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Are Local Authorities Building Their Capacity to Plan for Reduced Climate Impact? A Longitudinal Analysis of Swedish Comprehensive Plans

Vincent Wretling *  and Berit Balfors

Department of Sustainable development, Environmental Science and Engineering, KTH Royal Institute of Technology, S100 44 Stockholm, Sweden; balfors@kth.se

* Correspondence: vincentw@kth.se

Abstract: Spatial planning conducted by the local authorities has been identified as a key part of shaping carbon-neutral societies. Nevertheless, the question of whether local authorities are building their institutional capacity for integrating climate change mitigation aspects into spatial planning remains under-researched. This paper aims to fill this gap while also analysing the role of Strategic Environmental Assessment (SEA) in facilitating organisational learning. The methods employed were a longitudinal document analysis of Comprehensive Plans belonging to eight municipalities in Stockholm County, complemented by a focus group interview. A significant difference was identified, as the recently adopted Comprehensive Plans included more strategies for climate change mitigation and, to a greater extent, linked these strategies to reduced climate impact or energy efficiency than previously adopted Comprehensive Plans. However, numerous additional strategies could have been given further consideration in each studied Comprehensive Plan. Thus, this calls for more continuous and cyclical comprehensive planning processes to facilitate capacity building, primarily by being a vehicle for mobilising political support. Lastly, the findings indicate that SEA can lead to organisational learning of both single-loop and double-loop nature, where the latter can enable SEA to shape the planning process in a more profound and sustainability-oriented manner.

Keywords: spatial planning; urban planning; local authorities; climate change mitigation; climate policy integration; Strategic Environmental Assessment; institutional capacity building; organisational learning; longitudinal analysis; sustainable development



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1. Introduction

The ongoing climate crisis has been argued to be the greatest imminent threat to humanity and ecosystems [1]. It is thus of utmost necessity to pursue multiple different solutions to curb emissions imminently. A potentially essential piece of the puzzle is to utilise spatial planning as a tool to achieve carbon-neutral societies [2]. Spatial planning is predominantly a task of local authorities, which are highlighted as key actors for decarbonisation due to their broad set of responsibilities for providing services and conducting different types of local planning [3,4].

The consideration of climate change mitigation in spatial planning could be realised in a variety of ways. It could include aspects concerning energy efficiency, often in relation to reducing transport demand by promoting more compact urban density with mixed land use [5]. Proximity to public transport and good preconditions for cycling and walking are other factors to be considered in spatial planning [6]. In addition, renewable energy production at a small scale, e.g., ensuring the possibility of utilising photovoltaics in the future by the orientation and relative placement of buildings, and at a large scale, e.g., wind farms and solar farms, ought to be accounted for [7]. Further, an aspect to consider is the distribution of renewable energy sources so that they can be consumed in favour of fossil fuels. This could be undertaken through the planning of district heating [8] as

well as facilitating the electrification of the transport fleet by ensuring accessibility to charging stations for electric vehicles [9]. As global warming sets new records and its impacts become clearer, the need for local authorities to consider aspects of climate change mitigation in their spatial planning is correspondingly intensified. The ability of authorities to respond to such a challenge will, nonetheless, be highly dependent on their institutional capacity, that is, their ability to respond and manage pressing social and environmental issues in planning, decision making, and implementation [10,11].

A planning tool with the potential to aid consideration of climate change mitigation aspects in spatial planning is Strategic Environmental Assessment (SEA) [12]. SEA is a systematic process intended to assess the environmental effects of a plan, policy, or programme to enhance the environmental considerations of planning [13,14]. It must be conducted for all plans and programmes that meet the following criteria: (i) Are adopted by an authority in the European Union, (ii) Are required by legislative, regulatory or administrative provisions, and (iii) Are found likely to bring significant environmental effects in an initial screening procedure. The findings of the process should be presented in an environmental report [15]. Climatic factors are included in the list of issues to be considered in the SEA (*ibid.*), a fact underlining the potential of this regulatory planning tool to promote the integration of climate change mitigation aspects into strategic spatial planning. Although SEA, in theory, could aid in considering climate change in planning, previous research of spatial plans in Germany and the UK has shown that global climate impacts and national climate targets were seldom considered even where SEA was utilised [16]. Moreover, experiences from Denmark show that climate change mitigation is integrated into half of the studied SEA reports for spatial plans [12]. One way that SEA can contribute to building institutional capacity for integration of climate change mitigation aspects into spatial planning corresponds to its potential to facilitate organisational learning [17].

Sweden, which has often been claimed to be a frontrunner in sustainability efforts such as mitigating climate change [18,19], adopted a Climate Act [20] at the beginning of 2018, and its first climate policy action plan in December 2019 [21]. These policy instruments are a vital part of the ongoing efforts at the national level to reach Sweden's climate objective of becoming carbon neutral by 2045. However, the success of this climate objective will depend heavily on the actions of Swedish municipalities [22] and the support provided by the regional authorities [23]. A key aspect of the municipalities' possibilities to contribute to decarbonisation lies in how they conduct their spatial planning [24]. One statutory spatial plan where climate change mitigation aspects could be integrated, covered by SEA requirements, is the Comprehensive Plan (CP), required to be adopted by all of Sweden's 290 municipalities [25]. Despite extensive research on the relationship between land use planning and climate change [26], studies concerning how the consideration of climate change mitigation aspects in spatial planning has developed over time are scarce [27].

Therefore, the overall aim of this paper is to investigate whether and how local authorities have been building their institutional capacity for integrating climate change mitigation aspects into spatial planning over time. Two specific aims have been established, revolving around the integration of climate change mitigation aspects into Comprehensive Plans in Stockholm County:

- (i) Analyse which aspects are integrated into comprehensive plans, how the integration has evolved over time, and whether it has contributed to changes in municipal planning and decision making.
- (ii) Examine how SEA, as a planning tool, can contribute to organisational learning in the comprehensive planning practice.

2. Theoretical Framework

As mentioned above, the theoretical concept of institutional capacity building intends to capture an authority's ability to respond and react to urgent social and environmental issues such as climate change [11]. Three key dimensions of institutional capacity have been identified, namely (i) Knowledge resources, including, for example, the range of

different knowledge accessible, the integration of different policy and planning processes, and the willingness to learn from new knowledge, (ii) Relational resources, a dimension that relates to the range of different engaged actors, as well as the different networks in which they engage, and (iii) Mobilisation capacity, which encompasses the perceptions and desires for institutional change by different stakeholders, the different arenas in which they engage and the presence of change agents [10]. It should be seen as a fluid and dynamic trait that is continuously evolving as these three dimensions interact [28].

A concept that resonates well with the theory of institutional capacity building is that of organisational learning [11,29]. Organisational learning can be conceptualised as a process where actors critically reflect upon their previous knowledge and practices to regenerate forms of acting and engaging with each other [29]. In the context of adaptive capacity, Storbjörk [29] (p. 239) states that “learning-oriented reflexive processes are an important condition for climate change considerations to be made part of the structure, practices and behaviour of actors and organizations and administrative units from different sectors and levels.” Arguably, this is equally important for building institutional capacity for mitigating climate change. A distinction is to be made between individual learning and collective learning, which are related but different entities [30]. This distinction relates both to the fact that organisations can either facilitate or restrict individual learning depending on the norms, culture, and structure of the organisation and that collective learning is not the sum of individual learning (Ibid.). Additionally, organisational learning can be of single-loop character, meaning to instrumentally improve plan-making by identifying alternative strategies and measures for addressing different problems or challenges, or it can be characterised as double-loop learning, which in a more transformative and profound manner, questions and alters values, norms, and structures [17,31].

3. Comprehensive Planning and SEA in Sweden

Planning and governance are largely decentralised in Sweden, with the 290 municipalities possessing a high level of autonomy [32]. This autonomy is manifested in municipalities’ responsibility to both provide services to citizens (e.g., education and elderly care) and carry out local planning (e.g., spatial planning, energy planning, waste planning) [33,34]. A central component of what is often referred to as the *municipal planning monopoly* is the municipal comprehensive plan, i.e., a strategic plan concerning the long-term use of land and water within the municipality [35,36]. Although the Comprehensive Plan is not legally binding but rather of a visionary character, it should indicate the municipality’s intended development [37]. The municipality can then draw up legally binding detailed development plans to specify the allowed use of land and water in a more detailed fashion for a demarcated area [38]. Recent studies have highlighted the need to more strongly link municipal energy and climate planning with municipal comprehensive planning in order to use the Comprehensive Plan as a tool to plan for carbon neutrality [39,40].

As previously mentioned, all Comprehensive Plans are covered by the SEA Directive and should be made subject to an SEA as a rule of thumb [41]. Previous research has shown that the utilisation of SEA for Comprehensive Plans has increased over time since the imposition of SEA requirements in 2004, and it could be regarded as a standard practice today to conduct SEA for Comprehensive Plans [42].

4. Materials and Methods

4.1. Longitudinal Analysis of Comprehensive Plans

The main research design consists of a longitudinal content analysis of municipal comprehensive plans. There has been a growing body of literature analysing and evaluating the content and quality of both climate action plans (e.g., [43–48]) and, to a lesser extent, land use plans in terms of addressing climate change (e.g., [24,49]). Most of these, however, use a cross-sectional approach, which provides a snapshot of the current state of planning. In a meta-analysis of plan evaluation [50], the longitudinal research design of Brody [51], which consisted of analysing two generations of plans from the same local authorities, was

deemed inferior, especially in combination with a comparative approach. Furthermore, Tang et al. [47] (p. 58) has called for longitudinal analysis of climate action plans to “better pinpoint the factors contributing to policy learning in response to the growing problem of climate change.” Since then, Stevens and Senbel [27] have conducted a longitudinal study evaluating how climate change mitigation and adaptation is considered in a land-use plan comparable to a Comprehensive Plan in British Columbia.

To the authors’ knowledge, this is the only paper using a longitudinal approach to analyse the integration of climate change aspects into spatial planning. The conducted study builds on this branch of research and adds the analytical component of considering the utilisation of SEA in this context.

4.1.1. Data Collection

The studied municipalities are those in Stockholm County that adopted their most recent municipal Comprehensive Plan during 2018–2020. Each of the Stockholm County municipalities’ websites was searched to check the year of adoption of the Comprehensive Plan and to retrieve those plans that met the temporal criterion, which amounted to eight of the County’s 26 municipalities. Additionally, the previously adopted Comprehensive Plans, which had been in effect before the adoption of the most recent Comprehensive Plans for each of the eight selected municipalities, were obtained through a database built up during earlier planning research projects. These previous Comprehensive Plans had been adopted between 2005 and 2013. Thus, the dataset consists of 16 Comprehensive Plans from eight municipalities, with a temporal difference of 5–13 years between the recently adopted CP and the previously adopted plan.

4.1.2. Study Area and Presentation of Study Objects

Stockholm County, which includes the City of Stockholm, Sweden’s capital, is the most populous of Sweden’s 21 counties. Stockholm County is located in the east-southeast of Sweden, adjacent to the Baltic sea. The eight municipalities that fulfilled the selection criterion stated in Section 4.1.1. were Ekerö, Nacka, Salem, Stockholm, Sundbyberg, Upplands Väsby, Vallentuna, and Österåker. Their locations are visualised in Figure 1.

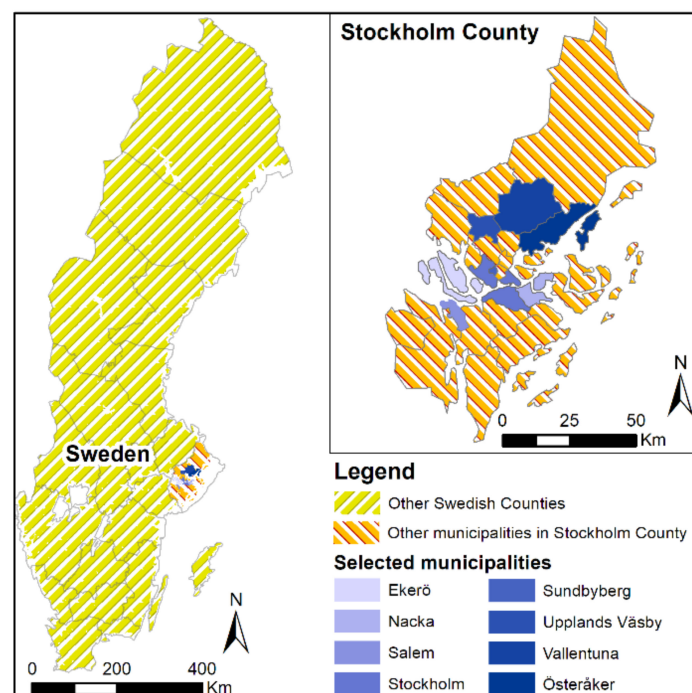


Figure 1. A map of selected municipalities in relation to other municipalities in Stockholm County and other Swedish Counties.

As highlighted in Table 1, the characteristics of the municipalities differ, where for example, the municipality of Stockholm is an urban capital, in contrast to municipalities such as Salem and Ekerö, which are more of a peri-urban/rural character.

Table 1. Key statistics on selected municipalities [52].

Municipality	Population Size	Land Area (km ²)	Population Density (Inhabitants/km ²)	Proportion of Inhabitants Living in Urban Settlements	Proportion of Land Used for Settlements
Ekerö	29,000	217	133	82.3%	13.3%
Nacka	107,000	95	1120	99.4%	36.6%
Salem	17,000	54	313	98.9%	11.8%
Stockholm	976,000	187	5212	100%	55.2%
Sundbyberg	53,000	9	6076	100%	51.0%
Upplands Väsby	47,000	75	629	98.4%	18.3%
Vallentuna	34,000	358	95	84.7%	7.1%
Österåker	47,000	312	149	93.5%	15.4%

4.1.3. Qualitative Content Analysis

The content analysis employed in this study takes inspiration from the coding scheme of Tang et al. [47] and the coding scheme utilised by Stevens and Senbel [27], which was originally described by Baynham and Stevens [49]. However, in this paper, a more qualitative, thematic analytical procedure has been employed. The content of the Comprehensive Plans has been analysed thematically, guided by some overarching topics set to be:

- Municipal climate objectives;
- Energy production, distribution, and use;
- Transport;
- Land use.

These themes were derived from the coding schemes from which inspiration was drawn [27,47], and their relevance is supported by the literature presented in the introduction. All text within each topic that was recognised to be a part of strategic standpoints concerning long-term development for the municipality was coded to an overarching node of this topic. Within each topic node of energy, transport, and land use, the content was iteratively analysed and thematised to identify and cluster themes concerning how climate change mitigation is addressed in comprehensive planning. The common procedure to score each plan on an ordinal scale from 0–2 regarding each theme [27] was then followed. In principle, on this scale, 0 denotes that this theme is not addressed in the plan, 1 denotes that the theme is addressed, but without linking it to climate change mitigation/energy efficiency/renewable energy production, and 2 denotes that the theme is addressed and linked to climate change mitigation/energy efficiency/renewable energy production. The criterion of providing a higher score when the link to climate change/energy is explicit was similarly exploited in the coding scheme by Baynham and Stevens [49]. An exception was made for the topic of municipal climate objectives, where the scoring scale is altered such that 0 denotes that no climate objective is included in the plan, 1 denotes that regional/national/global climate objectives are mentioned, and 2 denotes that a municipal climate objective is stated. For clarity, these scales are summarised in Table 2.

A Wilcoxon signed-rank test was executed to investigate whether the overall scores differ when comparing the previously adopted Comprehensive Plans to the recently adopted plans. The test is used because it permits the dependent variable to be measured by an ordinal scale [53]. More details are given in Appendix A.

Table 2. The specifications of the scale for scoring plans. The principal scale applies to all identified themes except the theme *Municipal climate objectives*, which have its scale specified in the table.

Score	Principal Scale	Municipal Climate Objectives
0	The theme is not addressed in the plan.	No municipal climate objective for the municipality as a geographical area stated in the plan.
1	The theme is addressed but without linking it to climate change mitigation/energy efficiency/renewable energy production.	Qualitative municipal climate objective for the municipality as a geographical area stated in the plan.
2	The theme is addressed and linked to climate change mitigation/energy efficiency/renewable energy production.	Quantitative municipal climate objective for the municipality as a geographical area stated in the plan.

4.2. Focus Group Interview

In addition to the longitudinal document analysis, a focus group interview was held with municipal officials from Stockholm County. Focus group interviews can be inclusively defined as “a research technique that collects data through group interaction on a topic determined by the researcher” [54] (p. 6). The purpose of the focus group interview was to gain complementary insights regarding how the practitioners experienced the progression over time concerning the integration of climate change mitigation aspects into comprehensive planning. This included exploring factors that have spurred such integration and whether the integration of such aspects into the Comprehensive Plan has led to changes in other domains of municipal planning and decision making. The focus group interview was moderated by the researchers, with the aid of open-ended questions, to foster discussion among the practitioners, in accordance with Short [55]. These pre-determined questions can be found in Appendix B.

All comprehensive planners or officials with similar positions employed by the studied municipalities were invited to the focus group interview, with a request to forward the invitation to any other official considered more suitable for participation or if they could not participate themselves. In total, seven officials from six different municipalities participated. A detailed list of the participants and their respective position is provided in Table A1 in Appendix C. The focus group interview, which was held in digital form, was recorded and subsequently transcribed. Moreover, at the initiative of the participating planning coordinator from Ekerö municipality, an environmental strategist from Ekerö contributed reflections concerning the open-ended discussion questions via e-mail after the focus group interview. These reflections were included in the empirical material, which was subsequently clustered into overarching themes and summarised.

A follow-up was made with a number of municipalities regarding their efforts to implement the identified strategies to show the diversity of approaches in the municipalities' endeavour to put these strategies into practice. A deeper analysis was made of the municipality of Österåker in order to be able to provide a more detailed illustration regarding how the strategies for climate change mitigation integrated into their Comprehensive Plan affect municipal planning and decision making. Österåker Municipality was chosen due to the large increase between their previously adopted and recently adopted CP.

5. Results and Analysis

5.1. Institutional Capacity Building over Time

The findings from the qualitative content analysis are shown in Figures 2 and 3. In total, 19 sub-themes, which can be characterised as different strategies related to climate change mitigation, were identified in the studied Comprehensive Plans. Examples of coded text for some of the most common strategies within each sub-theme are provided in Table A2 in Appendix D. Generally, the recently adopted Comprehensive Plans have included more strategies for climate change mitigation, and these strategies have also been more clearly linked to reduced climate impact or energy efficiency, compared with the previously adopted plans. This is manifested in that the recently adopted Comprehensive Plans have a mean total score of 24, a 50% increase compared to the mean score of 16 for the previously adopted plans (Figure 3). A Wilcoxon signed-rank test found a statistically significant difference concerning

the median values of the two groups, $p < 0.05$. The focus group interviewees recognise that there has been an increase concerning the integration of climate change mitigation strategies into comprehensive planning during the last decade. Largely, they attribute this development to a general increased societal awareness, which has led both to a broader spread of knowledge and increased political support for addressing climate change mitigation in their spatial planning.

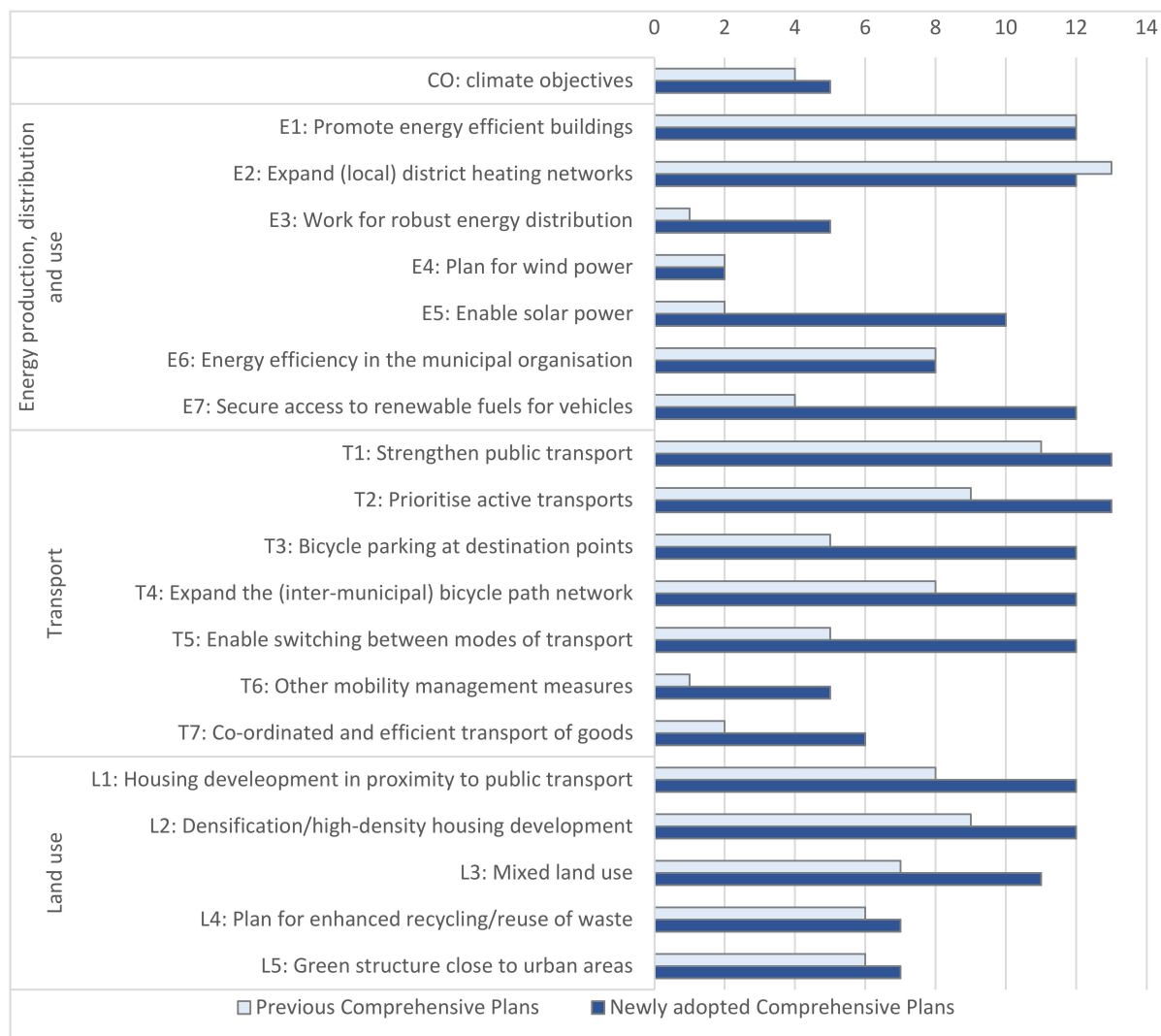


Figure 2. A comparison of the aggregated score for previously adopted Comprehensive Plans and recently adopted Comprehensive Plans for each identified strategy.

As presented in Figure 2, there is heterogeneity concerning the increase in the scores of the different strategies over time. There may be different underlying reasons concerning the progression for some of the strategies with the largest increase. Strategies such as *Enable solar power* (+8) and *Secure access to renewable fuels for vehicles* (+8) (a theme mainly encompassing the deployment of charging stations for electrical vehicles) may be more strongly related to the diffusion of technological innovations. Other strategies, for example, *Bicycle parking at destination points* (+7) and *Enable switching between modes of transport* (+7), would plausibly be more strongly linked to a successful spread of examples of best practices and knowledge exchange among municipalities. Evidently, the former strategies relating more strongly to technological innovation and development will also require such spreading of best practices to be fully utilised in a strategic planning context by more municipalities.

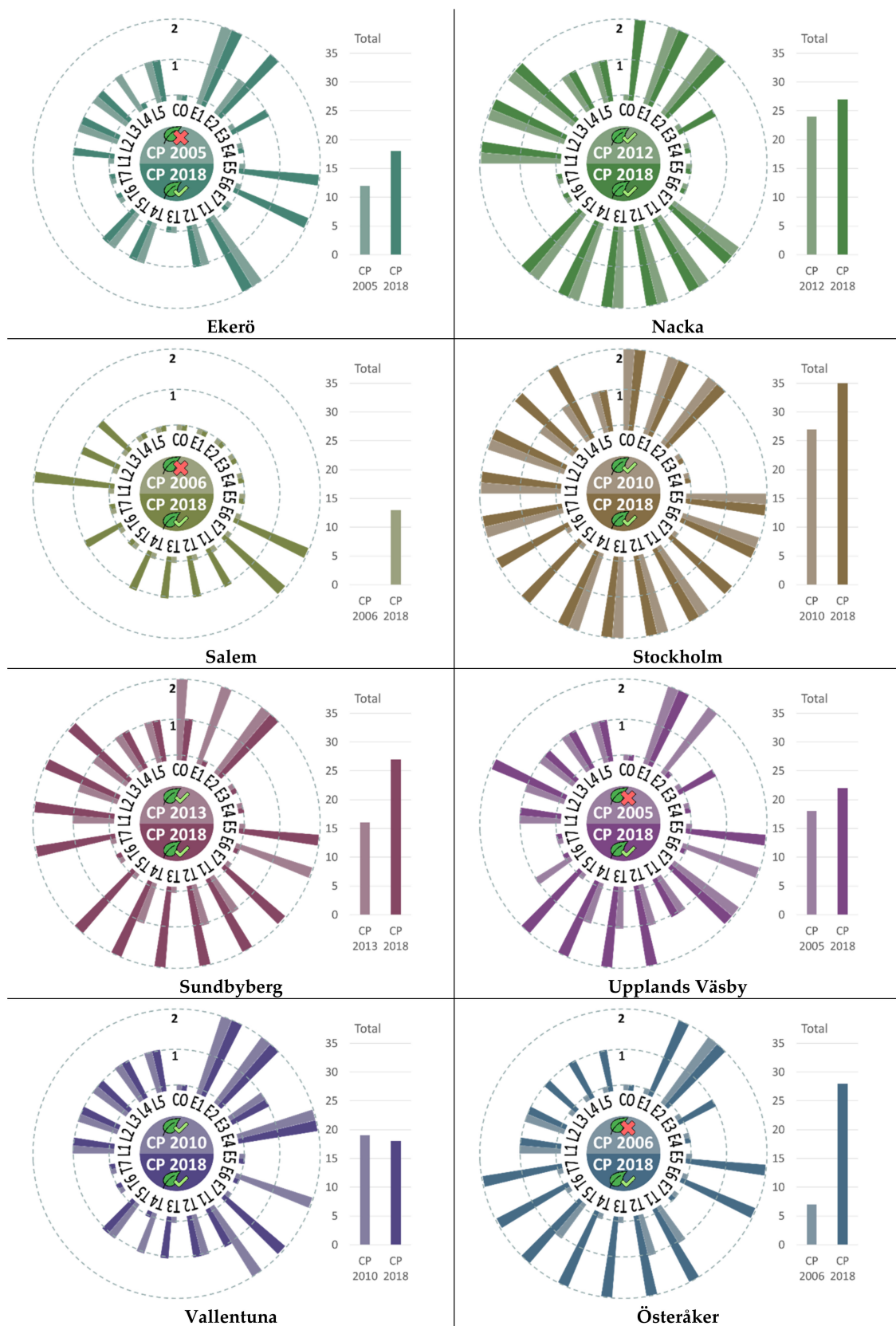


Figure 3. Visualisation of scoring of studied municipal Comprehensive Plans. Explanations of abbreviations are given in Figure 2. The checkmark/cross mark situated adjacent to the year of adoption for each plan indicates whether an environmental report due to the execution of SEA had been identified or not.

Some generalisations concerning the three categories *Energy production, distribution, and use*, *Transport*, and *Land use* can be made. As can be discerned in Figure 2, the categories concerning energy and land use had the lowest overall progression, with an average increase of 0.3 points per strategy per municipality. The average in the transport category, on the other hand, increased twice as much, 0.6 points per strategy per municipality. As a result, the transport category has the highest average score for the recently adopted Comprehensive Plans, 1.3 per strategy per municipality, followed by the land use category, 1.2, and lastly, the energy category, 1.1.

When investigating the aggregated scores for the individual plans as presented in Figure 3, Stockholm Municipality stands out, with the highest score in both of the two sets of plans. Given their vastly larger population size, as the capital of Sweden, and consequently better financial preconditions for acquiring relevant personnel resources, this outcome might be expected. A notion that stands out for Stockholm Municipality, as emphasised by their official, is that Stockholm's participation in transnational municipal climate networks and international research projects has contributed to building its capacity over time.

Content-wise, the interviewees agreed that climate change mitigation is mostly addressed in municipal policy documents other than the Comprehensive Plan. Policy documents focusing on energy and climate, such as a municipal energy plan, or energy and climate strategy, or the like, were found to be the most central. For example, the environmental strategist of Ekerö perceived the general lack of clear climate objectives and strategies in Ekerö's most current Comprehensive Plan to be a consequence of the absence of a municipal energy and climate strategy, which could have clarified the positions of the municipality on this topic. The presence of Climate Objectives in the Comprehensive Plan seems to be correlated with higher overall scores, as the three municipalities with either qualitative or quantitative climate objectives present in their most recently adopted CP, i.e., Nacka, Stockholm, and Sundbyberg, were found among the top half concerning aggregated scores (Figure 3).

Moreover, the point was raised during the focus group interview that additional municipal policy documents expand on relevant strategies included in the Comprehensive Plan, such as a *Plan for the management of construct masses*, a *Public Transport Plan*, *Guidelines on Green Space Factor*, etc. The interviewees emphasise that there is a dynamic interplay between the CP and all the other policy documents, where strategies/planning principles that have been established in a sectoral policy document can be incorporated and developed in the forthcoming comprehensive planning process, and vice versa. When discussing how comprehensive planning can lead to substantial change for reduced climate impact in the focus group interview, there was a consensus that its most important role is to spread knowledge and build internal support from politicians and other officials concerning how this can be realised. Thus, it revolves around building knowledge resources in the organisation and improving the mobilisation capacity during the planning process. Even if the CP only addresses certain climate strategies to a limited extent, it can create legitimacy for the officials to keep working with this issue, for example, by elaborating on the strategy in a policy document of its own.

The Relation between Climate Change Mitigation Strategies and Municipal Planning and Decision Making—Examples from Österåker and Other Municipalities

It was expressed by numerous interviewees that the Comprehensive Plan, as well as these related municipal policy documents and guidelines, in turn, ought to be considered in detailed development planning, thereby influencing binding decisions concerning land use. This could be exemplified in the municipality of Österåker, which has included numerous of the identified strategies in their recently adopted Comprehensive Plan. According to the comprehensive planner of Österåker, several strategies related to transport, such as *Strengthen public transport*, *Prioritise active transports*, *Bicycle parking at destination points*, and *Enable switching between modes of transport*, have been expanded on in other policy

documents, such as a *Public Transport Plan* and a *Parking Plan*. These policy documents, together with the CP, then form a basis for subsequent planning stages such as developing planning programmes and conducting detailed development planning. The municipality also has numerous ongoing detailed development plans where the bicycle path network is expanded and continuously works at overseeing the need for constructing additional bicycle parking at destination points. Further, they are planning to create a public transport hub in the central urban area of the municipality that should enhance the inter-modality between a public light rail system named Roslagsbanan and buses.

By expanding on the efforts of Österåker Municipality as an example of how the identified strategies could be utilised in municipal planning and decision making and contribute to substantial change, it is worth pointing out that two strategies relating to land use, i.e., *Housing development in proximity to public transport* and *Densification/high-density housing development*, have had a great impact on decisions regarding which areas to concentrate intended housing and commercial development. Emphasizing such principles in the CP has partially been driven by The National Negotiation on Housing and Infrastructure (Sverigeförhandlingen), where Österåker Municipality commits to housing development of a certain extent, under the premise that the light rail line Roslagsbanan, which connects Österåker with central Stockholm, will be developed and improved. In their municipal planning, this has taken its expression in that planned housing development is concentrated around stops on the Roslagsbanan line, with development of higher density within closer proximity to the stops, whilst still adapting the intended development to the scale and type of the surrounding areas. Some older housing development projects have been situated in more secluded locations, but the comprehensive planner of Österåker recognises that such types of development will no longer be planned for. Furthermore, the strategy to *Enable solar power* has been incorporated in planning programmes and related detailed development plans concerning the orientation and placement of buildings.

Additional examples of how the strategies are intended to be turned into practice can be given from some other municipalities as well. As a part of the strategy to *Secure access to renewable fuels for vehicles*, Vallentuna Municipality has adopted a separate policy document for the deployment of EV charging infrastructure. A handful of EV charging stations have also been built at strategic locations in Vallentuna, in accordance with the policy document. Nacka Municipality provides another viable example. They have integrated the strategy of *Promote energy-efficient buildings* in both of their analysed CPs. Since 2012, they have also had politically adopted guidelines regarding sustainable construction of the built environment. These guidelines intend to present the municipality's ambitions on this topic and should be used as a basis in all larger urban development projects. Among others, these guidelines promote the use of sustainability certifications, such as BREEAM, as well as stricter requirements concerning energy use for heating.

5.2. Organisational Learning in Planning Processes

In general, the four municipalities that adopted their previous plan between 2010 and 2013 received a high score for their recently adopted plans, with three appearing in the top half of scores, in comparison with municipalities whose previous plans were adopted during 2005–2006 (Figure 3). These municipalities with high scores were the same ones that had included municipal climate objectives in their recently adopted CP. Thus, the continuity of comprehensive planning stands out as a potential factor affecting the integration of climate change mitigation strategies into Comprehensive Plans. In essence, these municipalities have assumingly been able to conduct an additional, comprehensive planning process since the turn of the millennia, which could have been an opportunity to deliberate strategies for reduced climate impact and build political support for such actions. Most often, such processes may lead to single-loop learning, where solutions and practices are altered. However, it could also contribute to double-loop learning, with a change in norms and beliefs, although the interviewees mostly attribute this perceived increased political awareness to general societal development. The participants also emphasised the need for

a continuous process to build institutional capacity for climate change mitigation, in which new knowledge from, e.g., national guidelines and different inter-municipal networks can be accumulated and disseminated internally with the intent to put it into practice.

Given that there can be a turnover both concerning municipal officials and politicians between comprehensive planning processes, a tendency illustrated by the fact that neither of the interviewees had been extensively involved in the most recent comprehensive planning process, the Comprehensive Plan itself can become a platform for organisational learning. This is supported by the focus group interview, where the interviewees expressed that the previous plan forms a basis for the following comprehensive planning process and that content assessed by planners and politicians as relevant will be retained and potentially expanded upon for the forthcoming plan.

As conveyed by Figure 3, the previously adopted CPs adopted in 2010–2013 were also made subject to SEA, which differs compared to the previous plans dating back to 2005–2006. Therefore, the utilisation of SEA may also have contributed to single-loop as well as double-loop learning in both the previous and the most recent comprehensive planning process for half of the municipalities and may have contributed to a higher score. The interviewees provide some support for single-loop learning, with the landscape architect of Sundbyberg recalling that some aspects related to climate change mitigation and adaptation were revised at a late stage of the planning process, presumably due to input from the SEA process. Another example of such single-loop learning is found in the recently adopted Comprehensive Plan of Salem, which states that the environmental report included suggestions for sustainable transport, such as the deployment of charging stations and expansion of the regional bicycle network [56].

Some focus group interviewees, and the Vallentuna strategic environmental planner, in particular, highlight how municipal officials continuously learn how to gain increasingly added value from the SEA by becoming better at procuring and coordinating with the SEA process. This stems from what can be characterised as double-loop learning, i.e., a recognition of the role of SEA as an iterative process that should feed into the planning process, in contrast to a parallel but separate process that provides input to the planning process at a much later stage. A potential explanation of the occurrence of this double-loop learning is given by the Vallentuna strategic environmental planner, who attributes this recognition in part to SEA guidelines and handbooks issued by the Swedish Environmental Protection Agency in conjunction with a legal revision to clarify SEA legislation in 2018.

The focus group interview depicts a view in which internal cooperation concerning the integration of climate change mitigation into spatial planning has improved over time. This entails comprehensive planners, planning architects, environmental strategists, and environmental planners. For the municipality of Österåker, this enhanced internal cooperation with environmental planners in the detailed development planning phase has led to higher-quality assessments regarding significant environmental effects and potential need of SEA. Additionally, the municipality has recently integrated aspects relating to energy use and climate change into a basis for decision making regarding whether a detailed development planning process should be initiated or not when receiving such a request from a developer. This highlights that double-loop learning concerning how the organisation ought to cooperate and coordinate different processes and routines, in turn, can lead to consideration of environmental and climatic concerns early on in different planning processes.

Another aspect highlighted by the Stockholm Municipality representative was the need for mechanisms for capturing experiences and learning outcomes from specific city development projects. Without such links of double-loop learning between the strategic planning level and subsequent levels of planning and implementation/project development, knowledge accumulated at the lower levels may be lost. This could inhibit the dissemination and upscaling of best practices, both within the municipality and in effect to other local authorities as well.

6. Discussion

This study has employed a longitudinal analysis of Comprehensive Plans for a selection of municipalities in Stockholm County. The selected approach has allowed for an examination of the institutional capacity building concerning the integration of climate change mitigation aspects into spatial planning over time in a more detailed and exhaustive manner. A qualitative content analysis guided what different aspects of the Comprehensive Plans were included in the scoring phase. This ensures that all different strategies included in the Comprehensive Plans are recognised in the analysis, although with some limitations concerning comparisons across different longitudinal analyses. A focus group interview was conducted in order to achieve methodological triangulation of the focus group interview, which provided an opportunity to validate some of the findings in the document analysis. As mentioned, many of the officials did not themselves actively participate in the most recent comprehensive planning process, which prohibits a more thorough analysis of organisational learning throughout the two consecutive comprehensive planning processes. Most often, this was the result of personnel turnover due to changing jobs and retirements. The officials participating were, nevertheless, considered the most suitable representative of each municipality and had some insights into the previous comprehensive planning process, as well as the content and role of the CP within the municipal organisation.

The results show that the municipalities increasingly integrate climate change mitigation aspects into spatial planning, where the recently adopted Comprehensive Plans included more strategies concerning climate change mitigation, and to a greater extent, explicitly related these to reduced climate impact/energy efficiency. As the Comprehensive Plan reflects the political will, it highlights that the municipalities have advanced their ambitions on this front. Moreover, the described efforts by Österåker and other municipalities show that such strategies, as presented in the CP and potentially expanded on in other policy documents, can be put into practice in municipal planning and decision making. Thereby, the identified strategies can contribute to substantial changes in binding decisions regarding land use. By illuminating this increased consideration of climate change mitigation in strategic spatial planning practice, this paper supports one of the messages in the IPCC special report on climate change and land, namely that spatial planning can contribute to positive mitigation outcomes [57]. When comparing the presented results with the longitudinal study of Stevens and Senbel [27], a key difference is that they could not distinguish any statistically significant progress concerning the scores of the studied plans over time. One reason for this may be that the temporal difference between the studied sets of plans is larger in this study, in some cases 13 years, compared to the difference of four years in the recently mentioned study.

As the interviewees largely attributed this trend to general societal development, relating to increased awareness for climate change and, in effect, enhanced political support, it may well be that this trend is also reflected in other Swedish counties. However, there may be some regional differences concerning which types of strategies municipalities utilise. For example, it has been increasingly recognised in recent years that the Stockholm region is facing an electricity grid capacity shortage [58], which may explain in part the increased consideration of robust energy distribution. On the other hand, the deployment of large-scale wind power may not be regarded as feasible in more urban municipalities in Stockholm, compared to rural municipalities across Sweden, and the corresponding strategy may thus be included to a lesser degree in municipalities in Stockholm County.

Although a progression over time concerning the integration of climate change mitigation strategies into comprehensive planning has been portrayed, the results simultaneously highlight that additional strategies could have been considered in all Comprehensive Plans. As discussed by Gustafsson et al. [59] concerning energy and climate strategic planning, a more cyclical and continuous planning process could stimulate learning across internal and external actors. A process characterised by such features could also strengthen the role of comprehensive planning as a vehicle for building political support for incorporating different climate change mitigation strategies into the Comprehensive Plan. This could

then be elaborated in other policy documents, if needed, in order to address the topic in a sufficiently exhaustive manner. In relation to this, a legislative revision will impose requirements on municipalities to develop so-called *planning strategies*, in which the municipality should assess the appropriateness of strategic standpoints concerning the vision and objectives presented in the Comprehensive Plan unless a new CP is adopted under the first half of an election cycle [60]. Since such a continuous process was pinpointed by practitioners as key moving forward, this legislative revision could be a step in the right direction. Moreover, the results suggest that incorporating municipal climate objectives into the Comprehensive Plan could facilitate consideration of climate change mitigation concerns. This is supported by Solly et al. [61], who identifies the vitality of establishing ambitious planning objectives concerning sustainable land use in strategic spatial plans. Nonetheless, the results also show that the practice is uncommon in Stockholm County. The document analysis conducted by Dovlén and Khakee [24] suggests that the situation is similar elsewhere in Sweden.

The findings of this paper indicate that SEA can contribute to building institutional capacity through organisational learning. Primarily, the results suggest that single-loop learning does occur, where alternative strategies or measures included in the Comprehensive Plans can be produced. This has also been the case in previous research linking organisational learning with SEA [17,62]. Fischer et al. [62] identify that a barrier for organisational learning from SEA in land use planning can be that the SEA is carried out by consultants, making the assessment process more detached from other plan-making activities. The focus group interview suggests that double-loop learning, concerning how the assessment process is perceived and can interact with the planning process, can provide an opportunity to overcome this barrier.

Furthermore, such a reconceptualization of the nature of SEA by planning practitioners could improve the timing of the SEA, making it more proactive than reactive [63]. This means that SEA as a planning tool can interact with the planning process earlier, thus being able to shape enabling conditions for sustainability pathways rather than later in the process and merely mitigating adverse environmental impacts [13]. This could further stimulate single-loop and double-loop learning in the comprehensive planning process. In spite of this fact, early application of SEA has been recognised as often lacking in practice [64]. The presented results suggest that national guidance documents can be a way to facilitate such a recognition, although it will presumably require other types of mechanisms for the dissemination of knowledge as well.

The municipality of Stockholm has been characterised as a leading city for climate action [65,66], and the conducted study confirms this forefront position concerning the integration of climate change mitigation aspects into spatial planning as well. It is indicated that Stockholm Municipality deems trans-national city networks to be essential for exchanging knowledge and best practices, a forum through which they will mainly collaborate with other pioneering cities [67]. Depending on the willingness of Stockholm Municipality to also interact in different inter-municipal and regional-local networks at the regional level, the knowledge exchange and diffusion of best practices could also reach municipalities characterised as ‘followers’ by Kern [67]. To facilitate this coordination and enable followers to put this knowledge into practice, regional and national actors ought to provide support in the form of accumulating and facilitating the dissemination of such knowledge. This could further accelerate the ongoing institutional capacity building regarding the integration of climate change mitigation aspects into spatial planning.

7. Conclusions

This paper set out to investigate whether local authorities have been building their institutional capacity for integrating climate change mitigation aspects into spatial planning over time. By employing a longitudinal document analysis of municipal Comprehensive Plans, utilising a combination of qualitative content analysis and a scoring scale as the main methodological approach, this was proven a viable option within this branch of

planning research, still being in its infancy. The results show that the integration of climate change mitigation strategies has significantly increased when comparing the most recently adopted Comprehensive Plans with the previously adopted plans. Consequently, it is indicated that local spatial planning will increasingly contribute towards decarbonisation and the climate objective set in the Paris Agreement.

However, there is great heterogeneity concerning the integration of different climate change mitigation strategies, and numerous additional strategies could have been given further consideration in each studied Comprehensive Plan. This thus calls for more continuous and cyclical comprehensive planning processes to facilitate organisational learning and to build institutional capacity, primarily by being a vehicle for mobilising political support. The study also indicates that SEA has the potential to facilitate the integration of climate change mitigation strategies into spatial planning. Predominantly, this occurs through single-loop learning, where the SEA process leads to the identification of alternative solutions and strategies. Nevertheless, the focus group interview pointed out that double-loop learning, concerning how SEA is perceived and how it can interact in relation to the planning process, also can occur. This could give SEA the potential to feed into the planning process at key stages, thereby becoming more influential and potentially also being able to foster enabling conditions for exploring and identifying different sustainability pathways.

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Appendix A

As to investigate whether the overall scores differ when comparing the previously adopted Comprehensive Plans to the recently adopted plans, a two-tailed Wilcoxon signed-rank test for paired data was executed. H_0 states that the difference in median values of the two groups equals 0, whereas H_1 states that there is a difference in the median values. $\alpha = 0.05$. T^* for this test equals 3. The obtained result is $T = 1 \leq 3$. Thus, H_0 is rejected in favour of H_1 , $p < 0.05$.

Appendix B

Pre-determined questions that guided the focus group interview:

- (i) Do you think that you have integrated more aspects concerning energy efficiency and climate change mitigation in your recently adopted Comprehensive Plans when comparing with the previously adopted Comprehensive Plan? If yes, which factors have contributed to such an increase over time?
- (ii) Has the integration of energy efficiency and climate change mitigation aspects led to change in the municipality's planning and decision making?
- (iii) What do you think is needed in order to ...

- a. integrate additional climate change mitigation aspects into the Comprehensive Plan?
- b. align the planning and decision making of the municipality with the objectives and strategies concerning climate change mitigation expressed in your Comprehensive Plan?

Appendix C

Table A1. List of participants in the focus group interview.

Position of Municipal Official	Municipality Represented by the Interviewee
Planning coordinator	Ekerö Municipality
Comprehensive planner	Nacka Municipality
Urban planning strategist	Stockholm Municipality
Head of the planning department	Sundbyberg Municipality
Landscape architect	Sundbyberg Municipality
Strategic environmental planner	Vallentuna Municipality
Comprehensive planner	Österåker Municipality

Appendix D

Table A2. Examples of identified strategies in the studied Comprehensive Plans (First author's translation).

Strategy	Examples of CPs with Score 1:	Examples of CPs with Score 2:
CO: climate objectives	Sundbyberg Municipality [68]: Fossil fuel-free city The ambition to become a fossil fuel-free city is a part of our climate efforts ... (p. 83)	Nacka Municipality [69]: ... A changed climate will, among other things, lead to increased precipitation, sharper fluctuations in the weather and increased temperatures. Nacka has therefore set a target of reducing greenhouse gas emissions per person by 30% by 2030. (p. 13) Upplands Väsby Municipality [71]: The municipality shall work to ensure that both current and new residential and business areas can be supplied with renewable energy sources. An expansion of the current district heating network shall be striven for, and in other cases, as far as possible, renewable heating methods shall be used such as solar heating, local heating, pellets. The required space for such facilities should be reserved in future expansions. (p. 106)
E2: Expand (local) district heating networks	Ekerö Municipality [70]: • In detailed development planning and examination of building permits for new development, energy-efficient housing and premises, water-borne heating systems, and district heating systems shall, in turn, be strived for. (p. 89)	Stockholm Municipality [72]: Solar energy potential should be used for new buildings as well as for existing buildings and urban building elements, such as solar-facing noise barriers. Technical solutions for energy storage, as well as technology for solar heat and solar cells, need to be given space and integrated into the designed urban environment. (p. 105) Vallentuna Municipality [73]: An increased amount of renewable fuels is a step towards a transition to fossil fuel freedom. As part of this, charging stations for electric vehicles are under development in the municipality. ... Planning focus Land requirements must be taken into account for: ... a structure of available charging stations for electric cars according to the municipality's recommended locations. (p. 35)
E5: Enable solar power	(No plan received this score)	
E7: Secure access to renewable fuels for vehicles	(No plan received this score)	

Table A2. Cont.

Strategy	Examples of CPs with Score 1:	Examples of CPs with Score 2:
T1: Strengthen public transport	<p>Salem Municipality [56]: Based on the municipal overarching target of maintaining and developing the infrastructure of Salem and a sustainable environment, the municipal executive board has established the following targets:</p> <ul style="list-style-type: none"> • Salem Municipality should increase the share of trips made by public transport, walking, and bicycling. (p. 39) 	<p>Stockholm Municipality [74]: However, significant efforts are required from the city and from everyone who lives and works in Stockholm to achieve the ambitious goal of a fossil-fuel-free city by 2050. The city's main strategy is to utilise and invest in the city's benefits regarding the expansion of district heating and attractive public transport. (pp. 7–8) ...</p> <p>Advocate for a long-term investment in public transport</p> <p>The city must play an active role in the cooperation between the region's actors for long-term investment in public transport. In addition to the Stockholm negotiations' project, the Comprehensive Plan contains several connections and public transport routes that should be developed to achieve long-term sustainable growth. (p. 26)</p> <p>Upplands Väsby Municipality [75]: Climate impact</p> <p>Measures must continue to be taken to reduce the impact on the climate. The planning must be conducted so that efficiency and use of both energy and resources are prioritized, which, in turn, means that greenhouse gas emissions are reduced. Through a denser building structure where pedestrian and bicycle traffic is promoted, it becomes easier to opt out of the car for shorter journeys. This also means that the need for transport can be reduced. (pp. 72–74) ...</p> <p>To simplify cycling and accessibility to public transport, bicycle parking will be built near major destination points and at major public transport stops and stations. (pp. 63–65)</p> <p>In order to promote sustainable modes of travel, bicycle parking must be given priority over car parking next to important destination points. (p. 67)</p> <p>Österåker Municipality [77]: Plan for a transport system with reduced climate impact.</p> <p>Plan for a surface-efficient transport system with reduced emissions ... Through a developed road network for pedestrians and cyclists, short journeys by car and, thereby, local emissions are reduced. ...</p> <p>Future vision 2040</p> <p>... Österåker is a cycling municipality where residents have the opportunity to commute to work in neighbouring municipalities by bicycle ...</p> <p>Develop the cycle path network.</p> <p>... The regional cycle paths are being expanded and connect Österåker with the neighbouring municipalities ... (p. 61)</p>
T3: Bicycle parking at destination points	<p>Vallentuna Municipality [73]: Attractive bicycle parking spaces should be prioritised at public transport hubs and other destination points. The municipality shall continuously review the parking norms for bicycles in order to create good accessibility for cyclists. (p. 31)</p>	
T4: Expand the (inter-municipal) bicycle path network	<p>Ekerö Municipality [76] Walking and bicycling paths</p> <p>Continued expansion of the regional bicycle paths, other bicycle paths and neighbourhood paths is necessary. (p. 23)</p>	

Table A2. Cont.

Strategy	Examples of CPs with Score 1:	Examples of CPs with Score 2:
L1: Housing development in proximity to public transport	Vallentuna Municipality [78]: Vallentuna shall utilise the proximity to the Roslagsbanan line, which will be high frequency. Therefore, dense housing is planned at all stations between Kragstalund and Molnby. (p. 16)	Sundbyberg Municipality [68]: The climate challenges ... Sustainable energy use, environmentally friendly transport, and resource-efficient cycles need to permeate planning. (p. 16) ... Take advantage of locations close to public transport through higher exploitation and location of various functions. Locate functions for service, education, culture and leisure activities in good public transport locations. Expand areas so that frequency and expansion of public transport can be promoted. (p. 32)
L2: Densification/high-density housing development	Österåker Municipality [77]: The Comprehensive Plan shall contribute to a dense and cohesive development in Åkersberga, with active city life and strong development of services, schools, workplaces and good public transport. (p. 14)	Stockholm Municipality [72]: Objectives description Stockholm must be a climate-smart city, where efficient land use and transport-efficient city structure contribute to increased accessibility, reduced climate impact and limited resource consumption. (p. 26) ... Traffic and mobility The interplay between the planning of buildings and traffic is important for developing high accessibility and good living environments within a limited area. Accessibility is an important starting point for sustainable urban development, and it can be created through proximity, which presupposes density, a mix of functions, and good transport opportunities. ... The dense city provides several favourable conditions for efficient transport ... (p. 76)
L3: Mixed land use	Ekerö Municipality [76]: Our vision of a small town The small town includes preconditions for attractive and sustainable living environments in the form of high social values and a practical everyday life where it is close to everything—schools, leisure activities, commerce, service, nature, culture, meeting places etc. All functions are represented, and there are many different types of accommodation. (p. 8)	Nacka Municipality [79]: Reduced travel needs A reduction in the total need for travel leads to reduced emissions of greenhouse gases and air pollutants and thus to a reduced climate impact. To some extent, we can influence this in the planning. A rich variety of workplaces mixed with housing means that more people have the opportunity to work close to home ... (p. 19) A sustainable urban structure ... The presence of workplaces and trade in the vicinity of housing contributes to reducing travel and thus energy use and also provides access to work and services for groups that have little opportunity to travel long distances. (p. 20)

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