and subsequent solutions identified in results were consistent (both directly and indirectly) with the literature, including: the disproportionate regulatory burden facing SMEs which can be mitigated by technical advisors (Morgan et al., 2006); and the lack of capacity for meeting procurement demand, addressed through consortia development (Kundurpi et al., 2021). Other findings, such as misalignment of policy with SME needs, were not directly referred to in literature, but may be a tentative explanation for low policy uptake observed in Curran's (2000) study. Finally, the reluctance for sharing business plans associated with "builder dialogues" was identified as a barrier, but as the process itself was a novel finding, its lack of inclusion in the literature is not surprising.

In the context of Loorbach's (2010) governance principles, market-tilting policies are not discussed, but can be reflected upon in the context of the multi-level perspective to understand their importance for SME engagement at different points of the transition to climate-neutrality (Kanger et al., 2020). During the pre-development phase (Figure 6-1), economic policies like grants and seed-funding stimulate niche development (e.g., start-ups) to ensure alternatives for system change are present. At the acceleration phase, enabling policies such as land-allocation practices and public procurement support market-entry of niche ideas. Regulatory policy destabilizes the regime through mandatory adjustment to alternative practices (e.g., energy efficiency), which requires policies that address the repercussions of destabilization through supportive measures (e.g., municipal energy advisors). Further context to the findings is provided through the multi-actor perspective. Results indicating that policy follow-through, as exhibited in ongoing builder dialogues, empowered SMEs to reconsider their roles individually (from "builder" to sharing-economy service provider) and collectively (from other builders as "competitors" to "team member") (Hölscher et al., 2018).

Ultimately, policy processes aimed at tilting the market identified in the case study have potential for engaging SMEs; however, as noted by respondent B3 (2021), caution should be taken to

both avoid the political influence of incumbent actors dependent on the regime as well as overly supporting SMEs struggling with the burden of transitioning to the emerging, climate-neutral regime. Both do a disservice to the mission. **Practical implications** of these findings reflect a need for re-imaging government assets as tools for titling the market. By extension, emphasis should be placed on less prescriptive policies, with focus instead on the "by-proxy" mentality described by Future by Lund; in this, problems can be presented to the private sector (e.g., through competitions in bidding processes) so that markets, and especially SMEs, see climate-neutrality as a business opportunity and align themselves accordingly. As results indicate that follow-through is also essential, policies and programs like Malmö's Innovation Arena should be replicated and scaled as a means of maintaining communication lines with the private sector, inducing soft pressure.

Experimentation

Forms of experimentation undertaken by the government and intermediaries with SMEs in Lund and Malmö reflect the of co-creation of alternatives to the fossil-fuel dependent, urban system envisioned by Loorbach (2010) and Mazzucato (2018). The resources for experimentation provided by the government and intermediaries identified in the results as drivers include testbeds and Urban Living Labs, shared infrastructure for open innovation, and public buildings and resources for co-learning/working. These align with the literature (Asheim & Isaksen, 2003; Ballon et al., 2005; Mitev et al., 2019).

Conversely, the risk aversion and overly prescriptive nature of the government's institutional logic was identified as a barrier, but was not reflected in the analyzed literature, nor addressed in Mazzucato's (2018) framework. However, this can be expected within the context of the multi-level perspective. As the government is, by definition, the regime, norms and practices of the status quo will have to be tactically re-imaged. In past cases where urban transition processes were overly controlled, this led to poor follow-through of the transition agenda (Hölscher et al., 2016). Thus, while examples of experimentation show great promise, a level of control must be relinquished for this form for this engagement with SMEs to occur. Furthermore, a barrier to engagement with SMEs again was related to SMEs lack of resources, demonstrating that if experimentation is to occur, the process needs to be as streamlined as possible, and add value to the SME being engaged. Regarding **practical implications**, both governments and practitioners should continue to provide platforms and spaces for collaboration, rather than prescribing measures for change, as was demonstrated through the "by proxy" approach of Future by Lund. However, also demonstrated through Future by Lund's work, a blended approach should be taken so that the overall portfolio of activities addresses not only the creation of radical solutions, but also process improvements. Follow through is also needed so that the solutions developed through collaboration platforms can be coordinated. Finally, collaboration and co-creation is a skill, and one that intermediaries may be useful at helping SMEs and other actors develop; this better ensures that SMEs are able to utilize their time more effectively, and potentially see better results overall.

Reflexive Governance

Monitoring

Respondents' approach to monitoring through short- and mid-term milestones reflect Mazzucato's (2018) framework, and the use of this information for reflexive governance reflects principles outlined by Loorbach (2010). Interestingly, in the context of Loorbach's (2010) governance principles, long-term orientation is assumed (25+ years) for landscape level changes such as realizing climate-neutrality in urban systems. However, the MIP approach condenses

this to 10 years. Thus, it is not surprising that the former lacks specification on protocol for monitoring at the mid- or short-term, given that emergence is not planned but proactively directed. This presents questions regarding the relative strength of both approaches. Is the MIP approach naively ambitions given the significant regime-based changes which must occur, or is TM not ambitious enough?

Results highlight logistical barriers for SME engagement in this process, particularly given the number of SMEs, the challenge of monitoring scope-1 emissions (let-alone scope-2 and scope-3 emissions called for by the mission). This lack of technical capacity, or a "digital divide" has been discussed in the literature (Arendt, 2008; Wong & Sloan, 2004). At the city-scale, another barrier was a lack of infrastructure and internal processes for monitoring the "big data" called for by the mission which, by extension, limits SMEs capacity as well. This was not specifically addressed in the literature regarding SME capacity. Overall, the **practical implications** are that, for the mission's success, widespread efforts will be needed to roll-out new technology for monitoring emissions – and this unsurprisingly will be challenging for SMEs. Strategies should be (and likely are being) developed not only at the city-level, but for SMEs as well, particularly given the struggles of adapting to energy efficiency standards identified in both the results and literature.

Scaling and replicating solutions

Results indicate that the partnerships developed between SMEs and large companies provide an avenue for scaling SME-developed solutions. This speculation aligns with past transition pathways of "selective translation", through which incumbent actors proactively select green niche-solutions (Smith, 2007). However, the barrier identified in the results is that cities lack capacity for translating solutions from one context to another. This challenge was not specifically mentioned in the scope of the literature reviewed. A second barrier identified in results was the limited capacity for long-term planning in most project cycles; by association, a resulting barrier in the results was associated with the time needed for integrating new solutions into existing systems. These limitations can be understood as regime barriers within the multi-level perspective as there is lock-in to institutional norms and practices associated with funding and political cycles. These would be addressed through Loorbach's (2010) tactical governance principle; similarly, Mazzucato's framework (2018) identifies a need for re-imaging investment processes as more results-based than proposal-based so that adjustments can be made during projects' implementation. This may instigate more reflexive governance throughout the mission, rather than at its end, but as results also indicate that another barrier is of institutional inertia for integrating these solutions, fully recognizing outcomes at any stage will be challenging. However, caution should be taken when rapidly implementing new innovations. As mentioned in results and explained through the multi-level perspective, over-reliance on innovations may result in new forms of un-intended lock-in within emerging regimes (G5, 2021). Although challenging, a balance should be found.

Regarding **practical implications**, the solutions developed by SMEs may be scaled through the connections established by the government or intermediaries, but there is a broader need for idea sharing so that more localized solutions can be developed in other cities as well. SMEs are uniquely able to recognize trends and adapt them to local contexts, but this can only occur when solutions are made visible and communicated broadly. Systems such as Viable Cities' Transition Lab present windows of opportunity for cross-city collaboration; intermediaries may serve as gatekeepers of the knowledge gained from their project portfolios but would benefit from formalized communication channels or repositories of best-practice that have been identified and researched. This in-turn mitigates some coordination challenges associated with matchmaking. As the climate-neutral mission envisions selected cities as innovation hubs,

structures for learning and sharing will inevitably become more relevant in the future; given that the knowledge-based SME solutions developed in Lund and Malmö have potential for applicability in international markets, early establishment of these systems may provide Swedish SMEs a competitive advantage as climate-neutral missions are taken up in other cities.

Integrated planning

The main barrier facing integrated planning identified in results was that the government currently operates in a siloed institutional structure. This impacts their ability to engage with the mission overall, and thus also with SMEs; this barrier is often cited in the literature (Burch et al., 2016; Frantzeskaki et al., 2018; Hölscher et al., 2018; Westman et al., 2021). Interestingly, the process being undertaken by the City of Malmö reflects the overall logic of Loorbach's (2010) framework in that project begin with a small group which then identify other departmental frontrunners to translate and align the project's vision within the context of their own departments, eventually unifying disparate activities around a "sustainability spearhead" at the city-level. However, neither Mazzucato (2018) nor Loorbach (2010) explicitly address the need for this process of institutionalizing the mission; as such, this novel finding may have **practical implications** for other city governments as well who might struggle with integrated planning. By promoting cohesion within the government, engagement with SMEs becomes more streamlined, particularly as project-based knowledge and relationships become more integrated throughout the city-government.

Risk and Reward

Results showed that one of the main barriers for the government in working with SMEs relates to issues of budgetary constraints, which reflect the "risk" of investment discussed in Mazzucato's (2018) framework. This is, in-part, said to be addressed through stat-run banks (Lamperti et al., 2019; Mazzucato & Semieniuk, 2017). Funding is not considered in Loorbach's principles (2010), although literature shows that transition projects require significant investment (Frantzeskaki et al., 2014). Despite the need for risk-investment, results show that gaps still exist. These findings are not surprising (Brown, 2020), and Viable Cities acknowledges a need for unlocking new funding mechanisms so that public investment can live up to what is called for through the mission. Respondents also acknowledged a need for private, risk-based capital, although interestingly there was limited knowledge about whether a funding gap exists in the Region Skåne. This has significant **practical implications**, as the rhetoric of bottom-up solution development and collaboration do not hold weight if no one is willing to risky bets on co-developed ideas for radical solutions. More knowledge is needed so that intermediaries can form relationships with private funding agencies and link innovators with these resources.

6.2 Reflections on the conceptual framework and areas for future research

This thesis utilized the perspectives of transition studies as an analytical lens to examine components of MIP as it relates to government and intermediaries' engagement with SMEs in the climate-neutral cities mission, and the overall strategic importance of SMEs for the mission. The analytical choice of relying on transition studies is twofold. First, there is limited research focusing on MIP (none of which addresses SMEs), and Mazzucato's (2018) framework underpins most of the literature; second, given the similarities between the processes of the ROAR and TM frameworks, the link can be justified. Analytically, this link between the two frameworks is useful in that transition studies and management literature provides more grounded analysis of the case study as it tests the assumptions of MIP-related activities against a well-established vocabulary regarding the regime, the niche (i.e., multi-level perspective), and

the power/agency of actors within both (i.e., multi-actor perspective). This provides context into the policy itself, but also highlights some barriers which may limit its success, particularly regarding "tactical" governance approaches in aligning sectors around a problem. However, analysis overall may be qualified in part given that the interpretation required for bridging the two disparate bodies of literature, and second because the MIP framework envisioned by Mazzucato (2018) has not yet been fully implemented in practice, so the tentative connections made now may not hold-up over the coming decade.

However, the merit of the conceptual framework reflects an academic contribution made by this thesis, both stimulating debate and opening up possible pathways for future research. For example, three key limitations to Mazzucato's (2018) framework have been illuminated in findings which require further exploration: the limitations of MIP within SME-focused economies, the limits of the state in leading large-scale missions, and the limits of democratic inclusion in vision development. **First**, MIP maintains an assumption that the co-creation of radical solutions will result in the success of the mission. However, MIP alone may not meet the innovation needs of cities whose economic base is comprised primarily of SMEs (like in Sweden) as it narrowly aligns investment to start-ups and high-tech SMEs (Brown, 2020). While necessary for innovation, as Ergas (1987) notes, Nordic nations have traditionally focused the primary goal of innovation policy toward broadly building firms' (notably SMEs') absorptive capacity –their ability to "recognize the value of new information, assimilate it, and apply it to commercial ends" (Aboelmaged & Hashem, 2019; Cohen & Levinthal, 1990).

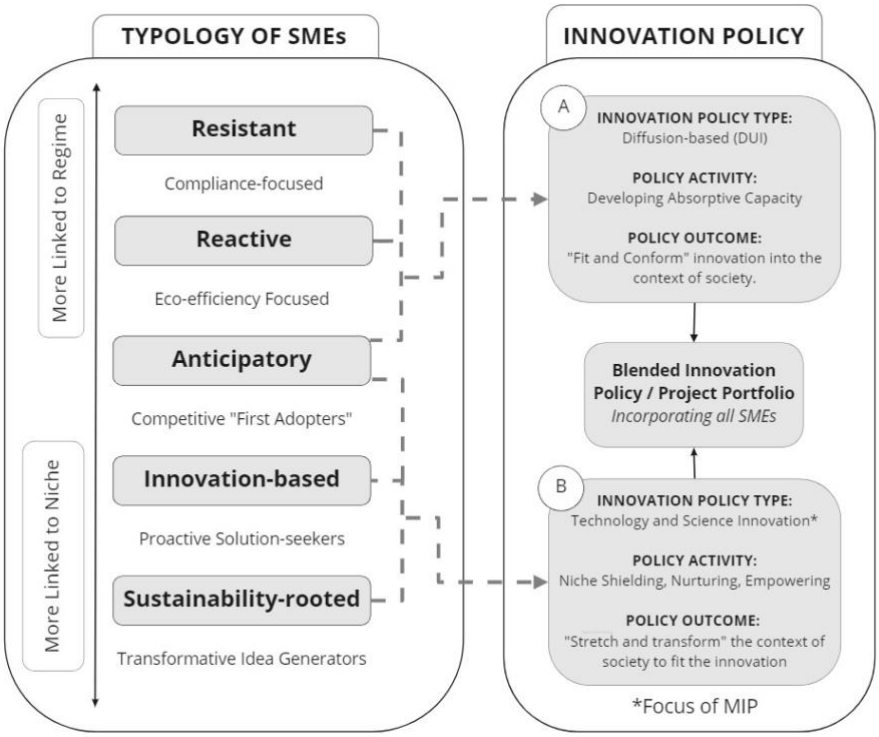


Figure 6-3. Blended innovation approach for the climate-neutral cities mission

Source: Based on Brown (2021), Klewitz and Hansen (2014), Mazzucato (2018a), Schot & Geels (2007)

Pulling from the multi-level perspective, while strong emphasis is placed on niche-development (e.g. developing radical innovation), as a stand-alone, missions fail to include all typologies of SMEs, including those "resistant" to change that are aligned with the regime as well as the

"sustainability rooted" SMEs operating in the niche (Figure 6-3) (Geels & Schot, 2007). Smith and Raven (2012) discuss a need for either "fitting and conforming" niche innovations within the context of the existing regimes, which aligns with diffusion-based innovation policy (A), or "stretching and transforming" the regime to fit niche innovation, which is aligned with MIP (B). Both are needed to capture all SMEs which comprise the economic base of the Region Skåne. Some intermediaries like Future by Lund recognize this need and build their project portfolio along a blended innovation policy approach (L2, 2021; T3, 2021; Wise, 2021). Given that climate-neutrality in cities requires inclusion of all actors, complementary policy is needed, requiring more research.

Second, Mazzucato's (2018) framework pulls from past examples of MIP (e.g., the Apollo mission) as justification for it approach in addressing societal challenges. However, past missions were technology driven and success has been attributed to the tight control maintained by few agencies (e.g. NASA) during a time where the state was arguably at the height of its leadership potential (Ergas, 1987; Robinson & Mazzucato, 2019). Conversely, the climate-neutral cities mission seeks bottom-up, democratically developed solutions to highly contested, wicked problems (Mazzucato, 2018a). Transition studies would question the assumption of whether the regime itself is able to facilitate a process that ultimately aims to change the regime? (A2, 2021). As the need for climate-neutrality has been long-observed, its lack of implementation can be attributed to regime-based barriers such as lock-in to a fossil-fuel based economic paradigm (A2, 2021), institutional structures such as siloed government departments (G1, 2021; G4, 2021; G5, 2021), political cycles (G4, 2021) and aversion to risk (L2, 2021). Thus, while landscape-level justification (e.g., social, and political pressure to address climate-change) indicates that society may be at a different phase of transition from the past, this does not mean that the government will be able to overcome its proclivity for preserving the regime. More research is needed to monitor this, and other underlying dynamics (e.g., political forms most suitable for MIP, etc.).

Third, Mazzucato's (2018) framework maintains a rhetoric of democratic and inclusive idealism, with citizen and stakeholder (e.g. SME) "meaningful engagement throughout all stages of the policy cycle" (European Commission, 2020 p. 26); however, to date both the European Commission and Viable Cities national efforts in mission formation have only done this to a limited extent (T1, 2021; Wanzenböck et al., 2020). Furthermore, the principle of problem-oriented selection (i.e., "pick the willing") assumes cross-sectoral engagement will result; however, for a mission aiming toward climate-neutrality, high-emitting large-scale firms may be disproportionately targeted (Brown, 2020), and, generally speaking, a gap exists in the "organization" pillar as to mechanisms for building new network arrangements. TM literature also reflects on the need for a networks perspective as an additional level of analysis to the multi-level and multi-actor perspective (Hölscher et al., 2018); while this thesis begins to do this (see section 5.3.2) a dedicated network-level perspective could inform both MIP and TM approaches.

Looking past the focus on the theoretical framework, there is a need for additional research highlighted in the findings, including 1) a more comprehensive systems analysis inclusive of SMEs, 2) analysis of the financial potential for risk investment in the Region Skåne, 3) strategic assessment of the Region's and SMEs' potential for digitalization. Furthermore, insight may be gained from additional research on the SME perspective of the climate-neutral cities mission. This could provide valuable insights as to the political activity of SMEs in the region, the barriers and drivers to engagement from their perspective, and much more.

6.3 Reflections on methodology

The case study methodology of this study was suitable given the thesis' aim of providing a more informed, strategic perspective to the government and intermediary practitioners who are beginning implementation of the mission. As a gap in the literature exists, which is (at least partially) filled through the empirical findings of this study, and the new knowledge generated has practical implications for the target audience. Moreover, exploratory case studies are not intended to state fact, but rather to generate hypotheses which can be further studied (Yin, 2003), and the thesis has largely accomplished this through the depth of analysis afforded by the case-study approach. However, there are some limitations worth considering.

As the nature of urban sustainability transitions and mission-oriented policy are highly inter- and trans-disciplinary areas of research, there are a plethora of factors worthy of attention which influence the climate-neutral cities mission. As such, there is a potential limitation to the research design given the breadth of the topic. This limitation informed the scope of the thesis by focusing on government and intermediary actors, limited to only those who are directly engaged with the climate-neutral cities mission and SMEs in a geographically delineated area. Still, as elements discussed in the thesis involve a variety of disciplinary lenses and topics –public policy mixes, urban experimentation, public procurement, etc.—the readers may identify areas in which greater depth or different forms of analysis may have illuminated interesting findings. As an exploratory case study, this research inspires these kinds of thoughts for future applications in research and in practice. Thus, the questions asked by the thesis can be considered legitimate, particularly as there is a dearth in both transitions studies and MIP literature examining a systems perspective on SMEs' eco-innovation potential in urban settings.

Furthermore, what emerged throughout the research process was a realization of the danger of discussing SMEs as a heterogenous group. While this was avoided analytically by distinguishing SMEs based on their eco-innovation typology (Klewitz & Hansen, 2014), this may not have been the case from respondents' perspectives. Even based on the typology utilized, there are significant differences within the category; for example, the eco-innovation of a community coffeeshop is vastly different from that of a start-up tech company, as is ways in which they should be engaged. Furthermore, a deeper level of analysis which distinguishes among firm-size could be suitable, given that respondents noted different engagement patterns between small- and medium-sized firms. The term "SME" creates a "black box" for policymakers trying to discern approaches for engagement and in recognizing strategic importance in the climate-neutral cities mission. However, while additional questions may be asked, the initial question is still legitimate, particularly as many drivers identified highlight a need for providing space for innovation, rather than exact measures of who operates within these spaces or why. Indeed, it is the fact that SMEs are so heterogenous that makes them important; their diversity provides a multitude of opportunities and approaches to climate-neutrality, embodying the spirit of emergent, bottom-up solutions that would not be possible in a society comprised only of large institutions. Taken together, it is through recognizing the difficulty in defining "what an SME is" that begs a more important question— "what an SME could be".

Also, in relation to the complexity of urban systems, the generalizability of this thesis' results are partially limited by factors related to context (e.g., local laws, influence of the government, surrounding innovation ecosystem) which shape the landscape of urban transition to climate-neutrality. However, as the mission being implemented in Sweden through Viable Cities only has twenty cities current engaged, and only nine which have been engaged for more than six months (Viable Cities, 2021a), the case study selection was limited. Still, in addition to the findings' relevance to the intended audience, the case study presents an opportunity to gain insight ahead of the forthcoming European Commission "100 Climate-neutral Cities by 2030- by and for citizens" program. Given that the at least some of the core drivers and barriers

experienced by government and intermediary practitioners to engage with SMEs are not context-specific, there is some generalizability, particularly for practitioners working in similarly structured institutions and equipped with similar resources as those outlined throughout the case study. However, many context-dependent factors are worth noting, including: 1) the Region Skåne's innovation ecosystem is highly developed in comparison with many other areas, 2) the government of Sweden has a long history of sustainability-oriented innovation policy, 3) the two cities in the case study both have well established environmental departments with a long history of climate action.

Regarding the thesis' validity, the study would have benefitted from communication with more than the 20 interviews and 4 email correspondence. Internal validity may have been supported by interviewing practitioners at different governance levels of the city's climate programs, for example, or from a different department such as an economic development department; however, given the siloed nature of the government institution as discussed throughout the thesis, engagement with the climate-neutral mission would only be indirect among these groups. Similarly, multiple interviews within each organization would improve internal validity, although this occurred in some cases. Additionally, direct consultation with SMEs would provide a wealth of information about the nuances of barriers identified, likely revealing additional barriers not perceived by practitioners themselves. However, outreach to the many SMEs in the Region Skåne was not feasible nor was it within the scope of this thesis. To combat this issue, interviews were conducted with three researchers who have worked extensively with SMEs, analyzing their role in urban sustainability.

7 Conclusions

This thesis set out to investigate the characteristics of small- and medium-sized businesses which may have an impact on the "Climate-neutral Cities by 2030" mission undertaken by the City of Malmö and City of Lund, as well as the ways in which the city government and intermediary organizations leading the mission may better engage SMEs throughout the course of the mission's implementation. In doing so this thesis aimed to provide practitioners with a better-informed, strategic perspective regarding the relative importance of SMEs. For this purpose, qualitative empirical data was collected, including a range of documents as well as 17 practitioner interviews, 3 academic interviews and 4 email correspondences, and analyzed through qualitative content analysis for the purposes of answering the following research questions:

RQ1: What are the characteristics of SMEs which may influence the success of the climate-neutral cities missions in the City of Malmö and City of Lund?

SMEs possesses several characteristics which make them uniquely suited for seeking the innovative solutions needed for the climate-neutral mission. While small, their organizational structure maintains the flexibility required to quickly make decisions and pivot to capture emerging market value, which will be important within the Region Skåne's rapidly decarbonizing economy. This flexibility extends to an ability to test out new products and services, or entire business plans which challenge the status quo; when coupled with the leadership of an intrinsically motivated owner, SMEs may be inclined to embed the principles of sustainability into the core values of their business. Furthermore, as SMEs are integrated within the communities where they operate, they maintain important ties with citizens who also need to engage with the mission if it is to be successful. In the broader context of the urban transition to climate-neutrality, the innovations developed by SMEs have the potential to diffuse through peer-networks to other SMEs, or to be replicated by SMEs in other contexts. Solutions may also be scaled through acquisition and integration within larger businesses or in the urban infrastructural and institutional system. Additionally, as trends indicate that systems may become more decentralized in the future, citizen-focused solutions may also present a new market for niche, SME solutions.

Despite these positive characteristics, SMEs are constrained by a lack of resources such as time, money, personnel, and expertise. Many SMEs also lack the capacity for implementing significant process improvements needed called for by the climate-neutral cities mission. For both change-inclined SMEs and those that may struggle with adjusting throughout the climate-neutral mission, support from the government and intermediary organizations is important for helping realize the full potential of the SMEs that comprise the region's economy. Thus, this study shows a need for policy which not only seeks the co-creation of radical solutions, but also methods of diffusing these innovations through complementary policy that addresses capacity needs of SMEs.

RQ2: How can government and intermediary practitioners better engage SMEs in the climate-neutral cities missions in the City of Malmö and City of Lund?

While engagement with SMEs during the missions' development was limited, garnering early commitment through symbolic contracts with SMEs helped to develop an early sense of co-ownership. However, sustained and coordinated political outreach will be required to align disparate actors around mission-efforts and mitigate contestation throughout the mission. This will require the government to recognize the more nuanced ways that SMEs politically engage with sustainability-related issues. Also early in the mission, intermediaries provide SMEs a palate of services for the development of their innovative solutions, which is later translated into the broader, urban system through the inter- and intra-sector connections that intermediaries

facilitate. Intermediaries link SMEs and their larger counterparts (i.e., large companies and the municipalities) who become end customers, scaling solutions. Intermediaries also connect SMEs with one another, leading to the formation of informal support networks, open-innovation clusters, and industry-driven agendas for climate-neutrality. The collaborative spaces created by intermediaries helps to establish trust between parities, account for power disparities between actors, and bridge communication divides between SMEs and the government. However, given the vast number of initiatives and actors in the urban network, intermediaries need to coordinate efforts within and between themselves to overcome initial barriers for engagement. Furthermore, interactions with SMEs should be efficient and communicate the value-added for SME engagement given that their time is a scarce resource.

Government policy and practices also engage SMEs in the climate-neutral mission. Regulations act to push SMEs toward climate-neutrality, whereas economic policies provide resources for innovation. City governments which lack direct control over national policies can control their assets (e.g., land) and devise competition schemes which incentivize collaboration among SMEs and big business, resulting in the development of consortia aligned with the climate-neutral mission. Furthermore, governments can devise public procurement measures that favor SME engagement, stipulating mission-oriented requirements. More directly, the government and intermediaries both establish testbeds, Urban Living Labs and shared community spaces through which SMEs are empowered to engage in urban experimentation. However, the government needs to address its own aversion to investing in experiments which often fail and be cautious when devising policy as to not overly influence market dynamics which may have negative repercussions.

As the mission advances, learning and reflection must continually occur; repercussions of failing to adequately institutionalize the mission inevitably impacts SME engagement efforts. First, monitoring emission at scale will be challenging given the limited technical capacity of SMEs, and the city. Furthermore, the government must reform institutional structures and practices to coordinate its currently siloed departments and combat the challenges of political and funding cycles which limit investment in and learning derived from urban experimentation. Furthermore, for SME-developed solutions to be scaled and replicated, communication lines within and between cities needs to be formalized and strengthened. Finally, private financing channels need to be identified and strengthened for high-risk, high-reward SME solutions.

In reflection of these empirical conclusions and the practical implications discussed in Chapter 6, several areas for improving practice can be identified. While most relevant within the case-study's context (as was intended), recommendations may prove applicable in other cities. For government practitioners leading the climate-neutral cities mission, SME engagement could be improved through the following actions:

1. **Complement mission-oriented innovation policy with diffusion-based policy** to capture the full spectrum of SMEs which must engage in the climate-neutral mission. Whereas the former seeks innovative solutions, the latter develops SMEs' absorptive capacity for the uptake of innovation.
2. **Coordinate political outreach to SMEs for early and sustained engagement, to garner commitment, inspire action, and inform policy feedback loops.** This might be accomplished by first securing commitment through symbolic gestures (e.g., Climate Contracts) with identified frontrunner SMEs. Second, establish/maintain regularly held, open communication forums to increase visibility of SME solutions and provide feedback to city government. Finally, realize the potential of SMEs' more nuanced forms of mission-aligned, political engagement (e.g., hosting community meetings) to possibly foster community linkages.

3. **Create a repository of best-practices and SME solutions** on an openly shared platform to spur uptake of solutions and alleviate the coordination burden facing intermediaries.
4. **Follow-up with "market-tilting" policy mixes** to recognize unintended consequences and to better ensure commitments of involved parties have been followed (e.g., builders' shared development plans).
5. **Institutionalize the climate-neutral mission throughout departments** by following an internal process like transition management (See Chapter 3). Additionally, innovation and business development strategies should be co-developed by the business and sustainability departments of cities.

For intermediary practitioners involved with the climate-neutral cities mission, SME engagement could be improved through the following actions:

1. **Strengthen relationships and build trust by embedding offices or meetings within SME-centric spaces, such as start-up incubators and science parks.** This allows intermediaries to learn about SMEs through observation and informal communication so more efficient matchmaking can occur.
2. Viable Cities should **coordinate the network of intermediaries** functioning in a city, as no single intermediary fulfills all the facilitative roles required by the mission. This can occur through meetings between practitioners leading intermediaries.
3. Develop a **one-stop-shop of network resources** to link SMEs more efficiently with third-sector actors on an ad-hoc basis.
4. **Communicate a business case for decarbonization** which appeals to SMEs. As markets decarbonize, niches form; intermediaries can use these windows of opportunity to appeal to and coordinate SMEs through clusters to accelerate the mission.
5. **Couple the development of collaborative space with capacity building** for systems thinking and collaboration.

In addition to these recommendations, several research gaps directly relevant to practitioners were identified, demonstrating a need for future research specific to the Region Skåne. First, as the mission begins, a systems analysis is conducted to understand the key resource flows in the city. However, this should be complemented with research on existing networks, including actors such as SMEs within them so they may be engaged. Additionally, systems analysis should also be complemented with analysis of the financial landscape, both private and public, to identify possible channels for financing high-risk investment. Finally, digitalization strategies are increasingly prevalent in Sweden, but their diffusion and application for Scope 1-3 emissions in SMEs is limited; given that the mission calls for inter-operable networks of shared data, a significant amount of research will be needed to inform strategies relevant to all actors.

In addition to the practical contributions made by this thesis, there are some theoretical contributions made as well. Given that there are few studies which discuss the role of SMEs in the context of urban sustainability transitions, and none which have applied this to the context of the climate-neutral cities mission, more research is needed. First, as this thesis focuses on how government and intermediary practitioners engage SMEs in the climate-neutral cities mission, it is important to gain more knowledge from the side of SMEs as to the barriers and drivers for engagement that they experience. Specifically, more information is needed regarding the ways in which SMEs interpret the climate-neutral cities mission, and how this translates to action within their firms. Research related to the motivations for engagement with the government and intermediaries is also needed, as is research identifying the ways in which the mission influences their engagement with the community and within their industry networks.

Furthermore, through the conceptual framework, the framework of transition management and the perspectives of transitions studies literature were linked with the MIP framework developed by Mazzucato (2018). As this has not yet been done in the literature, more research is needed to strengthen these conceptual links. The framework itself can be improved upon, given existing gaps in the transitions' study literature. For example, while the multi-level and multi-actor perspective help frame certain dynamics of transition such as the "niche", "regime", and "landscape" elements, as well actor roles and their relative agency, there is limited research for addressing the function of networks within transition. Additionally, key assumptions made by the MIP framework should be tested, such as the public-sector's capacity for directing transformative change, the usefulness of MIP in SME-based economies, and the inclusivity of the policy at its various stages of implementation.

Overall, this thesis largely achieved what it set out to accomplish. First, the drivers and barriers to engagement with SMEs have been identified, providing a practical contribution to practitioners. Second, the main activities and principles outlined in mission-oriented innovation policy were examined through a conceptual framework built from transitions studies and management literature; this allowed for a critical examination of the drivers and barriers identified by practitioners as well as allowed for some of the assumptions made by mission-oriented innovation policy to be tested. In conclusion, SMEs have a potential for shaping the trajectory of the transition to climate-neutrality through the bottom-up development of solutions, and through addressing their own environmental impact at the firm level. However, they cannot do this alone; intermediaries and the government in Lund and Malmö play a key role in engaging SMEs in the climate-neutral cities mission. While diverse and challenging to strategically engage, when given the space and resources for experimentation and collaboration, SMEs have significant potential for transformative sustainability in urban settings.

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Appendix I. Consent form

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MESPOM Masters in Environmental Sciences, Policy and Management

Climate Neutral Cities Mission in Lund and Malmö, Sweden: The Role of Small and Medium-Sized Enterprises (SMEs)

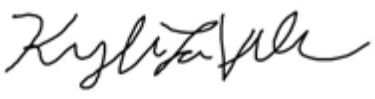
CONSENT FORM

This form is to ensure that you have been given information about the thesis project undertaken by Kyle LaVelle, MSc Candidate in Environmental Science, Management and Policy from the MESPOM Erasmus+ Program (Lund University, University of Manchester, University of the Aegean and Central European University. This document provides you opportunity to confirm that you are willing to take part in this research. For all activities below, please indicate which applies to you:

☐	I have been **familiarized** with Kyle LaVelle's thesis project on Climate Neutral Cities Mission in Malmö and Lund and the Role of SMEs, I have had the possibility to ask questions and I have received satisfactory answers to my questions.
☐	As a research participant, I am aware of my **right to withdraw participation** at any time.
☐	I give my consent that the interview can be **audio- and video**-recorded, transcribed (using Otter transcription software), and analyzed.
☐	I give my consent to **be identified by my organization.**
☐	I understand that the results of the research will be presented so that **no information can be traced to me personally.**
☐	I give my consent that a record of my interview can be **safely stored** for future reference.

Note: Your participation is voluntary. As an interviewee, you do not have to answer all the questions that are asked; you reserve the right to refuse or cease participation in the interview process without stating your reason and may request to keep certain materials confidential.

Please, sign below to confirm your consent:

	Participant(s)	Researcher(s)
Name(s)		Kyle LaVelle
		
Date(s)		

Appendix II. List of interview participants and codes

Semi-structured Interviews

Organization	*Type*	*Organization Relevance*	*Type*	*Area*	*Expertise/Relevant Knowledge*	*ID*	*Date*	*Length*
Lunds Kommun, Environmental Unit	Zoom	Develops and advances Lund's climate strategy	Government	Lund	Directly works with Lund's Climate-Neutral Cities Mission	G1	April 29, 2021	0:58
Lund Climate Policy Council	Zoom	Evaluate how the City of Lund's overall policy is compatible with goals adopted by the City Council	Government	Lund	Responsible for monitoring and reporting progress and providing recommendations to council.	G2	April 16, 2021	0:31
Lund Climate Policy Council	Zoom	Evaluate how the City of Lund's overall policy is compatible with goals adopted by the City Council	Government	Lund	Responsible for monitoring and reporting progress and providing recommendations to council.	G3	April 15, 2021	0:33
Malmö Stad Municipal Council, Environment and Urban Planning	Zoom	Leads work with the city, coordinating departments.	Government	Malmö	Leverages political support and action among departments for climate-neutral mission.	G4	May 4, 2021	1:10
Malmö Stad Environmental Strategy Department	Zoom	Develops strategy beyond compliance measures for the city.	Government	Malmö	Leads experimentation and testbeds in Malmö.	G5	May 7, 2021	0:44
McGill University, Canada	Zoom	Basic and applied, transdisciplinary research institution.	Academia	Both	Transition management expert with research projects related to role of SMEs.	A1	April 20, 2021	1:08
World Wildlife Fund (Sweden)	Zoom	Swedish office manages worldwide Cities program (and other programs)	NGO (Third sector)	Both	Local and global connection related to city climate-related reporting and programs.	N1	April 16, 2021	1:06
World Wildlife Fund (Sweden)	Zoom	Swedish office manages worldwide Cities program (and other programs)	NGO (Third sector)	Both	Swedish-level work with climate negotiations with relevance to city-based application.	N2	April 19, 2021	0:36
Viable Cities	Zoom	National innovation program for climate-neutrality in 9 Swedish cities.	Transition Intermediary	Both	Develops strategy and project portfolio for climate-neutrality at the national level. Works directly with Lund and Malmö.	T1	April 27, 2021	1:02
Climate-KIC	Phone	Europe's leading knowledge and innovation center for climate solutions (and climate-neutrality).	Transition Intermediary	Malmö	Advises cities on deep demonstrations for climate-neutrality (planning, negotiating, experimenting).	T2	April 26, 2021	1:12

Sustainable Business Hub	Zoom	Cluster organization for smart sustainable cities.	Cluster Organization	Both	Facilitates networking and program implementation with SMEs and other actors.	B1	May 5, 2021	1:02
Lunds Klimatallians	Zoom	Networking platform linked with Lunds Kommun environment dept.	Business Network	Lund	Connects businesses of various size and advances solutions through programs and networking meetings.	B2	April 22, 2021	0:42
Climate Business (and EIT Climate-KIC)	Zoom	Environmental advisory service and platform for businesses.	Business Network	Both	Consults businesses to develop transformative environmental strategies.	B3	April 29, 2021	1:16
Resilient Regions Association	Zoom	Neutral platform for business, academia and government.	Cluster Organization	Malmö	Holds networking and program events for various actors on climate resilience.	L1	April 16, 2021	0:56
Future by Lund	Zoom	Innovation for smart and sustainable cities of the future.	Regime-based Intermediary	Lund	Connects various actors with SMEs to develop and test solutions for sustainability and climate-neutrality.	L2	April 16, 2021	0:45
Future by Lund	Zoom	Innovation for smart and sustainable cities of the future.	Regime-based Intermediary	Lund	Connects various actors with SMEs to develop and test solutions for sustainability and climate-neutrality.	L3	April 23, 2021	1:01

Alternative Communication

Organization	***Type***	***Organization Relevance***	***Sector***	***Area***	***Expertise/Relevant Knowledge***	***ID***	***Date***
Erasmus University Rotterdam, The Netherlands	Zoom (webinar)	Basic and applied, transdisciplinary research institution.	Academia	Both	Transition management expert with research projects related to role of SMEs.	A2	Feb. 18, 2021
Klimatkomunerna	Email	Inter-municipal network advancing climate-neutrality goals (advisory).	NGO (Third sector)	Both	Helps municipalities develop and advance roadmap toward climate-neutrality.	N3	April 15, 2021
VINNOVA	Email	Swedish innovation authority.	Transition Intermediary	Both	Develops funding strategy and oversees national-level climate-neutrality innovation efforts.	T3	
VINNOVA	Email	Swedish innovation authority.	Transition Intermediary	Both	Develops funding strategy and oversees national-level climate-neutrality innovation efforts.	T4	

Interviews from Thesis Pre-study

Organization	***Type***	***Organization Relevance***	***Sector***	***Area***	***Expertise/Relevant Knowledge***	***ID***	***Date***	***Length***
University of Waterloo, Canada	Zoom	Basic and applied, transdisciplinary research institution.	Academia	Both	Transition management expert with research projects related to role of SMEs.	A4	Dec.7, 2020	0:36
Lunds NyföretagarCentrum	Phone	Hands-on business advisory service for SMEs and start-ups.	Business Network	Lund	Works with SMEs for business plan development.	B4	Dec.3, 2020	0:25
Future by Lund	Phone	Innovation for smart and sustainable cities of the future.	Regime-based Intermediary	Lund	Connects SMEs with support networks facing hardship in Covid-19 era.	L4	Dec.2, 2020	0:28
Almi	Email	Business development funding agency.	Business	Both	Advises the Brygglån loan program for SMEs investing in sustainability.	B5	Dec.4, 2020	N/A

Appendix III. Core distinctions between "old" and recent mission-oriented innovation policy

Table 0-1 Distinction between "old" and recent mission-oriented innovation policy

Old Mission-oriented Innovation Policy	**Recent Mission-Oriented Innovation Policy**
Diffusion of results outside of the core of participants is of minor importance or actively discouraged.	Diffusion of results is a central goal and is actively encouraged.
The mission is defined in terms of the number of technical achievements, with little regard to their economic feasibility.	The mission is defined in terms of economically feasible technical solutions to societal problems.
The goals and the direction of technological development are defined in advance by a small group of experts.	The direction of technical change is influenced by a wide range of actors including government, private firms, and consumer groups.
Centralized control within a government administration.	Decentralized control with many agents involved.
Participation is limited to a small group of firms due to the emphasis on a small number of radical technologies.	Emphasis on the development of both radical and incremental innovations to permit a large number of firms to participate.
Self-contained projects with little need for complementary policies and scant attention paid to coherence.	Complimentary policies vital for success and close attention paid to coherence with other goals.

Source: Soete and Arundel (1993, p. 31)

Appendix IV. Details of 100 Climate-neutral Cities – By and for citizens

The following sections provide details of the climate-neutral cities mission as outlined within the European Commission's proposal (European Commission, 2020). Details and activities are organized under the ROAR framework developed by Mazzucato (2018). An outline of the main aspects of the mission's framework are provided in Figure 0-1.

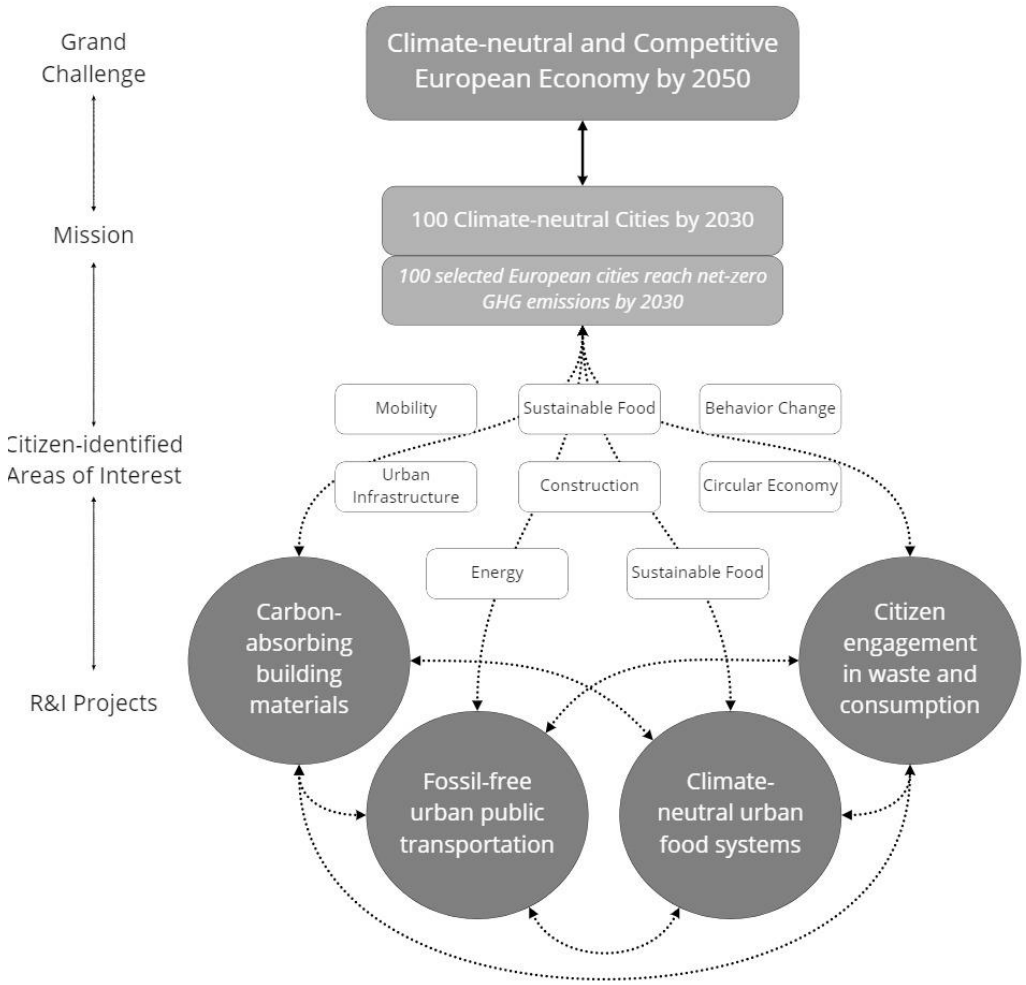


Figure 0-1. Climate-neutral Cities Mission components

Source: Adapted from Mazzucato (2018a, p. 22)

Routes and Direction

The mission pulls from the broader European Union objective of developing a climate-neutral and competitive economy by 2050 (European Commission, 2018b), utilizing the 100 selected cities as innovation hub which test and demonstrate solutions with the target of becoming climate-neutral by 2030. The arrangement is formalized through a Climate Contract which is co-developed by national/regional authorities, the European Commission and the city (including the business community, academic community and citizens/civil society)

(Kaźmierczak, 2018 p. 10). The Climate Contract serves the purpose of: expressing the ambition and commitment to the mission; highlight gaps in policy and implementation of climate strategy for the sake of driving change in these areas; build coordination between stakeholders, citizens and the government; link with the national- and international-level agendas for climate neutrality; and develop a platform for multi-level negotiation regarding issues of the transition toward Climate Neutrality (Clerici Maestosi et al., 2021). Specifications regarding the particular "market-tilting" activities that can be taken up by the state have not been specified, and will depend heavily on the context (i.e., legal, demographic, etc.) of the cities implementing the mission.

Organization

The approach of the climate-neutral cities mission begins by establishing a baseline regarding the cities' socio-ecological-economic dimensions and political stability, coupled with outlining existing gaps regarding climate policy. From this, cities can determine their own intervention through tools such as decarbonization pathways and theories of change, which, among other aspects, will highlight milestones, targets and timelines as well as identify relevant actors involved in the approach (Kaźmierczak, 2018). Alignment with regional, national and cross-border strategies (that should reflect the 2050 commitment to climate-neutrality) is also mandated, as well as the inclusion of citizen engagement (which has designated funding) (Ahvenniemi & Huovila, 2020; Kaźmierczak, 2018). The EU Mission proposal highlights the need for a multi-government approach through which stakeholders at all levels (e.g. private, public, R&I and civil society) utilize cross-sector and cross-scale functions (e.g. coordination, twining, scaling, designing, advising, training, monitoring, financial management, project management) through the use of instruments (e.g. financial, regulatory, taxation, procurement, incentives) (European Commission, 2020)

The economic transition towards climate-neutrality will be fostered through the development of innovation ecosystems including, but not limited to, the establishment of testbeds and/or urban living labs which allow for experimentation (the Missions R&I approach) (Bulkeley et al., 2019; Eneqvist & Karvonen, 2021; Jütting, 2020). Existing infrastructure will need to be upgraded and development of new districts can demonstrate climate-neutral practices (Mohareb & Kennedy, 2014; Wijk, 2020). Movement toward circular business models must also occur to reach this end, although barriers do exist (Bocken & Antikainen, 2019). Taken together, a paradigm shift will be needed that "breaks the silos in urban projects" by building capabilities including orchestration, capacitation (i.e. learning by experimenting) and evolutionary evaluation (European Commission, 2020 p. 15).

The process began in 2020 and will be further mobilized in 2021 through an open call for cities who will first be asked to do a self-assessment to determine their level of preparedness. The cities will then be invited to prepare an application for a Climate City Contract. These Climate City Contracts are not legally binding, but express ambition and commitment, identify gaps in policy and implementation to be overcome through strategy, unify stakeholders and citizens around a vision, link across governance levels at the national, regional and EU level (both legally and financially), and create a one-stop-shop for negotiations across all governance levels (Clerici Maestosi et al., 2021; European Commission, 2020; Kaźmierczak, 2018). The Climate Contract will involve: local government; citizens; other local stakeholders; national/regional government; national/regional stakeholders; and European stakeholders (European Commission, 2020). Strategy implementation is anticipated to begin by 2022.

Assessment

Monitoring of progress toward 2030 targets will be robust, transparent, and as simple as possible for cities to undertake. From the beginning of the Mission, Scope 1 and Scope 2 emissions will be monitored, as shown in Figure 0-2 below. It is suggested through the proposal that Scope 3 emissions are also accounted. The measurement of the direct (Scope 1), upstream (Scope 2) and downstream (Scope 3) emissions places an onus on city governments to establish reporting systems and build capacity among all relevant stakeholders for monitoring. Some potential challenges include determining who is responsible for measured emissions, double counting (particularly for Scope 3 emissions), a lack of unified measurement methodology, supply chain visibility and information, communication and technology barriers (Royo, 2020). Despite these challenges, the qualitative goal outlined in the proposal is to unblock transformative drivers along the decarbonization pathway toward climate neutrality (European Commission, 2020). Combining objective and transformative indicators, all measured biennially, allows for continual evolution along deep decarbonization pathways (Bataille et al., 2016). Furthermore, alignment with the European Digitalisation Strategy will be necessary for big data analytics which will help target emission reduction (Giest, 2017).

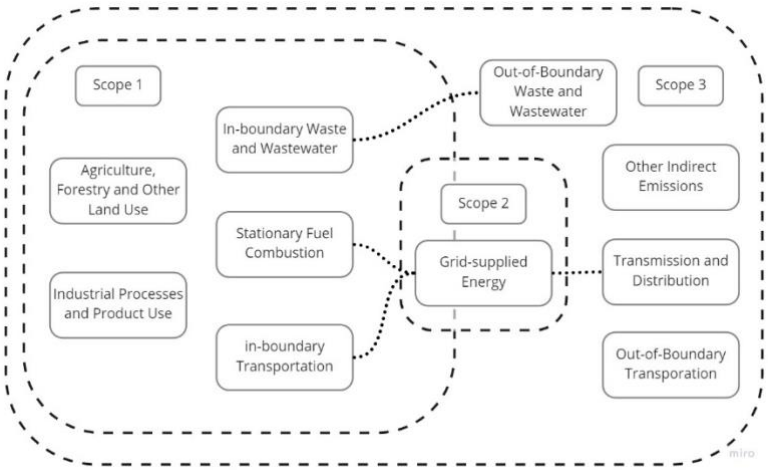


Figure 0-2. Emissions Scopes 1-3 under the Mission Proposal

Source: Adapted from European Commission (2020, p. 23)

Risks and Rewards

Co-funding of the Mission is anticipated at all levels from the R&I to implementation phases, although current systems for financing innovation and investment at the city level remains fragmented; a new Sustainable Europe Investment Plan provides a framework that is facilitated by the European Investment Bank and the EU multi-annual financial framework (MFF). The Mission proposal notes that leveraging of private investment will underpin success of the mission, but investment strategies are ongoing (European Commission, 2020). In a report commissioned by the European Commission indicated that for the mission, an estimated investment of EUR 96 billion will be required (Kaźmierczak, 2018). When assuming this investment risk, the sharing of rewards must also be taken into account; the same report noted the cumulative co-benefits such as air quality improvement, for example, will be EUR 121 billion between 2020-2050, although this pubic value is difficult to capture through existing financial instruments (Kaźmierczak, 2018).

Appendix V. Comparison between SMEs and large businesses

Table 0-1 Innovation potential of SMEs and large firms

SME Advantages
Flexibility of organization 1. Less bureaucratic 2. More responsive to change (technology and market) 3. Faster and more efficient internal communication channels **Owner/Manager** 1. Entrepreneurial, dynamic, extrinsically *and* intrinsically motivated 2. Horizontal leadership within firm structure 3. Directly connected to innovation activities
SME Disadvantages
Owner/manager 1. Poor managerial skills (short-term planning, lack of capacity, expertise, support) 2. Dependency on staff and external people for survival 3. Informal planning **Financial** 1. Difficulties securing investment from banks and risk capital sources (venture capital) 2. Failed innovation or internal/external experimentation could cause firm closure 3. High fixed costs for technological investments and start-up **Labor** 1. Recruitment challenges in attracting high-skilled personnel 2. More significant barriers for updating technical capacity
Large Companies Advantages
Financial 1. More likely to receive bank and venture capital investments 2. Less innovation risks given product and market diversity (sales) **Labor:** 1. More attractive to skilled labor **Knowledge** 1. More network and conference participation for knowledge updating 2. Systems for information management **Management:** 1. Decentralized management style for multi-level decision-making 2. Long-term planning and strategy
Large Companies Disadvantages
Management: 1. Top management isolated from customers and work floor. 2. Emphasis on short-term cost-cutting instead of long-term infrastructural enhancements. **Labor:** 1. No entrepreneurial fanatics tolerated **Flexibility of organization:** 1. Bureaucratic, highly formalized organization structure

Source: Adapted from Bos-Brouwers, 2010

Appendix VI. Documents collected

Data and Statistics (3):

Eriksson, S., Persson, E., Wessman, J., & Wiborg, T. (2020). *Scanian economy - Theme: Public finances [Skånsk konjunktur Tema: Offentlig ekonomi]*. www.oresundsinstituttet.org

Statistics Sweden. (2018). *System of Environmental and Economic Accounts*. https://www.scb.se/en/finding-statistics/statistics-by-subject-area/environment/environmental-accounts-and-sustainable-development/system-of-environmental-and-economic-accounts/

Statistics Sweden. (2020). *Structural business statistics*. https://www.scb.se/en/finding-statistics/statistics-by-subject-area/business-activities/structure-of-the-business-sector/structural-business-statistics/

Conference Recording (3):

Viable Cities. (2019). *Presentation Lars Coenen Viable Cities Strategy Day 11 April 2019*. https://www.youtube.com/watch?v=-V-cEQ8ZaOo

Viable Cities. (2019). *Presentation Dan Hill Viable Cities Strategy Day 11 April 2019*. https://www.youtube.com/watch?v=C6vqMthiZiU

Viable Cities. (2019). *Presentation by Olga Kordas Viable Cities Strategy Day 11 April 2019*. https://www.youtube.com/watch?v=OnCLDm4KhH4&t=25s

Strategy Documents (13):

European Commission. (2020). *Proposed Mission: 100 Climate-neutral Cities by 2030 – by and for the Citizens*. https://doi.org/10.2777/46063

European Commission. (2017). *Interim Evaluation of HORIZON 2020* (Issue January). http://ec.europa.eu/research/evaluations/pdf/book_interim_evaluation_horizon_2020.pdf#view=fit&pagemode=none

FIRS. (2020). *Skånes Innovation Strategy for Sustainable Growth*.

Lunds Kommun. (2017). *LundaEko II - Lunds kommuns program för ekologiskt hållbar utveckling 2014-2020 [Lund Municipality's Program for Ecologically Sustainable Development]*.

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Sweden, G. O. of. (2020). *Budget Statement: Budget Bill 2021*.

Viable Cities. (2021). *Climate agreement 2030 — Viable Cities*. https://en.viablecities.se/klimatkontrakt-2030

Tillväxtverket. (2018). *EU-programme Skåne-Blekinge - Tillväxtverket*. https://tillvaxtverket.se/eu-program/skane-blekinge.html

Tillväxtverket. (2020). *Hållbar utveckling i regionerna [Sustainable Development in the Regions]*. https://tillvaxtverket.se/amnesomraden/regional-kapacitet/hallbar-utveckling-i-regionerna.html

Government and Practitioner Websites (16):

EIT Climate-KIC. (2021). *Deep Demonstrations - Climate-KIC*. https://www.climate-kic.org/programmes/deep-demonstrations/

EIT Climate-KIC. (2021). *Overview - Climate-KIC Cities* . https://www.climate-kic.org/areas-of-focus/urban-transitions-2/overview/

KlimatAllians Lund. (2021). *About the Climate Alliance*. https://lundsklimat.se/english/about-the-climate-alliance/

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Lunds Kommun. (2018). *Open City Sensor Network | Future by Lund*. http://futurebylund.se/project/open-city-sensor-network

EIT Climate-KIC. (2018). *Work with us to achieve net zero, in time*. https://www.climate-kic.org/wp-content/uploads/2019/10/191029_EIT_Climate-KIC_FundingNetZero_Double.pdf

IDEON Science Park. (2021). *About us | Ideon Science Park*. https://ideon.se/about-us/

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Viable Cities. (2020). *Climate Neutral Lund 2030 — Viable Cities*. https://en.viablecities.se/foi-projekt/klimatneutrala-lund-2030

Viable Cities. (2018). *Digitally controlled cultivation systems in urban industrial areas — Viable Cities*. https://en.viablecities.se/foi-projekt/odlingssystem-industriomraden

Viable Cities. (2021). *30 cities want to take the lead in the climate transition — Viable Cities*. https://en.viablecities.se/nytt/30-stader

Viable Cities. (2019). *Digitala tomater [Digital Tomato] — Viable Cities*. https://en.viablecities.se/digitala-tomater

Blog (1):

Wise, E. (2021, May 11). *Stewarding innovation portfolios for the ecosystem: catalysing collective system change - Observatory of Public Sector Innovation Observatory of Public Sector Innovation*. Observatory of Public Sector Innovation. https://oecd-opsi.org/stewarding-innovation-portfolios-for-the-ecosystem-catalysing-collective-system-change/

Appendix VII. Interview guide

This list provides a basic structure of the interview questions asked of government and intermediary practitioners. Specific questions were constructed and adapted based on the in organization and interviewee's background. Additionally, interviews which were shorter may not cover all questions on the list, but the main themes that were covered in all interviews related to the extent of engagement with SMEs in the climate-neutral mission.

Government:

1. What is the status of implementation of the Climate Contract 2030, and the overall climate-neutral cities mission?
2. What do you perceive as the main challenges in implementing the climate-neutral cities mission?
    a. … in building commitment of SMEs and citizens?
    b. … in promoting bottom-up experimentation?
3. How does the city proactively engage SMEs in its environmental programme and/or the climate-neutral cities mission?
    a. … through political engagement?
    b. … when developing the climate contract?
    c. … through urban experimentation / innovation? (explain if needed)
4. What opportunities exist for SMEs to engage with the climate-neutral cities mission through the city?
    a. …how are these opportunities communicated to SMEs?
    b. …are SMEs interested in engagement with the mission?
5. What policies and practices does the city implement which might influence SMEs' sustainability-related behavior?
6. How is SME involvement in the mission important?
    a. What do you perceive as the potential role of SMEs as the mission advances?
7. What are the key challenges of engaging SMEs in the city's environmental programme and/or the climate-neutral mission?
    a. In what ways might the city work to mitigate these challenges?
8. What resources does the city provide to SMEs that are relevant to the mission?

Intermediaries:

1. How is your organization working on the climate-neutral cities mission?
    a. In what ways do you specifically work on the climate-neutral cities mission?
2. What do you perceive as the main challenges in implementing the climate-neutral cities mission?
    a. …overall?
    b. …in your organization's mission-related work?
3. How does your organization engage with SMEs?
    a. …through programs?
    b. …through outreach?
4. What opportunities exist for SMEs to engage in the climate-neutral cities mission through your organization?

   a. …how are these opportunities communicated to SMEs?
   b. …are SMEs interested in engagement with the mission?
5. What value do you add to SMEs?
   a. What value do SMEs add to your organization and network?
6. What is your approach to managing relationships within your network?
7. How do members of your organization (and network) work with each other?
   a. …how do they work with SMEs?
8. How is SME involvement in the mission important?
   a. What do you perceive as the potential role of SMEs as the mission advances?
9. What are the key challenges of engaging SMEs in your organization's work?
   a. In what ways might your organization mitigate these challenges?
10. What resources do you provide to SMEs that are relevant to the mission?
   a. What resources do your members provide to SMEs?

Appendix VIII Coding structure

For coding of SME characteristics and general role, coding occurred in later stages of analysis and then aligned with literature.

SME Characteristics

- Strengths
- Weaknesses

In relation to RQ1, the influence of identified characteristics on SMEs' contribution to the climate-neutral cities mission were derived through the subsequent coding structure below. Furthermore, for each of the engagement activities identified below, drivers and barriers were identified based on participant responses.

Initial codes were deductively identified from the literature as to 1) categorize the type of governance principle, which are **bolded,** and 2) identify the specific activities as outlined in the literature, which are underlined. Furthermore, the initial codes were then inductively extended based on responses.

Drivers and Barriers to Engagement and SME's Impact

1. Strategic Direction Setting

- Transition arena
- Vision Development
    - *Continued political engagement*
- Climate Contract

2. Tactical Organization

- System Analysis
- Network Integration
    - *Resources and Engagement*
    - *Underlying Drivers*
    - *Indirect Drivers*

3. Operational

- Market Tilting Policy Mix
    - *Regulatory*
    - *Economic*
    - *Enabling*
        - *Land allocation*
- Experimentation

4. Reflexive Governance

- Monitoring
- Scaling and Replication
- Integrated Planning
- Sharing Risk and Reward

Appendix IX. LFM 30 – Malmö

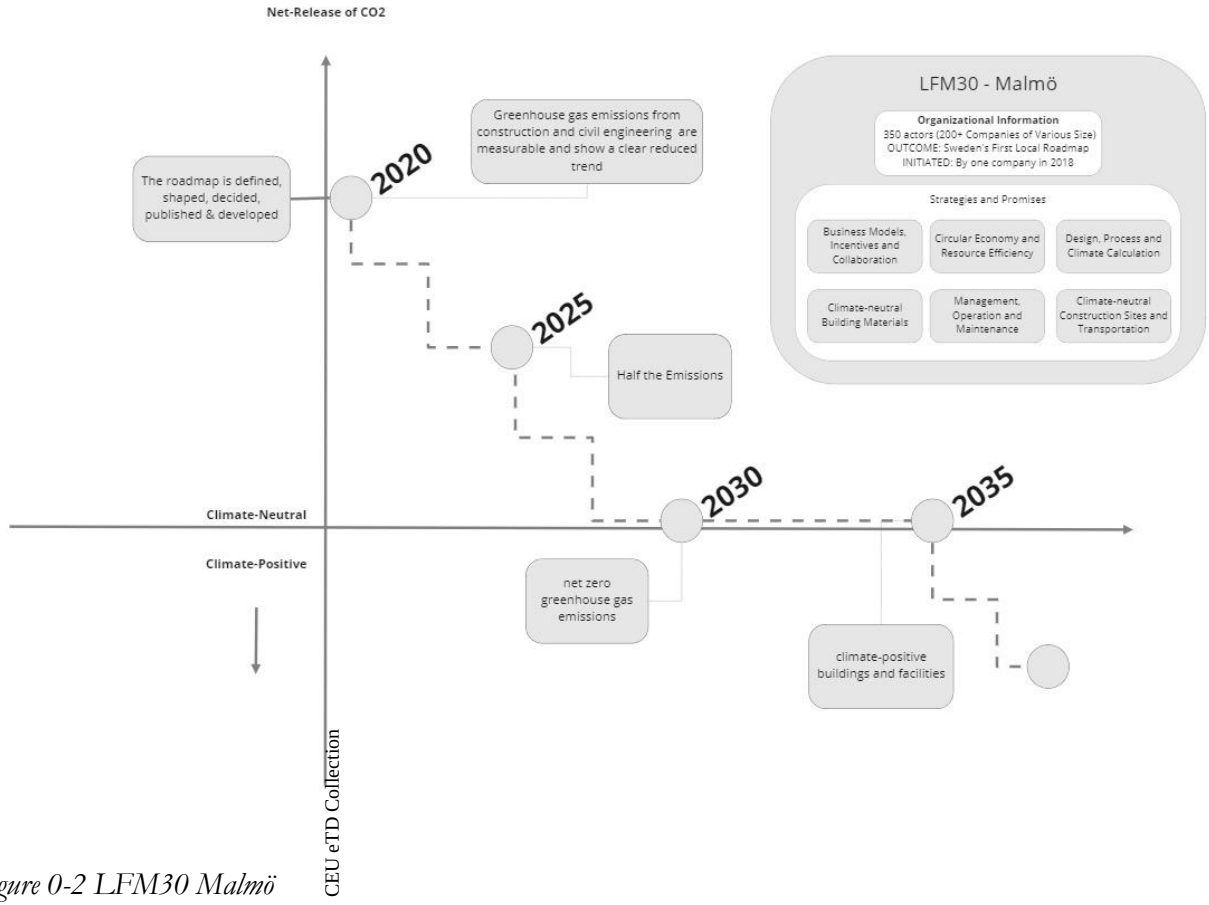

Figure 0-2 LFM30 Malmö

Source: Author's own illustration based on (LFM30, 2021c, 2021b)