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Challenges and Opportunities in Early Stage Planning of Transport Infrastructure Projects: Environmental Aspects in the Strategic Choice of Measures Approach

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Abstract: The Strategic Choice of Measures (SCM) approach aims to integrate different perspectives and identify measures to adapt new infrastructure projects to their local context at an early stage of Swedish transport planning. SCM is a loosely structured framework for collaboration between actors from, e.g., municipalities and the Swedish Transport Administration, in order to facilitate the coordination of transport planning and land use planning. This paper aims to explore the consideration of environmental aspects in early-stage transport planning by analyzing the SCM approach. An explorative research approach is applied based on literature studies, semi-structured interviews, and a focus group interview. The result shows that in the SCM process, environmental aspects such as noise and air pollution generated by road traffic in urban areas, engage the actors, whereas aspects related to landscape and water were perceived as poorly addressed and received less attention. The consideration of environmental aspects in the SCM process is affected by the local and national authorities' different interests and the competences involved. To consolidate environmental aspects in early transport planning, these aspects need to be explicitly addressed in the SCM guidelines and the link between the SCM and preceding and following planning stages needs to be strengthened.

Keywords: urban transportation planning; transport infrastructure; environmental aspects; collaborative planning; Strategic Choice of Measures; Sweden



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1. Introduction

Transport and mobility are central to sustainable development, and the establishment of sustainable transportation is expected to be coordinated with economic policy while respecting the environment by improving social equity, health, the resilience of cities and urban-rural linkages [1]. However, there is still a pressing need to better integrate sustainability principles in transportation [2]. The transport system has a wide variety of direct and indirect ecological effects on the adjacent terrestrial and aquatic ecosystems, including water, air, and noise pollution [3]. Furthermore, the transport system affects social aspects positively by facilitating connectivity between places, but also negatively by creating barrier effects and health problems [4]. The awareness of the social and environmental impacts of transport systems has changed the prerequisites for transport planning [5] and has contributed to the inclusion of sustainability issues. In line with research on the integration of transport and environmental policy [6], it has been argued that environmental aspects need to be given more consideration in transport planning in order to minimize the environmental impacts of the transport system [7].

Which strategies should be used for strengthening environmental aspects in transport planning depends on the stage of the planning process [2]. The early planning stages, which are open and complex [8], have different prerequisites compared to the later stages in the process [9]. Moreover, spatial complexity can play an important role for processing

and managing a planned region that is affected by the interplay of many factors, which implies that the more spatially complex a planned region is, the more time consuming and less precise the environmental management plan will be [10]. Therefore, it is important to frame the process in a way that meets the problems that need to be solved. The early planning stages are frequently characterized by a loosely structured framework, since this allows participants in the process to address problems that are not well defined [11]. A framework that facilitates the integration of transport, land-use, and environmental issues can contribute to sustainable development [2]. However, disagreements between participants regarding the framework's design and a lack of awareness of the agreed framework in the planning process are barriers to its implementation [12].

In Sweden, the Strategic Choice of Measures (SCM) approach is a response to the need to integrate early transport planning into a local context. The SCM approach strategically addresses possible measures before a plan is developed. The SCM process has been defined by the Swedish Transport Administration [13] as a state-led transport planning practice with a focus on dialogue and collaboration between multiple actors. Previous studies reveal challenges with the application of the SCM; for example, the legitimacy of the SCM is highly dependent on the actors' willingness to involve and commit to the measures that are suggested in the SCM [14]. Still, there is limited knowledge on how environmental aspects, e.g., noise, air quality, water, landscape, and health are to be considered in the SCM process and the type of early stage transport planning that it represents.

This paper aims to explore the consideration of environmental aspects in transport planning by analyzing the early stages of the Swedish transport planning process, the Strategic Choice of Measures (SCM). The paper contributes to the scientific debate on developing collaborative approaches to improve the coordination of local land use planning and national transport planning in urban areas in order to strengthen environmental considerations in early transport planning. The paper addresses the following research questions:

1. How does the application of the Strategic Choice of Measures (SCM) in contemporary transport planning address environmental aspects?
2. What are the challenges and opportunities of incorporating environmental aspects into contemporary SCM practice?
3. How can contemporary SCM practice be adapted in order to manage the challenges of incorporating environmental aspects into the SCM process?

The next section provides a description of the methods applied in this research. In Section 3, the theoretical background, the SCM approach and its relation to environmental aspects are presented. The results of the interviews are presented in Section 4 followed by an analysis of the interviewees' view of the SCM process. The findings of the research are discussed in Section 6 and the conclusions are presented in Section 7.

2. Method

A qualitative research design (see Figure A1) was applied to investigate how environmental aspects are integrated in practice in the early stages of transport planning with special reference to the Swedish SCM planning processes. To answer the research questions, the practitioners' perspectives were investigated through triangulations using three different qualitative methods [15]: literature studies, interviews, and a focus group interview.

Scientific literature was reviewed in order to map previous studies on the consideration of environmental aspects in the early stages of the planning process for transport infrastructure projects. The literature study used forward and backward snowballing [16], which resulted in an iterative review process [17] to facilitate an explorative approach to the study. Furthermore, grey literature, such as internal policy documents, SCM guidelines, and reports from STA was reviewed with specifications of how environmental issues are incorporated into the early planning stages of transport infrastructure projects in Sweden.

In addition to the literature study, semi-structured individual interviews and the focus group interview [15] were conducted to explore SCM practice in Sweden and acquire in-depth information and understanding of the practitioners' perspectives. The semi-structured interviews were based on an interview guide [18] that was sent in beforehand to the interviewees. The interview guide addressed a number of themes that focus on challenges related to the consideration of environmental aspects in planning, which were derived from a content analysis of the literature (see Appendices A and B).

Within this study, eight officials from key organizations in the SCM processes in the Stockholm region (Table 1) were interviewed. The interviewees were selected due to their experience of involvement in several SCM processes conducted in urban areas in the Stockholm region, and because of their different roles, they had different experiences in the planning process. The interviews were conducted at the interviewee's office and lasted between 1–2 h. The interviewees were recorded and then transcribed. All interviews were conducted in Swedish, and the quotes in this paper were translated into English by the interviewer. The same interviewer conducted all the interviews and made the subsequent transcriptions. The focus group interview [15] was organized to discuss SCM in the early planning stages of transport infrastructure projects in a Swedish Transport Administration (STA) context and to gain an understanding based on the interactions of the participants. The group interview, which seven STA officials attended (Table 1), focused on how the participants perceived SCM. The focus group interview included a brain writing exercise in two small groups followed by discussions in each of the groups in a plenary discussion (see Appendix C).

Table 1. Overview of the interviewed practitioners and the participants in the focus group interview, including information about the role of the interviewee and his/her role within the organization. The ID in parentheses is a representation abbreviation assigned to the interviewees which is used in the text to identify a specific interviewee. The focus group interview is referred to as FGI.

Interviewees (no. Involved)	Role Description
Planners (4)	Planners working at municipalities (MP1, MP2) or the RPTA (TP1, TP2)
Environmental experts (2)	Environmental experts in transport planning in the strategic phase (EE1) and design phase (EE2) working at STA
Process coordinator (1)	Responsible for SCM processes at STA (PsM)
Project manager (1)	Responsible for transport investment projects at STA (PtM)
Process coordinator ¹ (3)	Officials at the STA, responsible for the SCM processes.
Project manager ¹ (1)	Project manager for investment projects, i.e., the internal planning process following the SCM.
Experts ¹ (2)	Environmental expert, expert on Traffic Safety
Head of unit ¹ (1)	Head of Unit that conduct SCM

¹ Focus group interview (FGI).

The analysis of the empirical material was conducted using an inductive approach. The SCM guidelines were critically reviewed with specifications on how the environmental aspects were explicitly and implicitly considered in the SCM. The analysis of the interviews was structured as a content analysis [15]. This meant that transcriptions of the semi-structured interviews and the notes from the focus group interview were systematically reviewed and sorted into themes. Furthermore, the interviews were analyzed against the background of the SCM guidelines to gain a better understanding of how the guidelines affected the scope of SCM practice.

3. Early Stages of Transport Infrastructure Planning

Within transport planning, collaborative approaches have been suggested as a way to facilitate the integration of environmental knowledge with other types of knowledge (e.g., technical and economic) [19]. Collaborative planning refers to planning as a communicative activity for reaching goals and interpreting problems in order to reach a consensus on

problems and goals [20]. Although collaborative planning is promoted as a solution to solve complex problems [21], the approach has its drawbacks. For example, critics point to the concept of consensus, as it does not contribute to the clarification of conflicts and fails to highlight different options in the decision process [22]. A practical consensus may result in the exclusion of potential participants, interests, issues, and actions [23]. Furthermore, the communicative approach has been described as a waste of time if it does not lead to action on the part of the relevant actors [24]. However, Willson et al. [25] (s. 366) emphasize that “discussion is an essential link between analysis and decision making. Through discussion we acknowledge different values rather than avoid them”. The commitment of the actors involved has been identified as a central feature in planning that effectively translates into action [21].

Collaborative planning has played a role in transport planning to varying degrees [26]. The transport sector in Sweden was reformed in 2010, with the introduction of new policies primarily intended to streamline the transport planning process [27,28]. In addition, the planning system was reconstructed, and the physical planning process, which consisted of three stages, was restructured into one coherent process [29]. As part of the new planning system (Figure 1), the Strategic Choice of Measures (SCM) approach was developed to analyze the necessity of a road or railway project before a physical planning process is initiated [30]. The aim with the SCM was to introduce a planning stage for a more open-ended analysis of how different transport needs can be fulfilled by different measures and actors [13]. The SCM intends to strengthen the dialogue and collaboration between the STA and other stakeholders, in particular with representatives from municipalities in order to facilitate the coordination of transport planning and land use planning. Tornberg and Odhage [14] set out to investigate if SCM represents a collaborative platform for planning activities and concluded that SCM has collaborative features, however, these features are framed in a wider institutional context in which a rational approach to planning dominates. In addition, the prevalence of collaborative features in an SCM varies between SCM processes.

The legitimacy of planning processes like SCM is highly dependent on the actors' willingness to engage and to commit to the proposed measures that results from the SCM process [14]. The importance of the willingness of actors' commitment to investment in issues associated with the transport system became more important with the reforms that were implemented in 2010. This is because the STA's sectoral responsibility was abolished, which reduced the possibilities for the STA to invest in measures that are not directly related to the transport infrastructure. Therefore, the SCM has an important role to play in creating agreement among actors and fostering commitment to solutions of problems associated with the transport system. However, according to Ek Österberg and Qvist [31], there is a primary focus on involving actors with a mandate to conduct planning and a capacity to invest in measures, rather than on a focus on the actors affected. As a consequence, important perspectives and interests may be excluded from the process.

Environmental Aspects in the SCM

Transport planning is governed by the transport policy goals [28,32] and the 16 Swedish environmental quality objectives [33]. To facilitate the consideration of the transport policy goals and the Swedish environmental quality objectives in transport planning, the STA focuses on three indicators that highlight the environmental aspects for which the transport system has the largest impact: climate, health, and landscape [34]. According to the STA, climate encompasses climate and energy aspects, such as emissions of CO₂. Health is about people's well-being, which is affected by a number of factors, including air and noise pollution, opportunities for physical activity, water quantity and quality, and contaminated soils. Landscape includes nature, cultural values, and outdoor life as well as water, landscape, and design aspects. Regarding the SCM, the guidelines published by the STA [13] (s. 25) state that “The transport policy goals are an obvious point of departure for the SCM process”. The environmental quality objectives and the three indicators, i.e.,

climate, health, and landscape, are also addressed in the SCM guidelines in order to ensure that SCM processes contribute to the fulfillment of these. Furthermore, environmental goals on the local and regional level are also referred to in the SCM guidelines. The guidelines address goal conflicts that may occur between the different goals and state that the SCM process provides an opportunity to bridge, highlight, or manage potential conflicts between goals or interests.

Major characteristics of Swedish Transport Planning

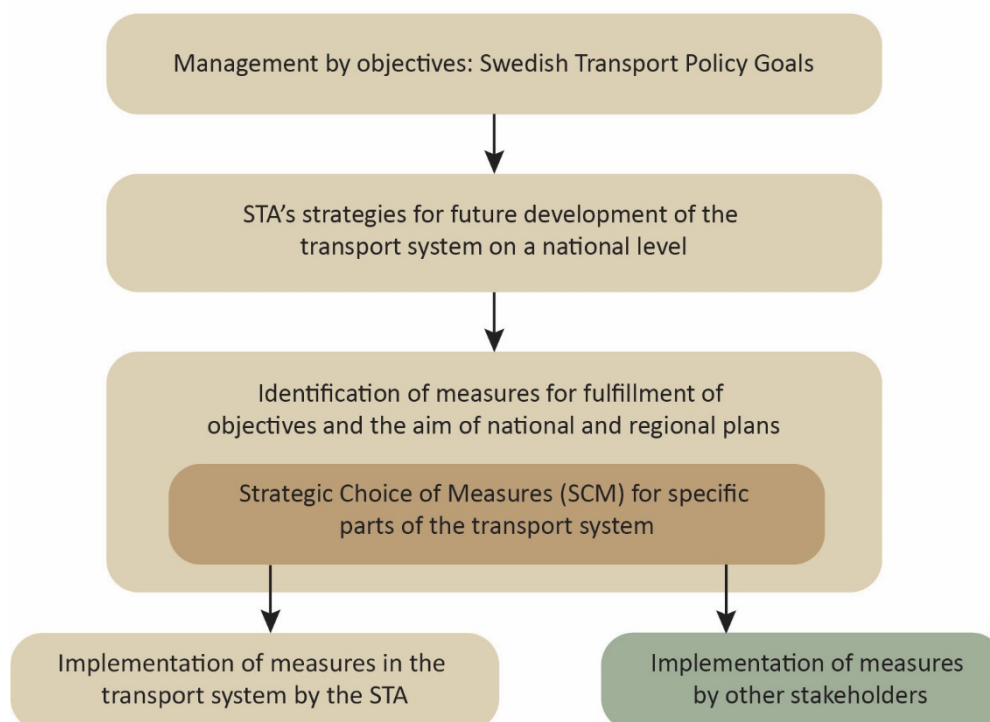


Figure 1. The role of the Strategic Choice of Measures (SCM) approach in Swedish transport planning as conducted by the Swedish Transport Administration (STA). The scheme only shows the major characteristics of the planning system. The light beige boxes show characteristics of transport planning governed by the STA. The brown box shows where the SCM process is located in the overall planning system. The green box shows that not only does the outcome of the SCM process lead to measures implemented by STA but also measures implemented by other stakeholders. The figure is developed based on [13,26,32].

According to the SCM guidelines, an SCM should contribute to how a certain function or quality level, e.g., capacity, safety, environment, and health, can be achieved for all or parts of a transport infrastructure network, a transport corridor, a smaller link within a transport infrastructure network or a transport node. The SCM should provide information and knowledge about why it is or is not motivated to invest in certain measures [13], and it is expected to provide input for implementation of measures in later planning stages. However, unlike the statutory environmental assessment requirement for plans and programs, the SCM process does not follow a specific legal framework, rather, it is an official process developed by the STA, which by extension means that the process falls under the agency's area of responsibility. Consequently, the STA is responsible for gathering relevant environmental knowledge to justify the implementation of measures deemed appropriate under the SCM. One part of this is the consideration of environmental aspects. SCM guidelines do not contain detailed information about what environmental aspects should be considered, the guidelines instead refer to information about environmental aspects in the STA's guiding documents in relation to the impact assessment of measures [35,36]. Regarding the sustainability aspects in SCM, the guidelines refer to information provided by the

Sustainability: National Road Administrations (SUNRA) project, which is a sustainability rating system framework for national road administrations [37].

The SCM guidelines outline how the SCM process should be conducted. The process is structured into four procedural phases [13] (see Figures 2 and A2). In the initial phase (phase 1), a planning process is organized based on initial assumptions and assessments of problems and solutions related to the transport system as defined by the STA. Resources are identified and a process coordinator is appointed by the initiating organization (often the STA). The process coordinator sets up a working group that consists of representatives from the stakeholder organizations that are invited by the initiating organization to participate. The working group drives the process forward and is organized in a way that ensures the inclusion of relevant competencies to address the issue at hand, including environmental expertise. According to STA [13], a working group with representatives from all organizations involved in the SCM is regarded as a quality control for the planning process. The guidelines outline the aim and scope of the SCM so that the working group can identify what environmental aspects should be considered and how. The second phase is about understanding the context, and a workshop is organized to gather information from multiple perspectives to broaden the scope of the SCM. This includes gathering information about the transport system and associated environmental, health, and traffic safety issues and providing a description of the baseline and the zero-alternative (no project) based on this information. The scope is then narrowed, the objectives of the SCM are determined and indicators are specified. The guidelines acknowledge that the root causes of problems do not always need to be present where the problem is observed, and the scope of the SCM should not be determined before problems, the root causes of problems, and the interaction between different parts of the transport system have been clarified. In the third phase, multiple workshops are typically held, where stakeholders with relevant knowledge and responsibilities are included and alternative measures for the particular SCM are generated. The SCM guidelines state that the most appropriate measures should be assessed before they are recommended. The assessment is expected to include environmental and sustainability aspects, i.e., to what extent the measures contribute to minimizing the negative impact on climate, health, and landscape. Although every measure is allocated to a responsible organization, the end product of the SCM process does not formally commit organizations to certain measures.

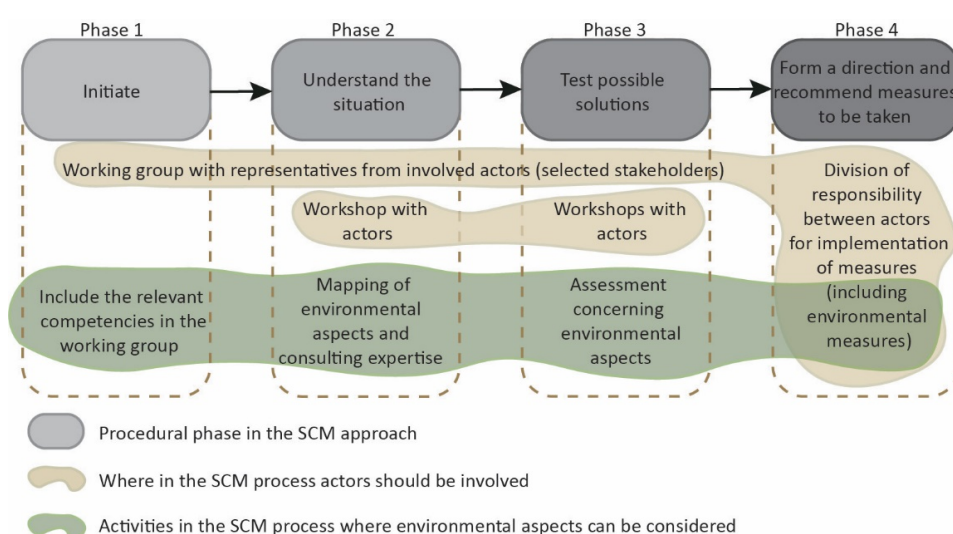


Figure 2. The four procedural phases of the SCM process as defined in the SCM guidelines [13]. In the first phase, an SCM process is initiated based on initial assumptions and assessments of problems and solutions related to the transport system. In the second phase, a workshop is organized to gather information from multiple perspectives. In the third phase, multiple workshops with selected actors

are held, where alternative measures for the SCM are generated. In the fourth phase, the most appropriate measures are selected to be recommended based on assessments. The shapes under the process show in what procedural phase actors are involved and environmental aspects can be considered. An extended figure is included in Appendix D.

4. Practitioners' Perspective of SCM

Two main themes were derived based on the content analysis of the empirical material: The SCM process and the coordination of the working group (4.1) and the SCM and Environmental aspects (4.2). The second theme includes the following issues: Actors' mandate, Changed prerequisites for managing environmental aspects, and Links to later planning stages. Highlights from the results are presented in Table 2 at the end of Section 4.

Table 2. Highlights from the results of the semi-structured interviews and the focus group interview.

The SCM Process and Coordination of the Working Group	The SCM Process and Environmental Aspects
Introduction of the SCM has increased coordination between actors in the early planning stages.	A general need to strengthen the consideration of environmental aspects in the SCM process.
Potential to collaboratively find solutions to integrated transport problems in complex planning contexts.	Difficulties to agree on responsibilities concerning measures to mitigate environmental impacts.
A role in preserving and creating links between local and region land use and transport planning.	Focus on environmental aspects related to direct impacts on human well-being such as noise, while aspects related to landscape receive less attention.
Should be flexible with regard to what perspectives and competencies need to be included in the SCM process.	Risk that environmental aspects on the border between two adjacent projects are neglected.
	Difficulties to find applicable mitigation measures for air pollution and greenhouse gas emissions within the boundaries of an SCM and the administrative boundaries of the municipalities.
	Extensive specifications from previous planning stages can reduce opportunities to develop measures that promote sustainability in the SCM.

4.1. The SCM Process and Coordination of the Working Group

According to the interviewed planners (i.e., MP1, MP2, TP3, PsM), the introduction of the SCM has increased coordination between actors in the early planning stages of transport infrastructure projects. However, the two municipal planners reported that the opportunities to solve complex planning problems through the coordination facilitated by the SCM approach were limited, especially in urban areas where existing infrastructure, adjacent planning, and construction projects narrowed the scope of the SCMs. Moreover, MP1 described an unbalanced mandate between the actors with regard to the ability to propose measures in the SCM process. While MP1 and PsM emphasized the SCM's limitations, MP2, TP1, and TP2 tended to highlight positive aspects, including its potential to address complex planning contexts by bringing actors together to collaboratively find solutions to integrated transport problems. In the words of TP1, "I believe the SCM approach improves the conditions for transport and land-use planning in the regions, provided that there are enough resources and such." The participants in the focus group also expressed a positive perspective about the potential of the SCM and stated that the SCM process had an important role in managing the complexity of the planning context and ensuring the linkages between the local and regional aspects of transport and land use planning are taken into account. However, one participant in the focus group emphasized the importance of having reasonable expectations for the process to avoid disappointment among actors, which could lead to reduced commitment to the results of the SCM.

Furthermore, the interviewed planners (MP2, TP1, TP2, PsM) stated that the SCM tends to focus too much on identifying and describing the problems rather than finding solutions to them. TP2 gave an example related to the workshop approach that is part of the SCM process: "The participants in the workshops have very different backgrounds;

sometimes they do not know what they are supposed to contribute or gain from the workshops. The workshops seem a little unstructured.” The process was perceived to be solely focused on the goal of the SCM, with no clear overview of the entire process, which weakened the incentives for participation given that the desired results of the process were unclear. MP2 expressed it as follows: “It is not always clear to me what the process will lead to and how the suggested measures will benefit all the involved organizations.” The lack of a clear direction in the process and uncertainties about outcomes could, according to the interviewees, affect the commitment level of actors and the quality of the planning process. Regarding the quality of the planning process, MP1 stated that planners are responsible for addressing all relevant issues associated with the particular planning context and should not expect the identification of problems and their consequences, as well as the establishment of associated measures, to be based solely on workshops: “A planning process that is based on what is ‘brought up’ is not a legitimate planning process”.

In the focus group, the participants argued that the SCM process should be flexible with regard to what perspectives and competencies may be included in the working group and the SCM process in general. One participant emphasized that even if representatives with different perspectives are included in the SCM, it is challenging to merge different perceptions of the planning context and to agree on which problems to address or measures to implement. One reason for this was the actors’ preconceived perceptions of measures and conflicting objectives. To meet this challenge, another participant highlighted the importance of a creative dialogue in the SCM to demonstrate the collective benefits associated with proposed measures.

4.2. The SCM Process and Environmental Aspects

4.2.1. The Actors’ Mandate

The planners interviewed emphasized the need to clarify the division of responsibilities between the organizations in the SCM process in relation to the various types of environmental impacts. The planning of a new infrastructure project generally involves an assessment of the environmental impacts caused by the project. In this way, the responsibilities for these impacts are clearly distributed among the organizations involved, but due to the focus on new infrastructure, the environmental impacts of the existing infrastructure are often neglected. In the words of MP1, “Environmental impacts from a new measure in a well-developed transport system are difficult to isolate and assess; the impacts are already there.” This means that the SCM will have to address cumulative environmental impacts. All other interviewees (MP2, TP1, TP2, PsM, PtM, EE1, EE2) confirmed this observation when they expressed the difficulties associated with managing environmental impacts by targeting only one specific source. The temporal aspect was also regarded as a complicating factor. One example outlined by MP1 was associated with heavily trafficked roads, where environmental impacts have changed in magnitude and significance over time: “Although there were problems with air pollution with severe effects on public health, no effective and serious measures that would counteract the problem were proposed, because it was difficult to agree on responsibilities.” Furthermore, the interviewees pointed to the difficulty of addressing environmental aspects falling on the outskirts of the scope of the SCM. MP2 expressed it as follows: “The issue of conserving green spaces often lies on the border between two adjacent projects (e.g., SCM); then the issue tends to be forgotten, as one project seems to think that the other project will take care of it.” The other interviewed planners (MP1, TP1, TP2, PsM) confirmed this observation.

4.2.2. Changed Prerequisites for Managing Environmental Aspects

All interviewees mentioned that in conjunction with the Swedish transport sector reforms and the introduction of SCM in transport planning, the STA has changed the prerequisites for how to address environmental aspects in the early planning stages of transport infrastructure projects. One of the environmental experts interviewed (EE1) expressed this as follows:

The introduction of the SCM resulted in a drop-off in consideration of environmental aspects, climate, and air quality as well as water and landscape in particular. The environmental aspects that are the easiest to handle in an SCM are often related to direct impacts on human well-being, such as public health, noise, and toxic substances.

EE1 explained that one of the reasons for this was a widespread awareness of and interest in issues relating to public health, noise, and toxic materials among municipalities involved in the SCM, which helped put these issues higher up on the agenda. The interviewees explained that the reason for the drop-off was a combination of the end of the STA's sectoral responsibility and the introduction of the new planning system. This meant that the STA's previously established approach for handling environmental aspects was no longer applicable. EE1 said: "The STA had developed routines to consider environmental aspects in the early transport planning stages (before the 2010 reforms). These routines are not adjusted to the SCM process." Furthermore, two focus group participants specifically expressed concerns about how the SCM fails to ensure the inclusion of perspectives that, according to them, are not the explicit focus of the planning process, such as environmental aspects. Several officials in the focus group interview advocated for strengthening the consideration of environmental aspects in the early stages of transport planning. A few participants noted the absence of measures developed from the environmental objectives, while they perceived that it was more common to have measures developed from accessibility objectives.

The interviewees addressed challenges related to four environmental aspects in particular: climate, air quality, landscape, and water. In terms of climate and air quality, the interviewees reported that it was difficult to find applicable mitigation measures for air pollution and greenhouse gas (GHG) emissions within the boundaries of an SCM and the administrative boundaries of the municipalities. In the words of PsM, "Air pollution is the most difficult issue; we are not even close to a solution even though we know the source." PsM also expressed that landscape was difficult to grasp due to the abstract character of the concept, and because it does not directly affect people. Moreover, EE1 reported that aspects relating to water quality and quantity were "fairly easy to identify." However, water aspects were reported to interfere with planning on several spatial levels, including the landscape level, which made it difficult to take a holistic approach regarding those aspects in the SCM. EE2 expressed that "Stormwater is very difficult and complex to address in planning and implementation. This is because there are so many parameters to consider." EE2 meant that the requirements for purification and detention of stormwater are high, and extensive investigations are sometimes needed along with advanced, surface-intensive solutions. This often resulted in conflicting interests between actors regarding the prioritization of investments and land use e.g., detention dam, road infrastructure, and housing in urban areas.

4.2.3. Links to Later Planning Stages

Two interviewees (EE2 and PtM) noted that conditions for addressing environmental aspects changed throughout the planning process, i.e., from the SCM stage to subsequent planning and implementation stages. In the words of EE2,

What are perceived as the best measures for minimizing environmental impacts in the earlier stages may not be the same in the design phase. A measure that was rejected in an SCM may prove to be the best solution in later stages (i.e., the design phase).

EE2 further concluded that extensive specifications from previous planning stages reduced flexibility in later stages, for example, contradictory environmental values can make it impossible to combine noise barriers with desirable landscape features. The interviewees gave examples of this by describing how agreements made in the SCM on which measures should be prioritized did not always align with opinions in later stages,

but they also added that the knowledge and guidelines produced in the SCM facilitated dialogue in the later stages. In relation to this, EE1 expressed concerns regarding a shortage of environmental knowledge in the decision-making process that follows the SCM and that this would entail multiple risks in later stages, such as incomplete and insufficient proposals with regard to measures and expensive supplementary investigations. Moreover, in the focus group, an infrastructure project manager emphasized the difficulties interpreting the description of measures from the SCM and how they are linked, which affects follow-up and how the measures are concretized. According to the interviewees (FGI), the variation in the interpretation of measures among actors causes disagreements about, for example, responsibilities in later planning stages. The participants in the focus group concluded that detailed documentation of the outcome of the SCM is needed to avoid misunderstandings in the subsequent planning stages.

5. Analysis: The Practitioners View of the SCM

The introduction of the SCM has altered the prerequisites for the consideration of environmental aspects in the early planning stages of Swedish transport infrastructure projects. In the previous planning system, before the introduction of the SCM, the STA had a sectoral responsibility, which implied that the STA was accountable for the environmental problems the transport system generated [38]. To handle this responsibility, the STA had a three-stage approach, and environmental aspects were considered in each step according to established routines. In the new planning system, the SCM guidelines aim to provide guidance in the early planning stages of transport infrastructure projects. However, no new routines have yet been established for planners to follow regarding the consideration of environmental aspects in the SCM. The SCM is supposed to provide information about why it is or is not motivated to invest in certain measures [13] and to provide knowledge and decision support for the later planning stages. However, what form this knowledge and decision support should take is not explicitly described in the guidelines, as it depends on the scope and context of the specific SCM. Depending on how the scope is defined, the degree of focus on environmental aspects varies.

The way the aim of a specific SCM is framed and the composition of the working group influence the scope of the discussions in the different phases of the SCM. Usually, the STA initiates the SCM process and identifies the problems that need to be addressed. According to the interviewees, most SCMs focused on problems such as capacity deficiencies and technical improvements of infrastructure. In an SCM process, where the scope is derived from such problems, the environmental aspects deemed to be relevant were limited to those associated with the specific problem rather than being based on a discussion of what solutions would be preferable from a sustainability perspective. Therefore, the environmental aspects became subject to the formal environmental assessment in a later planning stage rather than being integrated in the early planning stage, i.e., the SCM. However, the interviewees argued that the SCM process should have a broad scope to facilitate the inclusion of different types of knowledge and therefore environmental aspects should be integrated in an early stage. At the same time, the SCM process should be designed to facilitate implementation of measures, which can mean that the process has to be narrowed in order to address details. From the STA perspective, it has been emphasized that the SCM process should address environmental impacts in relation to other planning activities within the STA, which would allow cumulative impacts to be assessed.

The second phase of the SCM process focuses on the identification of different aspects relevant for the SCM. Both transport and land-use planners emphasize the potential of using the SCM to develop a common regional strategy, but divergent responsibilities among the participating organizations tend to result in different perceptions of problems that should be addressed and contradicting priorities. Thus, the interviewees emphasized the need of improved coordination between actors. In identifying pertinent aspects in the project area, both contextual knowledge (e.g., local conditions and planning practice) and expert knowledge (e.g., landscape, air quality, and traffic safety) were of great importance.

For example, landscape aspects were difficult to address for planners in SCM as were the cumulative impacts associated with integrated infrastructure planning. Water aspects, on the other hand, were perceived as easy to identify but difficult to address on a specific scale (local, regional, and national), as water is a relevant aspect on multiple scales. In urban areas, aspects concerning air quality and noise stood out in terms of the way they engaged the actors involved in the SCM, thereby taking a more prominent position in the process than other aspects. The workshop approach, as a way of integrating local and environmental knowledge in the process, implied that the capacity of the process coordinator to coordinate the activities was crucial for a successful process. The interviewees perceived that the workshop approach could entail difficulties in securing the consideration of relevant aspects and perspectives, for example, when certain actors were unable to attend or were underrepresented at the workshops.

In the third phase of the SCM process, similar to the second phase, a workshop approach was used to generate measures; however, identifying solutions to complex problems was considered to be difficult in this setting. It was particularly difficult to address and find applicable measures to reduce CO₂ emissions, since such measures span across multiple governmental levels and sectors. Measures to mitigate the impact of air and noise pollution were also difficult to identify, even though these aspects seemed to engage actors. Moreover, air, noise, and water aspects have a strong position in Swedish environmental legislation, which facilitated the promotion of such measures in the SCM. However, water aspects appeared to be mentioned only briefly during the process and were instead considered in separate investigations or in later planning stages where, for example, formal environmental assessments were conducted. Furthermore, the shared perceptions among planners was that it is difficult to establish a creative environment where innovative measures could be generated. The actors' preconceived opinions about the best measures for a specific problem limited the creative process and led to the exclusion of perspectives from the process. In addition, the actors often had different perceptions regarding what the measures they agreed upon implied.

Commitment between actors is important throughout the process. Whether the actors are committed to the outcome of the process becomes evident in the fourth phase when the working group divides responsibilities for the implementation of the informal agreements on measures among the actors. Without such an agreement, it is assumed that the collaboration between actors in the implementation of agreed measures would decrease.

6. Discussion

The results of this study provided insight into planning practices, where environmental aspects are considered in the early planning stages of transport infrastructure projects in Sweden, namely, the Strategic Choice of Measures. The practitioners, included in the study, represent key organizations involved in complex SCM processes in the Stockholm region and cover different areas of professional expertise (e.g., environmental experts, planners, project managers, etc.), which provided a variety of perspectives on the SCM process. This implies that the results presented in this paper focus on the experiences of public actors, while perspectives from other organizations and stakeholders, such as actors from the private sector, are not included in the research.

The explorative research design applied in the study, which in accordance to Kvale [39], provides access to personal perspectives of the interviewees' practical experiences. As the number of people with experiences from SCM is limited, the sample of interviewees was bounded. However, the combination of individual interviews and focus group interviews allowed to capture a broad understanding of contemporary SCM practice.

6.1. Characteristics of the SCM That Challenge the Consideration of Environmental Aspects

This study shows that perceptions varied among actors regarding the ability of the SCM to facilitate the integration of perspectives into the planning process, which indicates

that actors may be deluded in terms of how much influence they have on the planning process. Similar to what Mouffe [22] discussed, it is difficult to ensure that the agreements reached within the working group of an SCM process are upheld when they are transferred to subsequent planning activities, which may involve other actors who perceive the problem differently and may not take into account the deliberative process that took place in the SCM working group. In addition, Ek Österberg and Qvist [31] (s. 308) stated that “many SCM processes run the risk of creating increasing expectations ‘from below’ on future government funding,” which suggests that actors may perceive the benefits of participating in the process to be limited.

The results show that environmental aspects that will have a direct impact on the local living environment will receive more attention in the SCM. Consequently, issues like noise and air pollution generated from roads in the urban region engaged the municipalities in the SCM. Aspects of landscape and biodiversity, on the other hand, seemed more difficult to address and generated less engagement among the actors. A possible explanation for the municipal interest in noise and air pollutions might be that these aspects are important in relation to health [40] and the attractiveness of urban areas. This implies that although the transport system implicitly affects multiple indirect environmental aspects, such as biodiversity and ecological habitat [41] and landscape values [42], these aspects tend to be neglected. This may lead to unforeseen environmental impacts and a subsequent loss of landscape values [41,43].

The open framework that the SCM represents, with features such as the workshop approach, adds flexibility to the planning process so that relevant expertise can be included and the process can be adapted to the specific context. However, the loose structure of the SCM process implies that the process coordinator has an important role in determining which environmental competences to include in the SCM. Löfgren et al. [44] discuss the absence of people who fully comprehend landscape issues at the various stages of the transport planning process, and that it can impede integration of knowledge on landscape in the process. The SCM guidelines refer to other frameworks, e.g., SUNRA developed at the EU level for support in the identification of environmental and sustainability aspects in the process. However, these frameworks are extensive and detailed, and their use in the SCM process was shown to be dependent upon the planners’ and experts’ knowledge of them. The frameworks were used to a limited extent and a lack of knowledge of them can have been a barrier for their implementation in the SCM process [9], which can inhibit the consideration of environmental aspects in the SCM.

Since the SCM includes collaborative features [14], the process offers an opportunity for stakeholders to participate in, commit to, and affect the outcome of the SCM process. However, according to the guidelines, only invited stakeholders are involved in the SCM process, which implies that no open consultation with other stakeholders is conducted. According to Newig et al. [45], collaborative features can contribute to the acceptance of environmental aspects among stakeholders and encourage the implementation of environmental measures, but they may also negatively affect the commitment of actors when the environmental responsibilities that come with engagement are realized. Through the introduction of the SCM, the STA increased their coordination with other stakeholders in order to integrate transport planning with other planning activities, for example land use, which indicates that there are high expectations placed on the STA’s engagement regarding societal development. According to Tornberg and Odhage [14], it is difficult for the STA to meet other actors’ expectations. This study shows that actors in the SCM had different expectations on who are responsible for handling environmental impacts. Ambiguously defined responsibilities can inhibit commitment to engage in and contribute to a process [46], which can have implications for the implementation of environmental measures. Furthermore, the SCM approach is part of a wider institutional transport planning context in which the collaborative efforts made in the SCM process does not have a clear role [14], which may decrease the legitimacy of the loosely defined SCM framework. Consequently, the need and possibility of the SCM process to integrate environmental

considerations is intimately connected to how environmental considerations are handled in planning processes preceding and following the SCM process.

6.2. Possible Ways Forward

The introduction of an approach such as the SCM in the transport planning system implied new opportunities for facilitating a flexible process in which creative, new, and sustainable solutions to transport related problems can be identified. Additionally, the increased focus on dialog within SCM could improve the possibilities to solve complex societal issues; however, if such opportunities are to be created, the link to processes preceding and following the SCM must be further explored. For example, in line with Linseth and Reitan [47], the establishment of a unified vision of the future development of the transport system could increase the understanding of the main problems and also improve the degree of consensus regarding how to solve them. Furthermore, it could be considered to support municipalities with funding for measures that are needed to integrate the new infrastructure project in the local land use context.

To enhance a better integration of environmental aspects in early stage transport planning, the SCM guidelines needs to be more explicit regarding the inclusion of environmental considerations in the coordination of local land use planning and national transport planning.

7. Conclusions

This study has shown that early stage transport planning, namely, the Strategic Choice of Measures (SCM) approach, faces multiple challenges regarding the handling of environmental aspects. The following conclusions can be drawn from this study; Firstly, the introduction of the SCM implies an increase in collaborative features in the early stages of planning, which involves that the way the process is coordinated has a substantial influence over what environmental aspects are considered and how. Secondly, the local and national authorities' different interests, and the competencies involved in the process, affect how environmental aspects are considered in the SCM process. Moreover, in urban areas, environmental aspects that directly affect public health, such as noise and air pollution, engage municipal actors in the SCM process, whereas aspects related to landscape and biodiversity were poorly addressed and received less attention. Hence, when compiling the SCM working group, it is of importance to ensure that relevant environmental expertise is represented. Thirdly, the actors' commitment to the process and the subsequent implementation of measures can be attributed to their organization's mandate to act in planning, which affects what environmental measures are suggested. Fourthly, the SCM approach has the potential of bringing actors together to collaboratively integrate different perspectives and identify possible measures to adapt improvement measures and new infrastructure projects to their local context at an early stage of transport planning. Lastly, in order to consolidate environmental aspects in early transport planning, the link between the SCM process and the preceding and following planning stages needs to be strengthened.

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Informed Consent Statement: We followed ethical requirements and practice for research in Sweden as stipulated by the Act concerning the Ethical review of research involving humans (2003:460). Since we did not collect sensitive data, we did not need a formal approval from the Central Ethical Review Authority in Sweden. We did however inform the participants about the purpose of the study, how the collected data would be used and that they would be anonymous.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available since the interviewees were not asked for consent about that.

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Appendix A. Research Stages

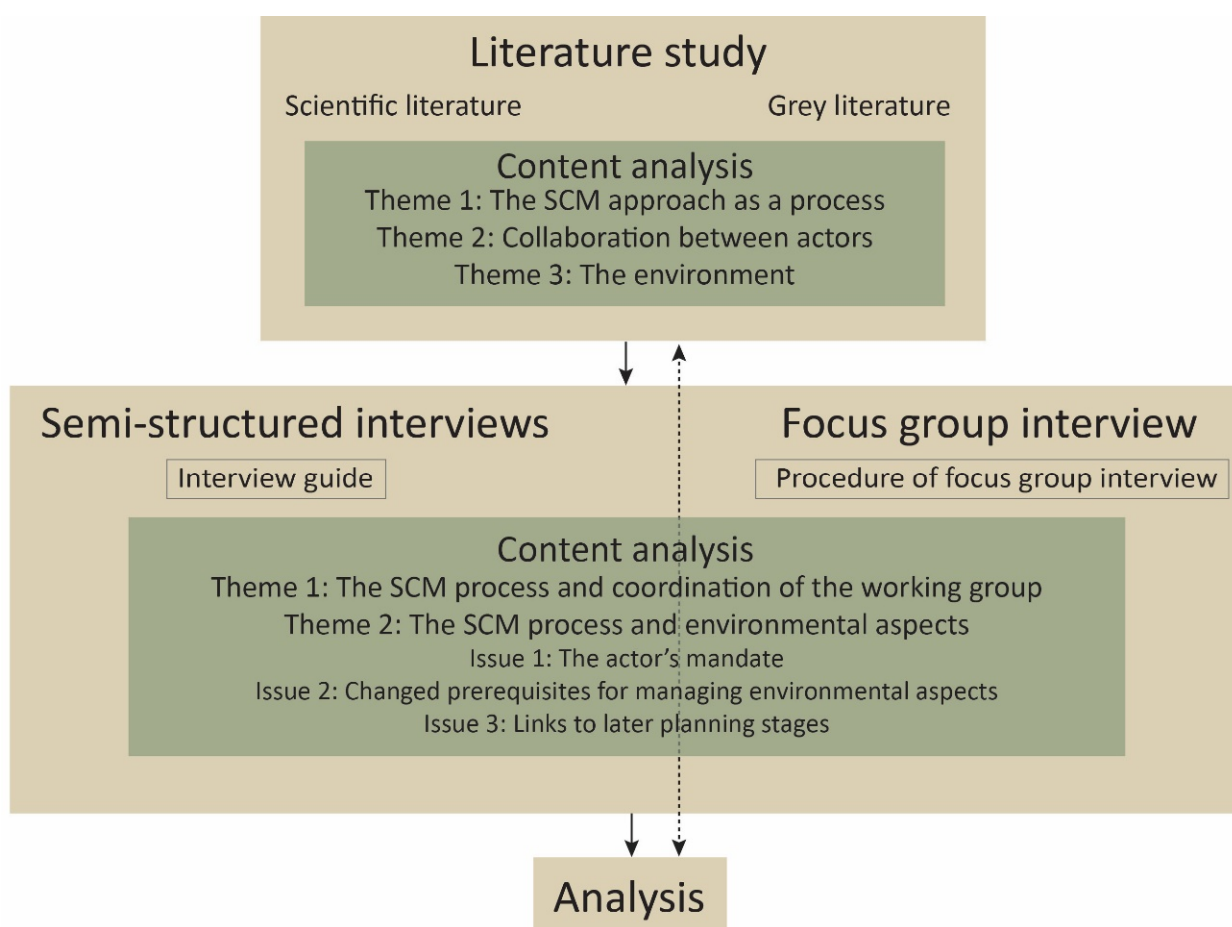


Figure A1. The scheme describes the research stages for this study. The study was initiated with a literature study, which comprised scientific literature and grey literature. Then semi-structured interviews and a focus group interview (FGI) were conducted. For the semi-structured interviews an interview guide was used and the FGI was structured to facilitate discussions between the FGI participants. The preparations for the interviews and the FGI was made based on findings of the literature study. A content analysis was conducted for the interviews and the FGI, which resulted in two main themes and three subthemes. The subthemes were related to the second main theme. After the content analysis, the interviews were analyzed in relation to the literature study. This was an iterative process.

Appendix B. Interview Guide

Interview guide used for semi-structured interviews:

The interviews were held in Swedish.

1. Theme 1: The SCM approach as a process.
 - a. What is the SCM to you?
 - b. Does the outcome of SCM process fulfill the expectations you have?
 - c. Are there any special challenges with the process?
2. Theme 2: Collaboration between actors.
 - a. How do you experience the collaboration between the actors in the SCM process?
 - b. Which actors participate in the SCM process?
 - c. Which are the most important actors in the SCM process and why? Do the involved actors receive attention for the issues that they bring up?
3. Theme 3: The environment
 - a. How are environmental issues handled in the SCM process?
 - b. Which environmental issues are handled in the SCM process? Are there environmental issues that are not handled in the SCM process?
 - c. How is the information about environmental issues used in the SCM process?
4. Is there anything we haven't talked about that you find important?

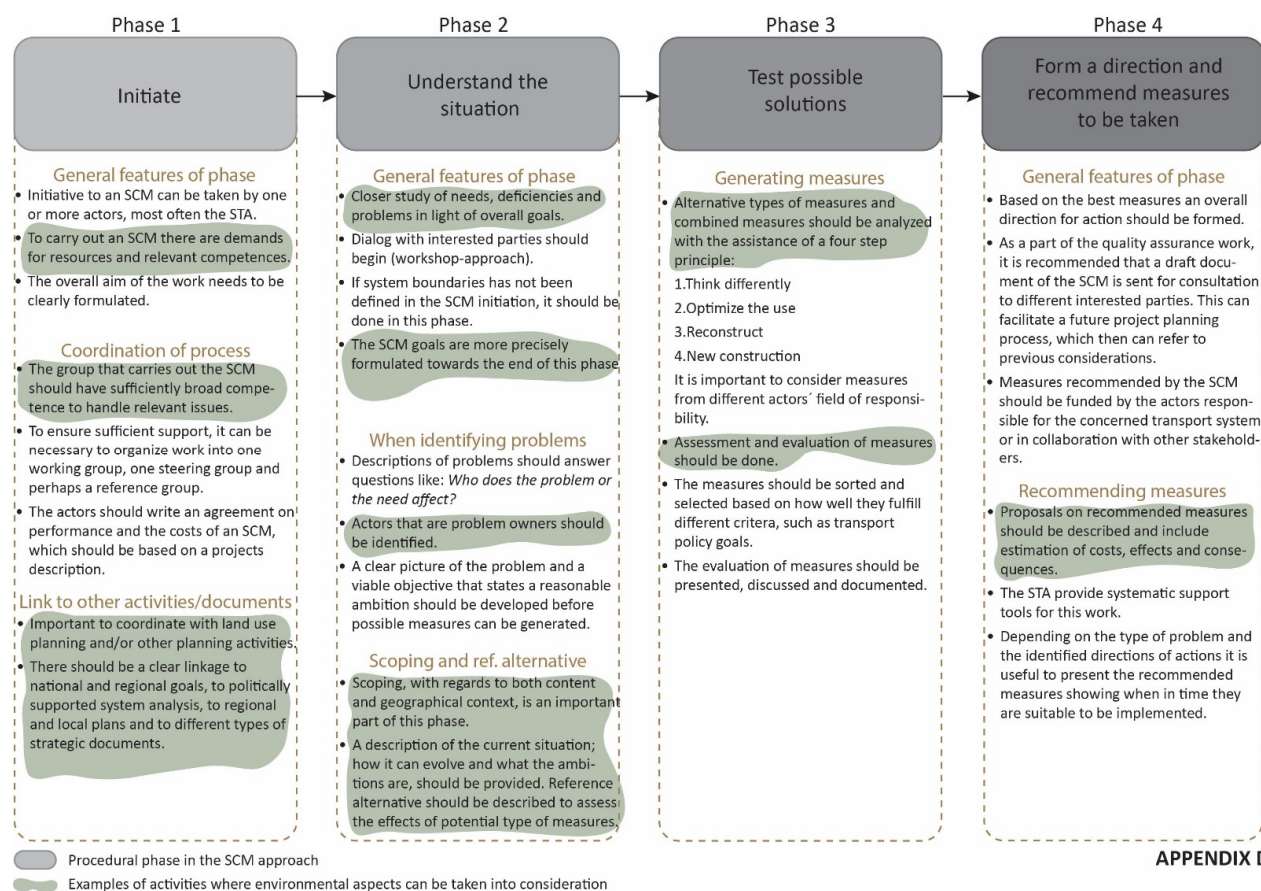
Appendix C. Focus Group Interview

Procedure for the Focus Group Interview (FGI)

One of the researchers led the FGI and the two other researchers took notes, which were analyzed.

5. Presentation of the purpose of the FGI: To reflect upon, learn about and develop the SCM approach.
6. The participants were divided into two groups in which they conducted a small brain writing exercise and then discussed the results of the exercise. The focus on the exercise and the following discussions were Theme 1 (The SCM approach as a process), 2 (Collaboration between actors) and 3 (The environment) from the interview guide.
7. The whole group were gathered again. The groups told each other what they had discussed in their separate discussions followed by discussions in each of the groups in a plenary discussion.
8. In the end of the FGI each participant wrote down three reflections.

Appendix D. The SCM Process



APPENDIX D

Figure A2. The figure provides a description of activities within each procedural phase (1–4) in the SCM approach. It is a complement to Figure 2. The green colored activities are examples of activities where environmental aspects can be taken into consideration. The figure is developed based on [13].

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