Barriers to integrating sustainable stormwater management in urban environments in Sweden

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2024

Document Version:
Publisher's PDF, also known as Version of record

Barriers to integrating sustainable stormwater management in urban environments in Sweden

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Highlights

- Economic, knowledge-based, legislative, organizational, and political barriers hinder the efficient implementation of sustainable stormwater management in Sweden.
- A comprehensive approach involving legislative clarity, improved financial models, enhanced collaboration, and a shift in political priorities towards blue-green infrastructure is needed.
- Balancing urban development with urban green spaces remains a significant challenge, requiring strategies for multiple functions of stormwater solutions.

Introduction

When cities densify, the current pipe-based stormwater systems are insufficient to meet the societal demands concerning water quality and flood protection during extreme precipitation events (Swedish Environmental Protection Agency, 2017, SOU 2017:42). Hence, there is a demand for stormwater solutions capable of meeting multiple societal requirements, known as nature-based or multifunctional solutions (EC 2015). However, the development of more sustainable stormwater management is hindered by a complex set of economic, environmental, and social challenges (see e.g., Storbjörk, 2010; Cettner et al., 2014; Wihlborg et al., 2019; Swedish Environmental Protection Agency, 2017; SOU 2017:42). Technical and institutional solutions that can be used individually or in combination need to be identified. Achieving large-scale implementation of sustainable stormwater solutions requires comprehensive and radical changes, including changed legislation, new business models for stormwater management, and upscaling of nature-based solutions. Due to the complexity of the challenges and, consequently, potential solutions, there is a need for a holistic perspective on stormwater management that encompasses various scientific disciplines as well as experts (Novotny et al. 2010, Ashley et al. 2011).

This study is a part of the synthesis project StormMan, where the overall goal is to identify solutions that enable a transition to sustainable stormwater management. We aim to identify policy instruments and structures that can reform or drastically change the current system. In this study, we have focused on identifying the barriers to a socio-technical transition of stormwater management in Sweden, which is the first step in the project.

Methodology

The study was conducted through discussions with stakeholders and experts in an expert group through interviews and a workshop. These discussions were used to update the findings from interviews conducted some years ago with professionals in Swedish water utility companies and municipalities (Wihlborg et al., 2019) and to broaden the perspective from southern Sweden to a national perspective that included also input from authorities. The expert group comprised professionals from 3 national authorities (4 experts), 1 regional authority, 1 municipality with stormwater management responsibility, and 1 landscaping consultancy company. The group have expertise in urban development, climate adaptation, environmental planning, and water management. They collectively focus on various aspects of sustainable stormwater management, including planning, design and implementation. A 2-hours expert workshop was conducted in May 2023. During the workshop, barriers related to legislation, economy, knowledge & engagement and

organisation were discussed. Detailed notes were made by two researchers and compared with results from the previous southern Swedish study and literature.

Results and discussion

Wihlborg et al. (2019) identified several obstacles to large-scale implementation of sustainable stormwater solutions, here called Blue-Green Infrastructure (BGI). These barriers can be categorised under economics, lack of knowledge, roles and responsibilities, legislation, municipal organisation, densification and housing shortage, political interest, as well as time and workload. Qiao et al. analysed 44 peer-reviewed articles in a literature review (Qiao et al., 2018) and concluded that governance factors are the main cause of the slow implementation of sustainable stormwater management in cities. Unclear leadership and responsibility, lack of funding, lack of cost data for sustainable stormwater management solutions, lack of space and knowledge, lack of consistent guidelines, and insufficient stakeholder participation were found to be the most prominent reasons (Qiao et al., 2018). These barriers were recognised by the expert group and illustrate a complex problem rooted in many parallel barriers. Legislation underlies or intersects with virtually all other barriers and is an area specifically discussed by the expert group. The complexity of legislation itself is problematic. There appears to be a significant lack of knowledge regarding legislation, including what can or cannot be done with current legislation. Authorities provide guides that should support the work on sustainable stormwater solutions, but these are insufficient as the legislation does not provide the opportunity to make strict requirements. As long as the opportunity to make strict demands is lacking, guidance alone is not sufficient in the work on BGI. One of the major obstacles is the lack of opportunities to demand developers and property owners to implement BGI (Wihlborg et al., 2019). Municipalities need a basis to show how they can make such demands.

Economic issues, like lack of funds, are significant barriers to implementing blue-green solutions, both according to the expert group and previous research in Sweden (Widarsson, 2007, Ashley et al., 2011, Cettner et al., 2014, Wihlborg et al., 2019). Due to insufficient funding or funding models, public officials and project managers often choose the well-known route: pipe-based solutions and occasionally externally financed pilot and flagship projects (Wihlborg et al., 2019). In Sweden, there is a strict division between obligations for the water utility companies, i.e. stormwater management up to ~10 years of recurrence, which are paid by water fees, and obligations for the municipality, i.e. urban green spaces, flood defence and climate adaptation, which is paid by taxes. This division often hinders multifunctional solutions, according to the expert group. Economics and lack of knowledge about the effectiveness and benefits of the solutions are closely linked, as the lack of knowledge makes BGI seem riskier than conventional pipe-based solutions (Wihlborg et al., 2019). Construction and maintenance costs and uncertainties about who should pay and maintain are crucial arguments for continuing with pipeline solutions (Penniman, 2013). It has also been argued that there is a lack of resources to proactively work with alternative solutions (Ashley et al., 2011), especially in many small municipalities (Widarsson, 2007). Widarsson further argues that the water utility company is often weak compared to the development offices, especially in securing space for BGI. Economic arguments counter an increased use of blue-green solutions in Sweden (Cettner et al., 2014), especially as developers perceive non-pipeline-based solutions as more costly (Ashley et al., 2011). However, Wihlborg et al. (2019) report that some interviewed officials at water utility companies and municipalities see BGI as potentially more cost-effective. Overall, it seems that the lack of economic models to implement BGI and the lack of knowledge about maintenance costs strongly contribute to the slow implementation pace outside pilot and flagship projects.

The expert group highlights a lack of collaboration within the municipality and between the municipality and water utility companies. This applies to everything from planning to maintenance and management. They and other experts we have talked to also mention ownership rights and control over implemented solutions as a problem. For instance, implemented solutions cannot be accounted for when designing the piped stormwater system because the water utility company does not have control over the solutions and thus cannot guarantee that the solutions will remain in the future. The ambiguity about who should pay and maintain is closely linked to several other barriers, such as unclear roles and responsibilities, legal structures, and municipal organisation, as the budget and legislation set the agenda for each organisation.

The expert group claimed that each organisation is forced to focus only on their duties, which leaves a gap. Municipal water management is perceived by personnel in Sweden as divided (Wihlborg et al., 2019). This division of expertise is also seen in other countries (van der Brugge et al., 2005; Mguni et al., 2015; van Herk et al., 2011, Qiao et al., 2018), where water management is described as a wicked problem, affecting the ability to allocate responsibility. The responsibility issue is passed around within the municipality without anyone taking responsibility for it, according to the expert group. The wickedness in water management has been noted by Pahl-Wostl (2015) and has increasingly begun to be addressed for drainage areas in rural areas, but a strategy considering drainage areas has not yet been implemented in cities. This is noteworthy because both the European Water Framework Directive and the Floods Directive cover cities. In Sweden, the ambiguity regarding stormwater management seems mainly related to the unclear legal responsibility of private landowners versus the municipality when it comes to the negative effects of heavy rainfall (Wihlborg et al., 2019). This ambiguity has also been reported earlier (Ashley et al., 2011; Persson et al., 2012; Dir. 2015:115, SOU 2017:42).

The political agenda for densification plays a significant role as a barrier, according to officials in water utility companies and municipalities (Wihlborg et al., 2019). The housing shortage in Sweden has a major political focus, making it challenging for officials to argue for BGI when competing with spaces for housing. In the region of Scania, 28 out of 33 municipalities have a housing shortage, and at the national level, only one municipality has a surplus of housing (County Administrative Board of Scania, 2017). According to the expert group, the politicians are afraid not to be able to sell land to investors, if too strong requirements are set. Private actors influence land use through investments, and urban infrastructure is significantly influenced by their economic and social interests. Focus on private developers' desire to maximise profits can both block and enable change (Olazabal and Pascual, 2012). It is also reported that the interests of constructors affect municipalities to choose traditional stormwater management to maximise land exploitation (Hordijk et al., 2014). According to Cettner et al. (2013), urban planners therefore have a key role in creating connections between public planning and other stakeholders, which also ties into their role when it comes to the use of environmental legislation to protect the well-being of city dwellers and nature.

In Sweden, there is widespread awareness of BGI (Ashley et al., 2011) and how they can contribute to climate adaptation and strengthen ecosystem services in the city (Wihlborg et al., 2019). However, there is a lack of knowledge on good design and dimensioning, according to the expert group. In the literature, knowledge about cost-effectiveness and a lack of practical experience in hydrological and other effects of new solutions is mentioned (Widarsson, 2007; Ashley et al., 2011). The expert group asked for studies on cost-efficiency that, besides stormwater management, include functions related to, e.g., road construction and urban greenery. They claim that the comparison often is false, comparing apples to oranges. One problem related to knowledge spread is that blue-green solutions often are implemented through pilot projects run by small groups of dedicated officials and financed with external project funds. The knowledge from these projects seems not to be integrated into general stormwater practice (Wihlborg et al., 2019). The introduction of blue-green solutions and climate adaptation measures often depends on committed individuals within the municipal organisation (Storbjörk, 2010; Widarsson, 2007; Cettner et al., 2014). The expert group asks for a more systematic approach to the implementation of BGI. They claimed that sufficient standards for working with BGI are missing. The situation seems to fundamentally be an organisational issue where there is a lack of structure to institutionalise knowledge transfer from projects that have implemented blue-green solutions (Wihlborg et al., 2019). This lack of continuity and the vulnerable knowledge base for climate adaptation were identified several years ago by Storbjörk (2010).

Another obstacle, according to the expert group, is time constraints and heavy workload, which was also seen in the previous study from Southern Sweden (Wihlborg et al., 2019). For instance, the experts discussed that municipalities could receive supervision guidance from the Swedish Environmental Protection Agency, but due to time constraints, they often fail to seek such help. Apart from time constraints, the lack of willingness among public officials to try new solutions and a culture where they are not allowed to test and fail as part of a learning process can also counter implementation (Farrelly and Brown, 2011). Another problem is a lack of political interest, noted in many places, including various municipal officials. When urban flooding is high on the agenda, hard solutions may be prioritised, and the

benefits of blue-green solutions may be overlooked (Ashley et al., 2011). According to this argument, the 2014 floods in Malmö could be a reason why the implementation of blue-green solutions is slower than expected based on the well-known pilot examples from Augustenborg and Västra Hamnen, which were constructed before the event. However, the City of Malmö has implemented some solutions since then, for example, when establishing a new park in Hyllie (SMHI, 2018).

Conclusions and future work

In conclusion, the study highlights the complex, interlinked nature of barriers impeding sustainable stormwater management. Addressing these multifaceted challenges requires a coordinated effort involving legislative clarity, enhanced financial models, improved collaboration, and a shift in political priorities towards resilient, nature-based stormwater solutions.

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