

The role of municipal governments in the sustainability transition – research and experimentation

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Abstract

Municipal governments play a key role in creating sustainable societies. To support the municipal sustainability agenda, diverse stakeholders such as academia, civil society and the private sector have set up collaborations covering experiments in the fields of digitalization, construction, and climate change, as well as inclusion and democracy. To understand the trends, we have assessed how nine municipal governments in Sweden (Gothenburg, Linköping, Lund, Malmö, Nacka, Örebro, Östersund, Västerås and Vellinge) have engaged with research and innovation projects, funded by four Swedish funding agencies. We analysed the projects according to budgets, partners and topics. Our results provide insights into the priorities of these cities and highlight knowledge and collaboration gaps.

1. Introduction

With over 50% of the world population living in cities (URBANET 2016), urban municipalities are struggling with environmental degradation, pollution, safety, housing and social inclusion. In Sweden, challenges relate to a shortage of housing, overcrowding, socio-economic segregation, high climate emissions, high use of materials, eutrophication of waterways, and a loss of biodiversity (Government Offices of Sweden 2021). These challenges are caused by unsustainable production and consumption patterns in socio-technical systems, such as energy, transportation, housing, agriculture and food; and cannot be solved by incremental improvements but warrant fundamental change towards a new socio-technical system, referred to as “sustainability transitions” (Köhler et al. 2019).

Sustainability transitions are “long-term, multi-dimensional, and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption” (Markard et al. 2012, p. 956). Such transitions entail a fundamental change in technological, institutional, political, economic, and socio-cultural systems, and require institutions to break with path dependency, or deeply ingrained systems that are unsustainable and

create “lock-ins”. Several research frameworks are available for interpreting sustainability transitions (Köhler et al. 2019):

- The Multi-Level Perspective studies the interactions and alignments that occur between niche innovations, sociotechnical regimes and the sociotechnical landscape (see e.g. Geels 2002; Geels & Schot 2007; Smith et al. 2010).
- The Technological Innovation System approach focuses on studying the development of novel innovations, rather than studying the path dependency and stability of contemporary regimes (see e.g. Markard et al. 2015; Negro et al. 2008).
- The Strategic Niche Management approach stresses the importance of social networks and learning processes for niche innovation to develop (see e.g. Geels & Raven 2006; Schot & Geels 2008).
- The Transition Management approach focuses on policies and policymakers’ role in enabling transition processes and radical innovation (see e.g. Loorbach 2010).

In summary, sustainability transitions occur when novel products, business models and organizations emerge and complement or replace existing ones, leading to substantial institutional, technological and cultural change (Markard et al. 2012).

Cities have immense potential for such transformation (Romero-Lankao et al. 2018). Overall, municipal governments play a central role in creating sustainable societies, regardless of the definitions of a sustainable city (see e.g. Marvuglia et al. 2020) for a bibliometric review of the concept; or Ahvenniemi et al. 2017; de Jong et al. 2015; Hamman 2017, for a comparison of different concepts). In the current “decisive decade of action”, municipal governments are essential to achieving the UN Sustainable Development Goals (SDGs), in particular SDG 11 on the creation of sustainable cities and communities, as well as other SDGs, such as SDG 4 on quality education, SDG 7 on affordable and clean energy, and SDG 8 on decent work and economic growth (OECD 2020).

In Sweden, development goals were first agreed in 1999 through “generational goals”. They are currently comprised of 16 focus areas, such as reduced climate impacts, clean air and clean water (Naturvårdsverket 2020). They have been incorporated within Swedish municipal governments’ own sustainability plans, partly because municipal governments are responsible for, among other things, the environment, waste management, energy provision, housing and social welfare, and economic development within their geographic areas (European Committee of the Regions 2019). Several other strategies and policies also support municipal governments: in 2018, for example, the Swedish government issued the Strategy for Liveable Cities as its guiding framework, focusing on transport,

green spaces, inclusive and sustainable urbanization, and the reduction of the environmental impact of cities (Government Offices of Sweden 2018a), as well as a Policy for Designed Living Environment, aimed at developing a people-centred, inclusive and well-designed sustainable society (Government Offices of Sweden 2018b). Furthermore, the Swedish urban environment agreements, set up in 2015, provide support to municipal governments to improve public transportation, bicycle traffic and freight transport (Government Offices of Sweden 2015).

Within transition theory, experimentation has recently entered as a way to accelerate urban transformations, as it enables social learning by offering a space where innovations can be tested (Williams 2016). More broadly, experimentation is viewed as a new form of urban governance (Bulkeley et al. 2015), as it allows a response to the complex challenges facing local governments. Benefits of urban experimentation, also referred to as “pilot projects”, “urban living labs” and “urban labs”, are that have the power to create a new sense of place among participants in the collaborative process, together with new visions of organizing urban space (Frantzeskaki et al. 2018). Experimentation can create new social bonds and networks within a community. As such, urban living labs and experimentation more broadly have the potential to enable sustainability transitions (Frantzeskaki et al. 2018).

Despite all of these emerging findings mentioned above, some areas of sustainability transitions and urban experimentation remain understudied, including ethical aspects such as distribution of benefits, climate justice and poverty (Köhler et al. 2019). Furthermore, Evans and Karvonen (2014) demonstrated how powerful urban actors can presume their property ownership of a collaborative space of innovation, thus exerting their influence of the development of urban space. It is therefore crucial to include different organizations and rights holders in the design, implementation, and control over sustainability transitions pathways.

Sustainability transitions are inherently complex and stretch over different institutions and geographical scales. As such, by incorporating different actors into the innovation process it can better facilitate a transition towards more sustainable ways of living. Recently, scholars have emphasized the importance of including civil society into innovation systems, aside from academia, industry and government. The triple helix model, comprising of the latter three, has been extended to a “quadruple helix model”, adding civil society organizations (Campbell et al. 2015; Carayannis & Campbell 2012).

Taking the above into account, we aim to understand how Swedish municipal governments engage in sustainability transitions through research and experimentation. We analysed their involvement in

research projects to uncover the topics on which they focus and the networks in which they engage. This further allowed us to understand the extent to which the role of municipal governments is changing in relation to research and experimentation, and to understand whether they are effectively collaborating with all stakeholders in society. This paper is structured as follows: in section 2, we describe the methodology and methods for analysis. In section 3, we present our results, and in section 4, our conclusions. This section also addresses some limitations of the research.

2. Methods and materials

We obtained a list of projects granted between 2011 to 2020 to nine Swedish cities from four Swedish funding agencies:

- 1) Formas (<https://formas.se>), a Swedish research council for sustainable development, which distributes over 1.5 billion SEK per year to research projects;
- 2) Forte (<https://forte.se>), the Swedish Research Council for Health, Working Life and Welfare, which provides about 700 million SEK per year for research in health, working life and welfare on behalf of the Swedish Ministry of Health and Social Affairs;
- 3) Vinnova (<https://vinnova.se>), Sweden's innovation agency, which operates under the Swedish Ministry of Enterprise and Innovation and invests about 3 billion SEK in research and innovation annually; and
- 4) Energimyndigheten (<http://energimyndigheten.se>), the Swedish Energy Agency, which operates under the Swedish Ministry of Infrastructures and distributes subsidies to municipalities for energy and climate advisory services and stimulates the development of new technologies and systems for energy supply.

Formas, Vinnova and Energimyndigheten collaborate in 17 Strategic Innovation Programmes, or large programmes that are deemed to be of strategic importance for Sweden. Disclosure: One of these programmes is Viable Cities, which funds the research reported in this paper. We also contacted Vetenskapsrådet, the largest of the Swedish government's research councils, under the Swedish Ministry of Education and Research, which allocates almost 7 billion SEK per year to research projects. This research council, however, had no projects that were awarded to any of the nine cities, either as a lead or as partner in a consortium.

We focused on nine Swedish cities: Gothenburg, Linköping, Lund, Malmö, Nacka, Örebro, Östersund, Västerås and Vellinge. These cities were selected because they have issued labelled bonds (financial instruments) prior to 2020, which indicates their willingness and ability to engage with organizations, such as private investors, that are traditionally not part of the municipal governments' core network,

and their frontrunner role related to sustainable development. As part of the process to issue a labelled bond, these cities have reviewed their sustainability plans and set sustainability goals. Together, they represent about 17% of the Swedish population (Figure 1).



Figure 1. Map of Sweden, with the nine cities selected for this study highlighted.

We cleaned and merged the lists of projects sent by the different funders, and our final dataset contained the following data:

- Project information: project number, project name, name of the funder (Formas, Forte, the Swedish Innovation Agency or the Swedish Energy Agency), project start date and end date, total funding awarded to the project.

- Topic: project abstract and research field. All projects were coded according to sector and theme. The ten sectors include: arts, recreation and tourism; care, education and wellbeing; climate and resource efficiency; construction; energy systems; food systems; government; labour and economic opportunities; transport and mobility; urban planning and green spaces. The ten themes include: AI and automation; behavioural change; business development; capacity building; digitalization; inclusion and citizen participation; metrics and tools; procurement; product development; and test beds. For example, the Vinnova-funded project “Agelab” (project number: 2019-01702) was coded as “care, education and wellbeing” (sector) and “digitalization” (theme); the Vinnova-funded projects “Timber on Top” (project numbers: 2018-02753 and 2019-03053) were coded as “climate and resource efficiency” (sector) and “product development” (theme); the Forte-funded project “Developing functional leadership behaviours among managers in local government organizations” (project number: 2018-00955) was coded as “government” (sector) and “capacity building” (theme).
- Consortium: name and type of organization of the project lead and project partners. Organization types were academia (including research institutes outside of universities); industry (including small and medium-sized enterprises); government (municipal government, regional government and national governments and agencies); and civil society.

We applied descriptive statistics (including histograms) to the dataset to understand general trends. In the section below, we provide the results of that analysis.

3. Findings: a changing landscape

From 2011 to 2020, 452 grants were awarded to research projects where one or more of the nine municipal governments participated. About one in three projects (137 of 452) are or were led by one of the municipal governments in our sample. In 2020, 151 projects (33%) were ongoing.

In total, the funding for these 452 projects was 1.7 billion SEK [average project budget: 3.7 million SEK; range: 0 SEK (budget not disclosed) to 51 million SEK]. Formas funded 78 projects, with a total value of 64.9 million SEK; Forte, 7 projects with a value of 43.1 million SEK; the Swedish Energy Agency, 45 projects with a value of 136 million SEK; and the Swedish Innovation Agency, 392 projects worth close to 1.5 billion SEK. Projects lasted on average for 21 months (range: 1 month to 73 months) and the consortia consisted of 8 partner organizations on average [range: 1 organization to 59 organizations].

Looking at the trends, we observe the following over the past decade:

1) A more diverse set of funders awarded an increased number of projects to more municipal governments.

Whereas in 2011, only 13 projects were awarded to our sample of cities, an exponential increase is seen in the years that followed. By 2020, 57 new projects were awarded to the municipal governments as partners in the project.

A change in funders can also be observed: in 2011, only the Swedish Innovation Agency and the Swedish Energy Agency awarded funding (with 12 and 1 projects respectively). In 2016, Forte started allocating funding to projects that had municipal governments in the consortia, and in 2019, Formas awarded funding too (Figure 2a).

Looking at the municipal governments' involvement in projects, we also note that more municipal governments have become part of the awarded projects over time (Figure 2b). In 2011, five of the nine municipal governments took part in research projects awarded by the four funders. By 2013, eight of the nine municipal governments took part and in 2015, all nine municipal governments took part in at least one project. Overall, Gothenburg municipal government has been or is now involved in 187 projects, followed by Malmö (138 projects), Lund (69 projects) and Västerås (29 projects). All other municipalities participate in on average 1-3 projects per year, aside from Vellinge who only joined in 4 projects. Vellinge municipality is also the only municipal government in our sample that does not lead any of the research projects awarded by the four funding agencies.

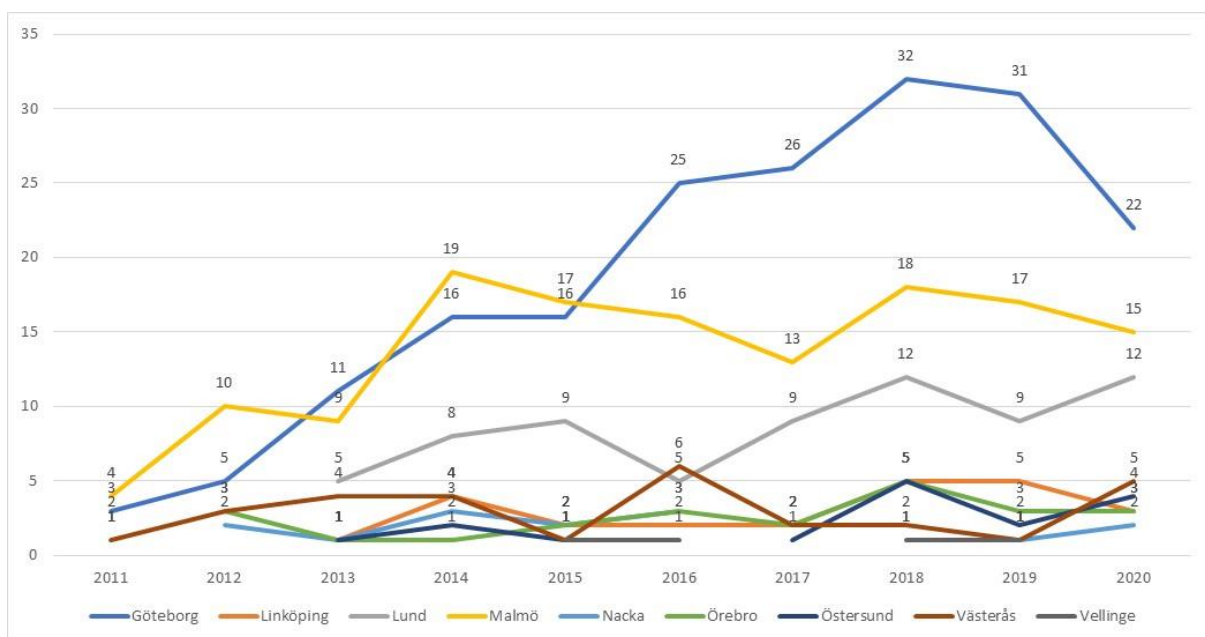
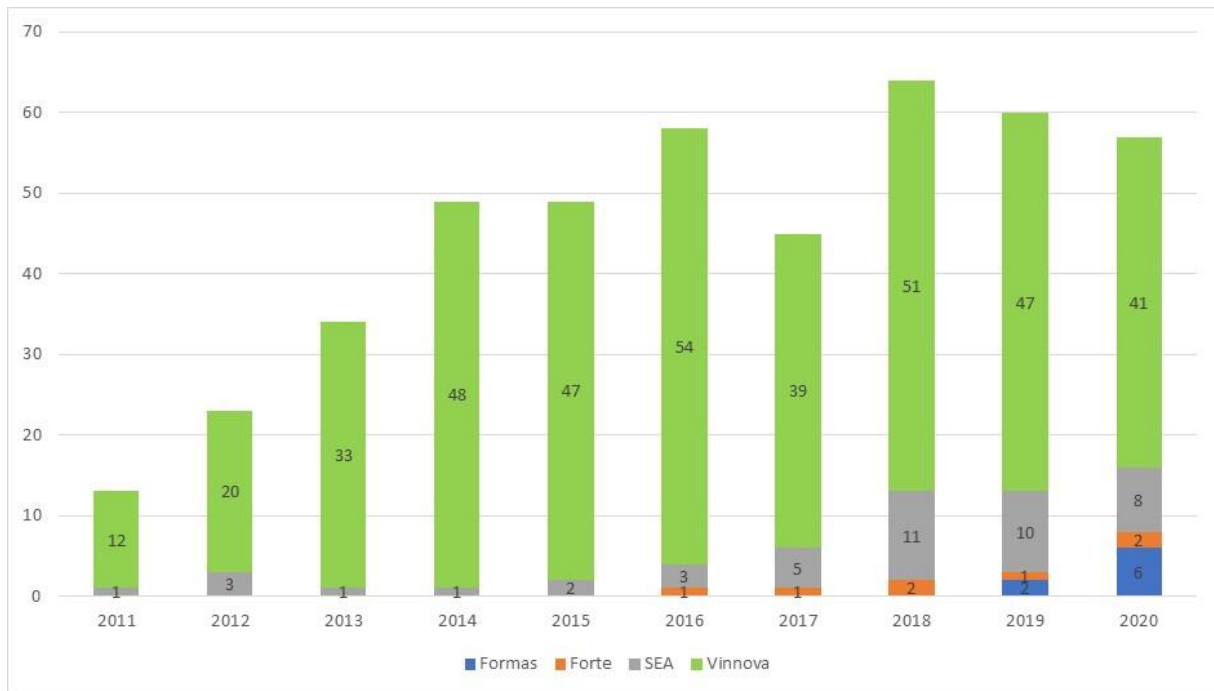


Figure 2. Total projects awarded per a) funder and b) municipal government.

Source: own analysis; n = 452.

2) Municipal governments are less often in a leading role, especially in the more traditional research projects funded by the research councils.

In 2011, four of the 13 projects (31%) were led by municipal governments (3 by Malmö and 1 by Västerås). By 2020, they led 11 of the 57 (19%) awarded projects (Figure 3). This is due to a change in the funding landscape:

- 1) the Swedish Energy Agency awarded 21 projects where a municipal government leads (44% of its 48 projects)
- 2) the Swedish Innovation Agency awarded 112 projects where a municipal government leads (29% of its 392 projects).
- 3) Of the 8 projects that Formas awarded, only 1 is led by a municipal government (Malmö). Until recently, Formas only awarded projects to academic institutions.
- 4) None of Forte's 7 projects are led by a municipal government.

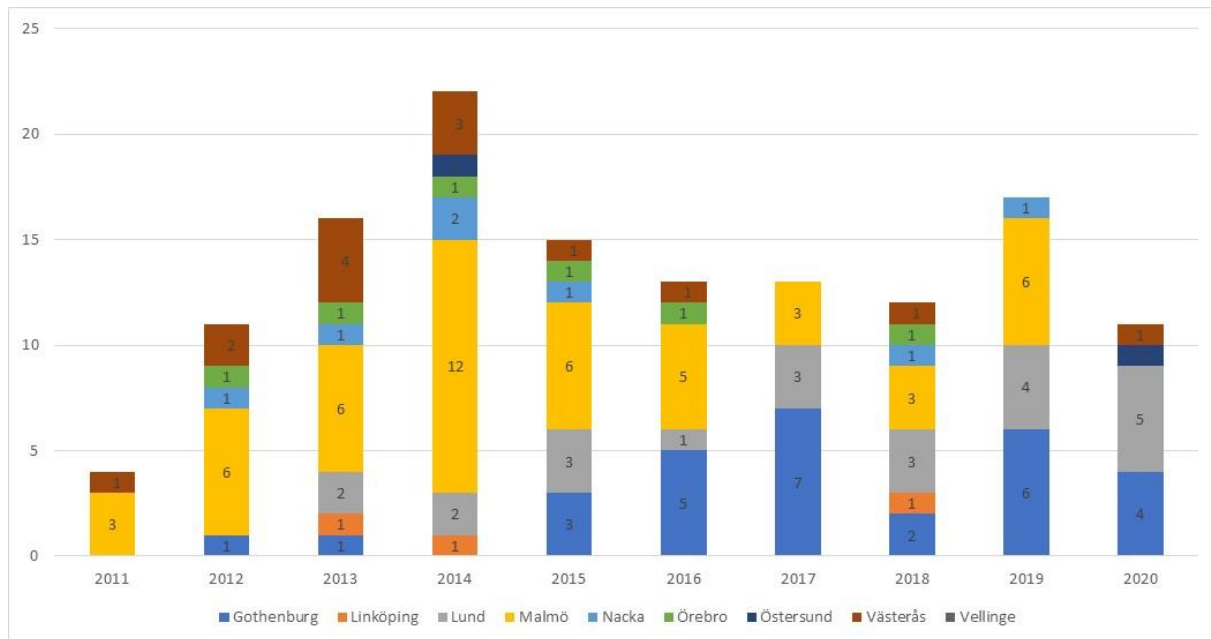


Figure 3. Projects awarded with municipal governments as project coordinator.

Source: own analysis; n = 452.

3) Projects have become more complex, diverse, and larger.

They entail more partners. Consortia have become more diverse, with different types of organizations collaborating more in recent years. Civil society seems underrepresented: most consortia are still “triple helix models”. Projects have received substantially larger budgets; however, budgets per partner organization are declining.

Their duration has remained roughly the same. There is only a minor increase in project duration from, on average, 19 months duration for projects awarded in 2011 to, on average, 20 months in 2020.

The project consortia have become slightly larger (from, on average, 7 organizations in 2011 to 8 partner organizations in 2020). The consortia constellation has also changed (Figure 5). Whereas in 2011, it consisted of 45% industry partners, 31% government partners, 20% academia and 3% civil

society; in 2020, the average consortium consisted of 59% industry, 25% government, 14% academia and 2% civil society:

- 1) The Formas' project consortia are triple helix constellations: industry, academia and government represent 98% of the consortium partners (35%, 33% and 30% respectively). Only one civil society organisations participated across the eight projects.
- 2) The projects awarded by Forte only have academia and government as official partners (62% and 38% respectively). It should be noted that for four of the seven projects, project participants had an affiliation with both a university and a municipal government. It is unclear to what extent municipal governments are represented in those projects.
- 3) Up until 2015, the projects funded by the Swedish Energy Agency up consisted only of municipal governments. Since 2016, industry and academia have also joined in on projects (48% and 21% of the consortium, with government making up 25% of the consortium). Civil Society only officially became part of projects in 2019 but have had a marginal role (4% of the consortium, on average, in 2020). The average consortium size is 7 partners in 2020.
- 4) The Swedish Innovation Agency's projects have always entailed all types of organizations. In 2011, industry, government and academia made up 97% of the consortium (46%, 30% and 21%). By 2020, the average consortium consisted of 53% industry, 28% government and 16% academia. Civil society's involvement remained marginal throughout the whole period (1 to 3% on average).

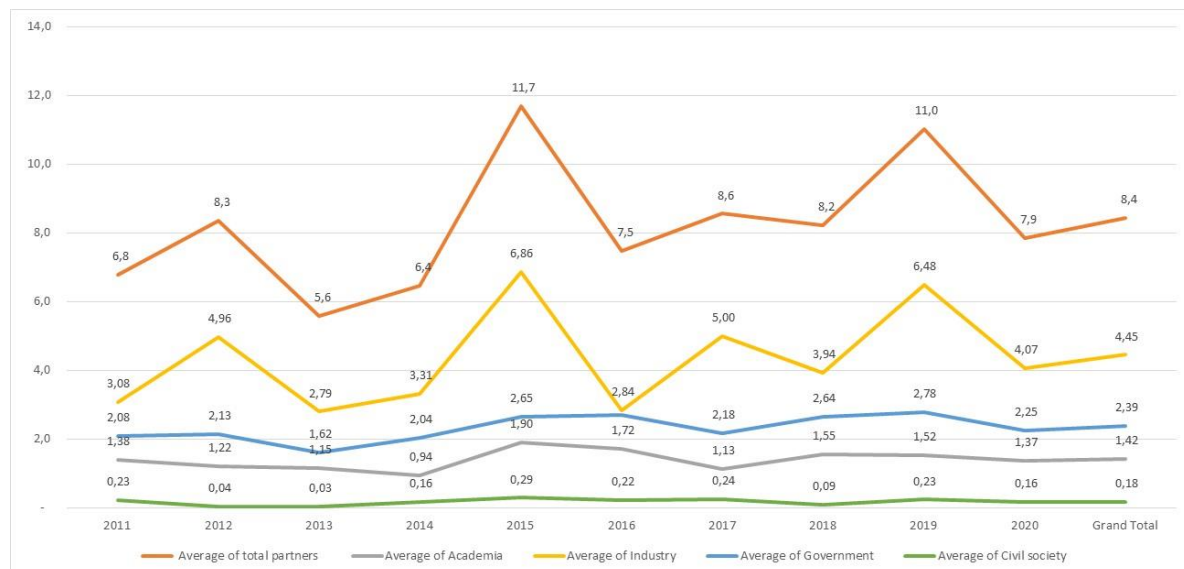
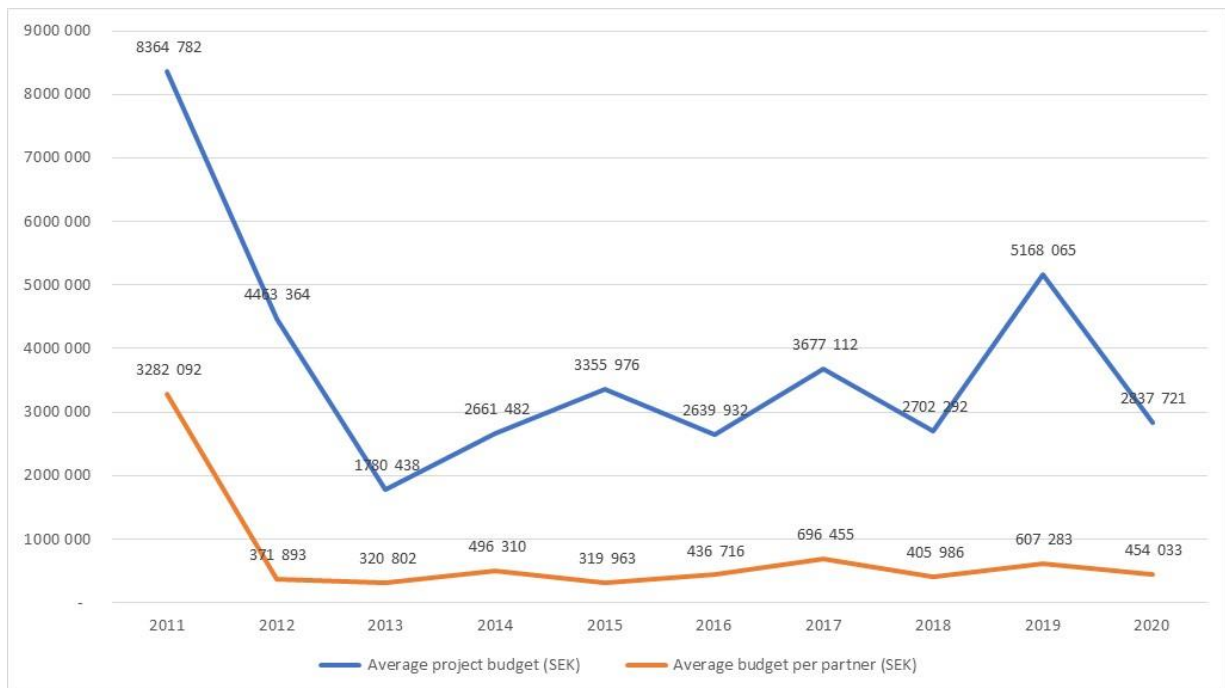
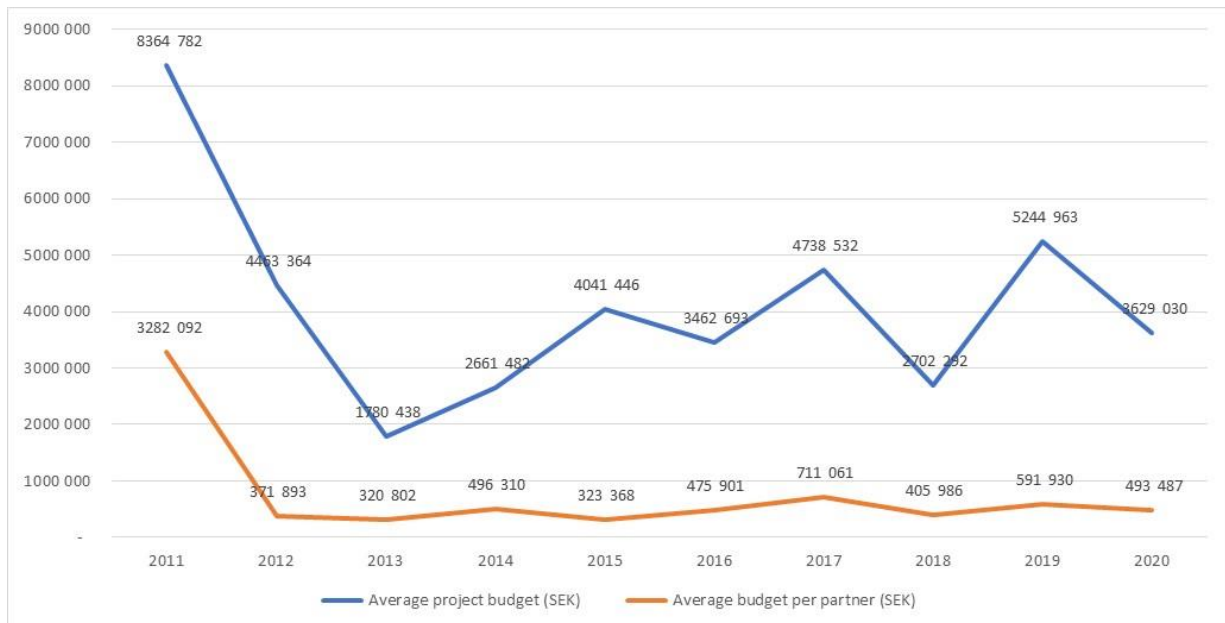


Figure 4. Average size of the project consortium, total and by type of organization.

Source: own analysis; n = 452.

Looking at the budgets, the average funding per project has decreased substantially from, on average, 8.4 million SEK in 2011 to 3.6 million SEK in 2020. Per partner per project, the average budget decreased from 3.3 million SEK in 2011 to 493 000 SEK in 2020 (Figure 5a). After removing a few outliers¹, our analysis showed that the budgets have decreased substantially (from 8.4 million SEK on average in 2011 to 2.8 million SEK on average in 2020). Per partner per project, the average budget decreased from 3.3 million SEK in 2010 to 454 000 SEK in 2020 (Figure 5b).



¹ These outliers were removed, given the size of the budget, project 2020-02843 (Formas) and 2017-02473 (Vinnova); the size of the consortium, project 2019-04466 (Vinnova) and 2015-03991 (Vinnova); and duration, 2016-00418 (Vinnova) and 2016-07128 (Forte)

Figure 5. Average project funding per project, and per partner per project: a) all; b) outliers removed.

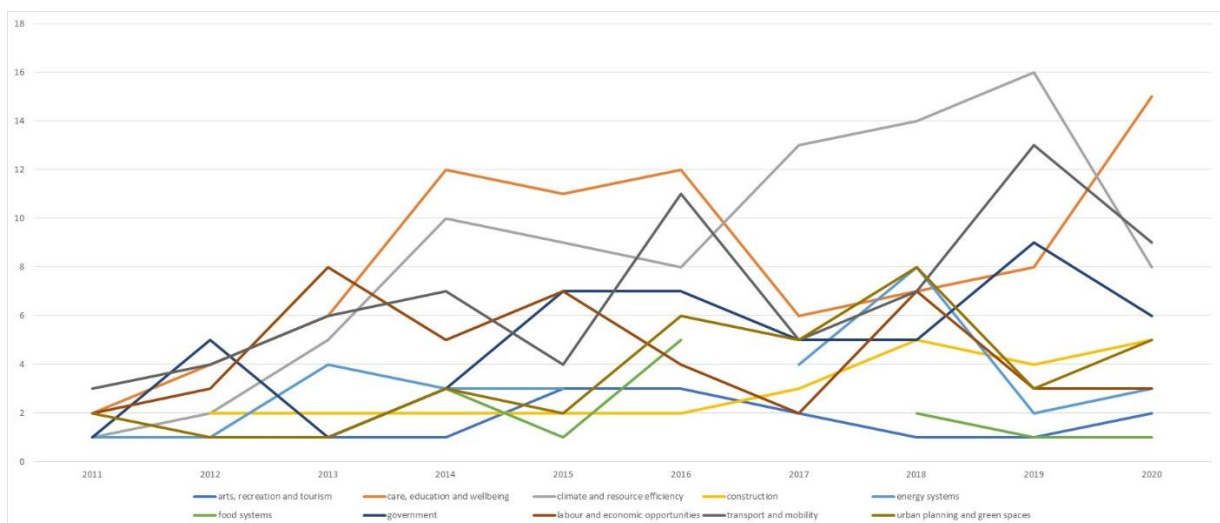
Source: own analysis; a) n = 452; b) n = 444.

4) More municipal governments engage with a wider variety of and an increasing number of topics.

Whereas in 2011 the municipal governments engaged in projects focusing on eight sectors, by 2014 they worked across the 10 different sectors and have continued to do so (Figure 6a). “Climate and resource efficiency” is the sector most projects focus on (86 of 452 projects) and it also receives most funding: 417 million SEK of the 1.7 billion SEK awarded. The sector “care, education and wellbeing” has the second highest number of projects (83 of 452 projects) but is in fourth place in terms of funding size (212 million SEK). The “transport and mobility” sector, with 69 of 452 projects worth 237 million SEK, takes third place in terms of number of projects and budget.

A similar trend is observed for the themes: in 2011, they worked on 8 themes, but by 2013, they were involved in projects across the 10 themes (Figure 6b). “Digitalization” is the theme that is worked on most (120 of 452 projects) and also receives most funding (445 million SEK of 1.7 billion SEK), followed by “business development” (75 of 452 projects, worth 327 million SEK), and “product development” (71 of 452 projects, worth 247 million SEK).

Combining both sector and theme, most funding is allocated to “product development” in the “climate and resource efficiency” sector (148 million SEK of 1.7 billion SEK), “digitalization” in the “care, education and wellbeing” sector (138 million SEK of 1.7 billion SEK), and “business development” in the “climate and resource efficiency” sector (103 million SEK of 1.7 billion SEK).



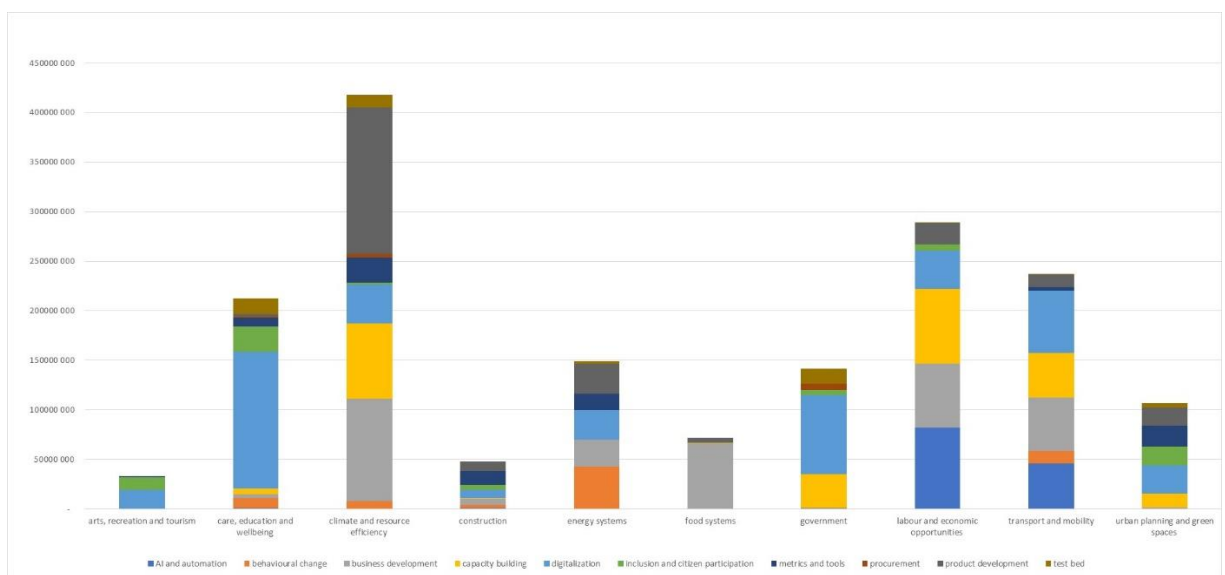
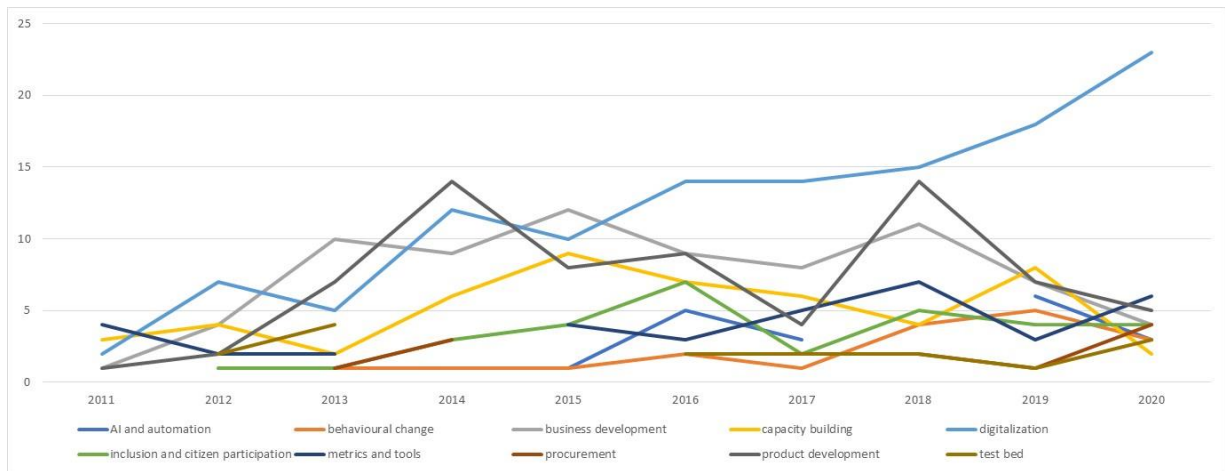


Figure 6. Overview research topics, by a) sector, b) theme, and c) sector and theme together.

Source: own analysis; n= 452.

4. Conclusion

The research funding awarded to nine Swedish cities by four Swedish funding agencies in roughly the past decade shows an increased involvement of municipal governments. Our analysis indicates an exponential increase in projects awarded where municipal governments take part, increasing their work in helping to resolve societal challenges through research collaborations.

We notice increased complexity: the consortia have become larger, the municipal governments focus on more topics (sectors and themes), and the average budgets have become smaller, per project as well as per project and per partner. The projects are not substantially longer. This increased complexity could bring with it delivery risks and would be good to monitor further. Did projects deliver

as anticipated? Were there unforeseen challenges in the partnership? Do partners continue to collaborate in new projects?

We also notice an underrepresentation of civil society across all projects. This absence is of particular concern in two sectors, “care, education and wellbeing” (5% of the average partnership) and “arts, recreation and tourism” (6% of the average partnership), and in the three themes of “inclusion and citizen participation” (7% of the average partnership), behavioural change (“4% of the average partnership”), and “digitalization” (2% of the average partnership). An interesting strand of research could be to uncover why civil society organizations are not part of research projects, as they have a substantial role to play in the uptake of research results.

We see several limitations of our research. We did not evaluate whether these projects delivered on their anticipated outcomes, which is something we also highlight above in terms of future research. Further analysis could be done by including other funders, such as foundations and international funding agencies such as the EU, to complete the analysis. The importance of transnational networks for increased research and learning has been well documented (Kern & Bulkeley 2009; Rashidi & Patt 2018), and Swedish municipal governments have joined in a multitude of networks. Assessing research projects awarded by non-Swedish funders and foundations would allow further understanding of how these networks manifest in actual research participation by municipal governments, both inside and outside of Sweden.

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