A sustainable reconstruction of the construction industry

Assessing biodiversity considerations and their outlook in the Finnish construction sector.

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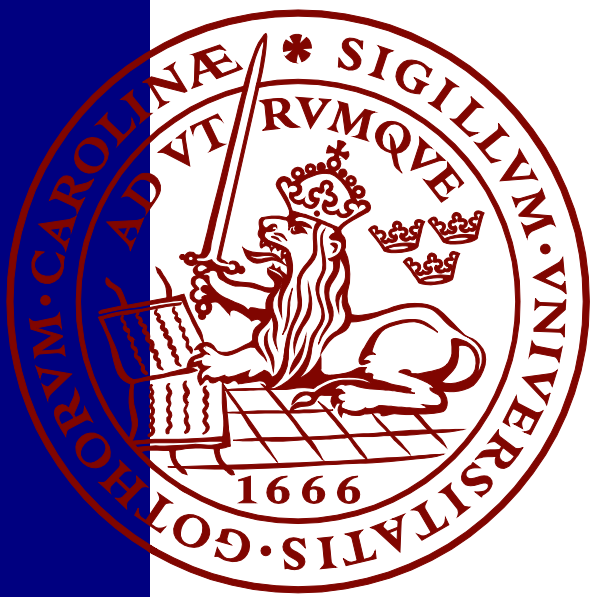

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Abstract

Biodiversity loss and diminishing urban green space are widely recognized sustainability issues, but little research exists on the construction sector's role and the attitudes they hold towards biodiversity. This study contributes to the sustainable urban design literature by studying how construction companies in Finland view their relation to biodiversity and how they could achieve better biodiversity outcomes.

Drawing from five semi-structured interviews with the Finnish construction sector, I contrast their viewpoints with the Biodiversity Sensitive Urban Design framework to assess how companies' standards relate to recommendations and analyze how companies view their relation to biodiversity and regulation on EU and national levels.

The study finds that Finnish construction companies are ambitious towards biodiversity, but that their operations don't yet align with biodiversity-sensitive guidelines. Informed by interviews and literature, the thesis recommends further regulation, in the form of legislation or pricing-in biodiversity, for driving further biodiversity action in the sector.

Keywords: sustainable urban design, biodiversity sensitive urban design, biodiversity loss, green space, developers, regulation

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List of Abbreviations

BSUD – Biodiversity Sensitive Urban Design

CBD – The Convention on Biological Diversity

CSRD – Corporate Sustainability Reporting Directive¨

EPD – Environmental Product Declaration

IPBES – The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

1. Introduction

Biodiversity loss is one of the world's biggest and most urgent sustainability challenges, as it unfolds at ever-growing scales and speeds and puts many of the social-ecological functions human societies rely upon in danger (Díaz et al., 2019; IPBES, 2019; Lund, 2022). The decline of biodiversity in both terrestrial and freshwater ecosystems is driven the most by land-use change and by the indirect demographic, social, economic, and political forces contributing to land-use change and resource use (Díaz et al., 2019). One such indirect driver of land-use change has been the increasing rate of urbanization, which not only takes up land in the form of urban expansion but also contributes to increasing raw material extraction causing further land-use change (Birkeland, 2022; Garrard et al., 2018; Li et al., 2022; Pardo Martínez et al., 2021).

Urbanization has severe negative impacts on biodiversity (Balfors et al., 2016). Locally it causes habitat loss, habitat fragmentation, reduced availability of resources, and changes to disturbance regimes, which all contribute to reduced species and genetic richness and diversity as well as to homogenization of urban biota (Garrard et al., 2018; Li et al., 2022; McKinney, 2006). Urbanization also exposes existing nature to pollutants, alters local temperatures, and increases the incidence of exotic invasive species (Garrard et al., 2018). Beyond cities, the raw material extraction that the construction sector needs to keep building causes biodiversity-affecting land-use change elsewhere, thus increasing the extinction risk of many species (Izaola & Akizu-Gardoki, 2024).

The loss of biodiversity caused by urbanization is also a negative for the social sustainability of urban environments (Bekessy et al., 2012; Bonnes et al., 2007). Studies have indicated positive physical and mental health effects of biodiversity, improving people's immune systems, encouraging healthier more mobile lifestyles, and reducing stress and anxiety (Apfelbeck et al., 2020; Sandifer et al., 2015; Shanahan et al., 2015). Furthermore, studies suggest that these effects are stronger when green areas are more diverse and hold more biodiversity (Fuller et al., 2007; Pett et al., 2016). People have also reported preferring to live near biodiverse areas and suggested that the presence of green areas drives investment and economic activity, which in turn increases taxable revenue (Cilliers et al., 2013).

Addressing urbanization-driven biodiversity loss is a vital concern because urbanization is projected to increase at an accelerating pace (Izaola & Akizu-Gardoki, 2024; UN DESA, 2018). By 2050, depending on the estimate, the percentage of the population living in urban areas is expected to grow to 68-78% of the global population (UNEP, 2021; UN DESA, 2018). As increasing urbanization will cause further biodiversity loss without more sustainable urban designs (Birkeland, 2022; Hassall, 2014; Li et al., 2022), this development complicates the achievement of UN's Sustainable Development Goals SDG11

(sustainable cities) and SDG15 (sustainably managing habitat and halting biodiversity loss) (Li et al., 2022; Opoku, 2019).

In the European Union, halting biodiversity loss has been adopted as a common agenda. The European Commission has adopted an ambitious Biodiversity Strategy for 2030 where the Union dedicates itself to achieving the post-2020 framework of the Convention on Biological Diversity by attempting to bring biodiversity in the EU onto the path of recovery by 2030. This is thought to be achieved by protecting 30% of the EU's land and sea areas, while also attempting to curb the loss of urban green areas by introducing Urban Greening Plans for its cities. (European Commission, 2020). More recently, the European Commission has attempted to introduce the Nature Restoration Act, which would set requirements for the mount of green area in urban, semiurban, and peri-urban areas, as well as for the amount of tree canopy cover in cities (2022/0195 (COD)). At the time of writing, the act has been approved by the EU Parliament, but the text of the act has not been approved by the EU Council and is being re-examined.

In academia, the fields of sustainability science and sustainable urban design have sought to study the issue of urban biodiversity loss in order to present alternatives for current unsustainable practices (Friedman, 2021). The research emphasizes the role of strategic planning for biodiversity in cities (Apfelbeck et al., 2020; Kay et al., 2022; Oke et al., 2021), as urban planning solutions such as nature-based solutions and design improvements to new and existing developments can help to mitigate and to reverse biodiversity loss in cities (Garrard et al., 2018; Guilherme et al., 2024). Such planning, however, is often marred by a lack of accurate ecological knowledge (Guilherme et al., 2024; Panagopoulos et al., 2016), contrasting developer interests (Bekessy et al., 2012; Pett et al., 2016; Reyers et al., 2012), or a lack of understanding of how to move from theory to practice (Kay et al., 2022). To help alleviate these difficulties, several biodiversity-incorporating frameworks for sustainable urban design have been designed (Apfelbeck et al., 2020; Birkeland, 2022; Garrard et al., 2018).

Despite the creation of these frameworks, considerable knowledge gaps still exist. One such gap that this thesis identifies is the lack of research into the role of construction companies and their ways of operating from biodiversity perspectives. Because sustainable urban design frameworks are designed for urban planners and developers (Friedman, 2021), they mainly target the planning phases of each development, ignoring the impact of those who eventually carry out the physical construction work of developments. To help fill this gap in a European context, this thesis takes one framework, the Biodiversity-Sensitive Urban Design (BSUD) framework, which outlines five biodiversity-sensitive design principles and a coherent step-by-step framework for urban developers to follow (Garrard et al., 2018), and uses it in combination with stakeholder interviews to analyze how companies in the Finnish

construction sector take biodiversity into account in their development projects and how companies in the sector approach biodiversity overall.

1.1. Research Aims and Questions

This research joins an ongoing discussion in the field of sustainable urban design surrounding biodiversity-positive urban design, and the ways of transforming the way urban development happens towards more sustainable outcomes. In it, I adopt a critical realist position (Gorski, 2013), seeking to bring together an understanding of the natural scientific phenomenon of biodiversity and the social reality of values, knowledge, expectations, and ideals affecting company actors to assess why construction companies operate in the ways that they do and to shine light on the processes and pressures that need to be altered for the operations to become more sustainable.

The main aim of this thesis is to analyze how Finnish construction companies view and approach biodiversity, how the existing European and national biodiversity measures affect their functioning, and to assess how their approaches could be driven towards a more biodiversity-friendly direction. The thesis also incorporates a secondary aim of testing the viability of the BSUD framework in the Finnish context by analyzing the companies' self-reported biodiversity actions through the framework.

To achieve these aims, the thesis poses following research questions:

> (1) How do Finnish construction companies approach biodiversity? And do their views align with the BSUD principles?
>
> (2) How do the construction companies see recent and upcoming EU and national biodiversity legislation affecting their operations?
>
> (3) How do construction companies think that the sector could be pushed to improve the biodiversity impact of the sector?

To answer the research questions, I conducted semi-structured interviews with representatives from Finnish construction companies and the lobby group/trade association for the Finnish construction industry. The interview responses are analyzed through the lens of the research questions, and the responses relating to the first question are compared with the principles and steps of the BSUD framework to identify whether Finnish construction companies' actions follow the BSUD guidelines.

1.2. Contribution to Sustainability Science

The main contribution of this thesis is to expand the sustainable urban design discussion by bringing in perspectives from business actors in the construction industry. Sustainability science seeks to combine scientific knowledge of both natural and social sciences, and to engage in transdisciplinary discourse

with actors beyond academia, to the end of formulating strategies and concrete actions towards solving sustainability issues (Jerneck et al., 2011). This thesis argues that the issue of urban biodiversity cannot be solved without including construction companies, whether in the role of developer or as contractors, into the discussion as regardless of the design of urban plans it falls upon the construction companies to realize them. By bringing in perspectives from the companies who know first-hand why biodiversity is or is not maintained, science can learn and focus its attention on the processes needed to bring about biodiversity-positive construction.

1.3. Thesis Roadmap

This thesis is structured into separate chapters. Following this introduction, Chapter 2 expands on the background of the research and explains important specifics of the Finnish construction sector. Chapter 3 presents the theoretical framework, discussing sustainable urban design and biodiversity in more detail and giving an in-depth account of the BSUD framework. Chapter 4 explains the methodology of this study, detailing the interview process and analysis approaches chosen. In Chapter 5, results of the analysis are and answers to the research questions are presented. Following the results, Chapter 6 discusses the implications of this study and offers insights into improving both the BSUD framework and the Finnish construction sector's biodiversity impact. Lastly, Chapter 7 concludes the thesis and presents future research avenues.

2. Background

This chapter situates the issue of construction-driven biodiversity loss in the context of the focus area of this thesis, Finland. First, I discuss the legal environment of urban planning in the country and explain how the roles and responsibilities enshrined in law affect how businesses in the construction sector can manage biodiversity loss. Secondly, following up on the first discussion, I examine in more detail the role of the construction sector in both causing biodiversity loss in Finland and the possibilities it has in combating it. Thirdly, as it bears significance for the methodological choices made in this study, I also discuss the organization of the construction sector in Finland, paying attention to the structure of the industry and explaining the role of the corporatist trade association and lobby group of the construction industry, Rakennusteollisuus RT ry.

2.1. Finnish Urban Planning Legislation

In Finland, all construction activity is regulated by the Land Use and Building Act (132/1999). The scope of the act extends to cover planning, building development, and the use of land and water areas, and it includes provisions on town planning, municipal building ordinances, planning and building of shore areas, plot division, expropriation of land, general requirements on building, and building permits and supervision (Ministry of the Environment, 2024a). Additional conditions and guidelines are set by authorities in the National Building Code of Finland, governed by the Ministry of the Environment (Ministry of the Environment, 2024b).

Two main stipulations in the Land Use and Building Act affect biodiversity management. Firstly, in Chapters 4 to 8, the Act enshrines municipalities with the sole legal right for creating regional plans, local master plans (general municipality-level plans guiding land use), and local detailed plans (detailed neighbourhood-level plans guiding land use and development) (132/1999). This effectively grants municipal authorities a total monopoly on urban planning, meaning that all green areas in zoned areas are demarcated and governed by municipalities rather than developers, whose only responsibility is to follow the stipulations of the local detailed plan. Secondly, as stipulated by Sections 5 and 54, the law determines the good condition and the avoidance of the weakening of the condition of the natural environment as one of the requirements for all construction activity. While the sections use relatively circumspect language, their stipulations still safeguard biodiversity to a degree and force planners and those undertaking construction projects to take the condition of nature into account.

2.2. Specifics of the Finnish construction sector

Like in most Western European countries, the construction sector is a significant industry in Finland (Ahonen et al., 2020). The sector has approximately 56,000 companies, employing between 180,000-

200,000 people depending on the year (Rakennusteollisuus RT, 2024b; Statistics Finland, 2022). The vast majority of companies in the sector are small companies employing only one or a small number of people, with medium and large companies making up only 580 of the 56,000 companies (Ahonen et al., 2020; Rakennusteollisuus RT, 2024b). In terms of yearly turnover, only 543 companies have a yearly turnover of over 10,000€ and only 24 companies exceed 200,000€ per year (Statistics Finland, 2022).

The Finnish construction sector is also characterized by the presence of a strong corporatist trade association, Rakennusteollisuus RT. Finland has a long tradition of a routine corporatist system where labourer's unions and their employer counterparts, trade associations, take part in political negotiations, are present in the preparation processes of legislation as experts, and lobby parliamentary politicians (Vesa et al., 2018). Rakennusteollisuus RT fills this role in the Finnish construction sector by acting as the main lobby group representing the interests approximately 3000 companies, including both smaller ones as well as the country's biggest construction companies (Rakennusteollisuus RT, 2024a), thus being an important actor in the industry. Rakennusteollisuus RT's role is also significant in the biodiversity concerns of the sector, as they have engaged the topic by bringing in a consortium of experts and representatives of the sector, who prepared a national biodiversity roadmap for the construction sector (Rakennusteollisuus RT, 2023).

2.3. Biodiversity impacts of the Finnish construction sector

Biodiversity loss is an ongoing problem in Finland (Auvinen et al., 2020). In a 2018 assessment of threatened habitat types, a declining trend was identified for 57% of the country's habitats (Kontula & Raunio, 2019). According to an investigation into the impacts of the country's previous biodiversity strategy carried out by the Prime Minister's Office, the main drivers of biodiversity loss are habitat loss, decreasing habitat quality, and habitat fragmentation caused by agriculture, construction, pollution, invasive species, and climate change (Auvinen et al., 2020; Ruokamo et al., 2023). According to Rakennusteollisuus RT, the construction sector has the 6th biggest biodiversity impact and is the 5th biggest contributor to land use change out of all sectors in the country (Rakennusteollisuus RT, 2023; Ruokamo et al., 2023).

Another key factor contributing to biodiversity loss is resource use. The Finnish national economy is very resource-intensive (Ruokamo et al., 2023), ranking highest in EU for domestic material consumption (Eurostat, 2023). According to modelling conducted in 2015, the construction sector is the biggest consumer of raw materials in the country, using 32% of all raw materials consumed by the economy yearly while also exerting biodiversity pressure abroad by importing foreign raw materials (Ruokamo et al., 2023; Rakennusteollisuus RT, 2023). Because the raw materials used by the sector are mainly natural raw materials, such as wood and aggregates like gravel, sand, and crushed rock, the

sector increases land-use change in the areas where it sources its raw materials from, contributing to further habitat change related biodiversity loss (Kontula & Raunio, 2019; Ruokamo et al., 2023).

Thus, the construction sector is a key actor in reducing biodiversity loss in Finland. Positively, however, the industry has several ways of reducing its biodiversity impact. The businesses in the sector are well positioned to decrease their biodiversity impacts by reducing their land-use impacts through strategic selection of their building locations (Auvinen et al., 2020), by opting for construction materials that reduce the need for new raw materials, such as recycled wood, cement, and stone materials, and by optimizing the life-cycles of existing buildings (Ruokamo et al., 2023).

3. Theoretical framework

This chapter outlines the theoretical framework that this thesis uses for its analysis of the biodiversity considerations of the Finnish construction sector. I begin by briefly introducing sustainable urban design as a field, then explain the Biodiversity Sensitive Urban Design framework in more detail, and finally move on to discuss how biodiversity is defined within the literature of the field and how this thesis conceptualizes of it.

3.1. Sustainable Urban Design

Sustainable urban design, within the context of sustainability science, refers to "a process of ordering coherently different natural and built elements for various activities in cities and towns to create environmentally responsive, economically feasible, and socially inclusive places for communities" (Ghosh, 2017, p. 1). At its core, sustainable urban design is a combination of sustainability principles and urban planning that has come about because urban planners and scientists have concluded that old urban design frameworks no longer deliver sustainable outcomes, thus needing to change (Friedman, 2021). Sustainable urban design practices seek to better address the environmental and social sustainability challenges of urban design, by reducing adverse impacts on the environment and people in urban areas (Aram, 2023; Friedman, 2021).

Sustainable urban design approaches try to account for all the five key pillars of sustainability – social, cultural, economic, and environmental sustainability, and their sustainable governance (Friedman, 2021). The theory of sustainable urban design suggests four principles for achieving sustainability: (1) path of least negative impact, effectively meaning that negative impacts of designs should be minimized; (2) self-sustaining systems, meaning resilience of urban systems; (3) symbiotic relationships, meaning that the connections between different pillars of sustainability must be deliberately built into designs; and (4) life cycle approaches, emphasizing long-term planning and policy objectives (Friedman, 2021).

3.2. Biodiversity Sensitive Urban Design Framework

The Biodiversity Sensitive Urban Design framework by Garrard et al. (2018) is designed to incorporate ecological knowledge into urban planning, design, and development to achieve biodiversity benefits at development sites. It seeks to combine environmental, social, and economic aspects of sustainability by providing planners and developers with concrete guidelines that combine existing urban design knowledge with urban ecological knowledge and help balance biodiversity with other development objectives (Garrard et al., 2018; Kirk et al., 2021).

The BSUD framework starts from five principles meant to mitigate the negative impacts of urbanization while simultaneously fostering positive human-nature interactions in each development project they are applied to (Garrard et al., 2018). These five principles are:

(1) *Maintain and introduce habitat* – including actions such as choosing low biodiversity locations for development, retaining vegetation during development, and enhancing and creating new habitat during development.
(2) *Facilitate dispersal* – helping local fauna and flora move and spread through developments.
(3) *Minimize threats and anthropogenic disturbances* – including invasive species control, control of runoff and spread of harmful substances, and noise and light pollution.
(4) *Facilitate natural ecological processes* – mitigating disruption of natural cycles and ecological processes by providing habitat or resources for key species.
(5) *Improve potential for positive human-nature interactions* – urban design facilitating local stewardship of nature.

The principles are operationalized in five steps (Figure 1) in order to implement BSUD-aligned design choices in a development project. First, existing biodiversity values are charted for the area being developed, including information about the abiotic environment as well as connectivity. Following this stage, the biodiversity information is processed and biodiversity objectives for the development are determined. Third, concrete BSUD actions are identified following the five BSUD principles and other development objects, such as building requirements and targets. Afterwards, the impact of each BSUD action is assessed, and finally suitable BSUD actions that support the biodiversity and development objectives are chosen and carried out in development (Garrard et al., 2018; Kirk et al., 2021). The last stage is particularly important because it allows planners and developers to consider trade-offs between biodiversity objectives and other development objectives (Garrard et al., 2018).

Figure 1. The five steps of the BSUD framework, carried out in sequence. Figure from Garrard et al. (2018, p. 3).

Real-world applications of the BSUD framework have shown its applicability to maintaining biodiversity in urban development situations, showing that it manages to bring biodiversity considerations into urban development discussions where they otherwise might have been lacking (Kirk et al., 2021). This makes it a promising tool for assessing the biodiversity approaches of Finnish construction companies, as even though the framework has not been directly applied in the studied contexts, its steps and principles are applicable to almost all urban development situations and can be used to study where developments are still lacking.

3.3. Definitions of Biodiversity

As established in the introduction, biodiversity is a key issue in urban environmental sustainability. However, biodiversity is often used in literature without a definition, so it is unclear whether different sustainable urban design share the same conceptual knowledge of biodiversity. Some studies use species richness and species abundance as proxies for biodiversity (Garzon Lopez & Savickytė, 2023; Li et al., 2022), while others also incorporate species genetic exchange into their definitions (Balfors et al., 2016).

Most commonly, however, literature refers to other accepted definitions for biodiversity, such as the IPBES and the Convention on Biological Diversity (CBD) definitions, cf. Pett et al. (2016). IPBES defines

biodiversity as “the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part. This includes variation in genetic, phenotypic, phylogenetic, and functional attributes, as well as changes in abundance and distribution over time and space within and among species, biological communities and ecosystems” (IPBES, 2019, p. 1033). The CBD definition, on the other hand, is that biodiversity “means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems” (CBD, 2006).

For the purposes of this study, I will be referring to the CBD definition for biodiversity, as the European Union, which Finland as the context of this study is a part of, abides by this convention.

4. Methodology

In this chapter, I explain the methodological choices made in this study and give an account of how the study was carried out. This study mainly employs qualitative interview-based methods but mixes in deductive coding and a basic frequency analysis to test the BSUD framework chosen for analysis. Section 4.1. details the data collection methods of the study, with section 4.1.1 paying specific attention to the sampling strategy chosen. Following this, section 4.1.2 describes the interview process employed in this study. Finally, section 4.2. describes the data analysis carried out after the interviews were conducted, describing both the deductive and inductive coding approaches carried out in this study in further detail.

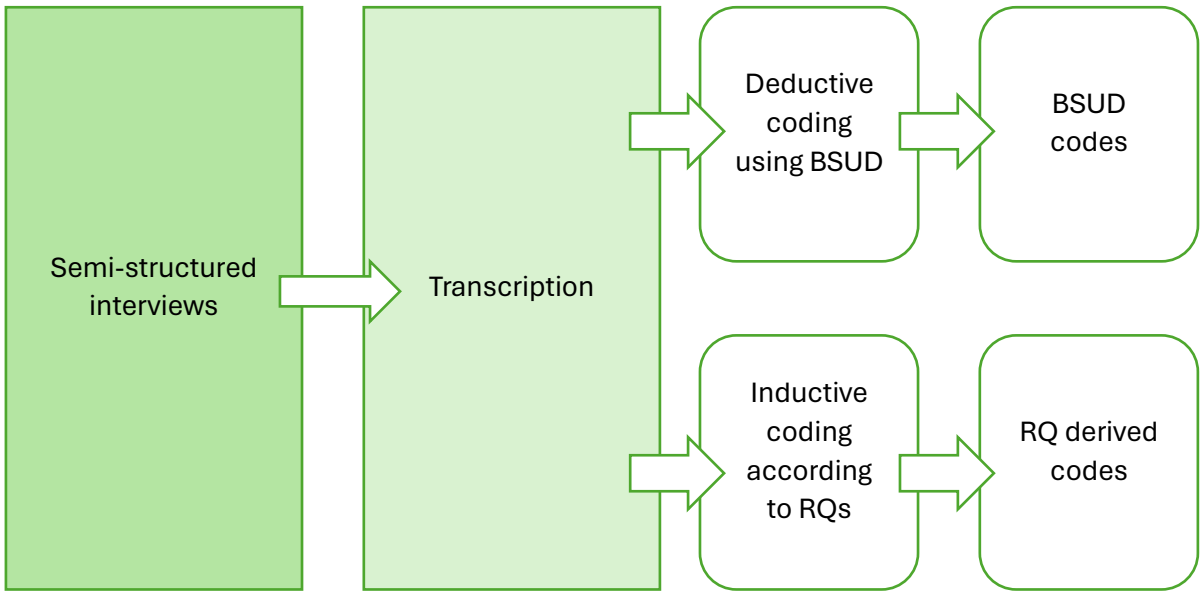

Figure 2. A visual representation of the methodological steps carried out in this thesis.

4.1. Data Collection

The focus of this study is the Finnish construction sector and how actors in it approach biodiversity. Thus, a natural starting point for data collection was approaching construction companies operating in the Finnish construction sector. As the Finnish construction industry is highly stratified, I started by finding out which construction companies were the largest and followed this by conducting preliminary research into the biodiversity approaches of Finnish construction companies by reading the corporate responsibility and environmental strategies of larger companies. During this process, I also discovered the Biodiversity Roadmap devised by the trade association Rakennusteollisuus RT and decided to incorporate them into the study as well as a voice in the industry. Simultaneously, I also checked the Finnish Land Use and Building act and the EU's biodiversity strategy as well as the proposed Nature Restoration Act to ensure that the legislative grounding of the study was correct.

Once I had established that biodiversity was on the agenda of companies in the construction sector, I devised a sampling strategy to limit my examination to actors deemed suitable for my research. After sampling was done, I sent out a total of 8 interview requests to seven companies and the trade association for the purpose of holding semi-structured interviews with industry professionals in order to collect data that I could analyze to answer my research aims. Some companies were approached more than once as their initial point of contact was a general contact email address found on their public website, which did not end up resulting in a response.

4.1.1. Sampling Strategy

The sampling strategy employed in this research was a type of purposive sample (Bryman, 2012; Knott et al., 2022) guided by preliminary research into available information about biodiversity approaches of different construction companies. Knowing that the Finnish construction sector only has approximately 20 larger companies, a preliminary search of biodiversity-related information was first conducted on the websites of the 15 biggest construction companies in Finland to see whether all larger companies reported biodiversity-related information. Companies only carrying out infrastructure projects, such as road construction and quarrying operations, were excluded from the search as studies have found their operations and their impacts deviating significantly from those companies who mainly operate in urban environments (Haule, 2022). Upon conducting this search, it became clear that only five of the largest companies had set direct biodiversity-related targets in their strategies. This led to a selection of eight companies and the trade association for a representative sample of both larger companies that specifically focus on biodiversity and larger companies that have not yet done so, as well as the trade association representing both overall sector interests as well as those of smaller companies. Before all interview requests could be sent out, one of the selected companies went bankrupt and ceased operations. No replacement was selected due to time constraints and the low availability of suitable alternatives, thus bringing the final number of interview requests down to eight.

4.1.2. Semi-structured Interviews

After sampling of suitable interview participants was completed, semi-structured interviews were set up according to good scientific standards (Bryman, 2012; Kallio et al., 2016). Semi-structured interviews were chosen as the interview method because they enable the interviewer to ask more open-ended questions and because they allow for a higher degree of reciprocity and follow-up questions with the interviewees (Galletta & Cross, 2013; Kallio et al., 2016). This was seen as important because biodiversity is a relatively new topic in the construction sector, and because of the highly subjective nature of the research questions two and three. A six-themed interview guide was prepared for the

interviews according to the research questions, following the steps outlined by Kallio et al. (2016) (Appendix 2). Once the interview guide was done, a preliminary interview was held with an urban planning expert to ensure that the interview questions designed were appropriate for the purposes of the study and could be answered by interviewees.

In the end, five (N=5) interviews were held with representatives from four large Finnish construction companies and the trade association Rakennusteollisuus RT (Appendix 1). Each interview was 40-60 minutes long and went over each of the themes outlined in the interview guide. Participants were asked about (1) their role in relation to biodiversity, (2) the company's strategy and its relation to biodiversity, (3) how the company approaches biodiversity, (4) how the company sees current and future biodiversity legislation affecting their operations, (5) how companies in the construction sector could be driven towards addressing biodiversity, and (6) whether any important aspect was missed in the interview questions prior. All interview participants consented to being recorded. The interviews were held in Finnish due to the ease of using the interviewees' native language and the companies' operating languages being Finnish.

4.2. Data Analysis

Data analysis took part in two main steps. First, all interviews were transcribed using Happy Scribe, and manually checked to ensure correct audio to transcript translation. After the transcription was completed, the data was coded according to both deductive and inductive coding principles to answer the research questions (Bryman, 2012; Galletta & Cross, 2013).

4.2.1. Deductive Coding Approach

To answer the first research question and to test the applicability of the BSUD framework to the operations of Finnish construction companies, deductive coding was first carried out. As deductive coding seeks to test an existing theory by contrasting data with prior assumptions and theories (Chandra & Shang, 2019; Thomas, 2006), a set of codes directly derived from the BSUD framework was devised. This set of codes (Figure 3) includes the five steps in the BSUD framework, with the BSUD principles included as separate codes underneath step 3 of the framework which calls for identifying principle-linked BSUD actions. If no concrete action was identified, but an action corresponding to BSUD step 3 was identified, it was simply labelled as code 3.

BSUD Coding Scheme:

1. Document biodiversity values. (DBV)
2. Identify biodiversity objectives. (IBO)
3. Identify BSUD actions. (BSUD)
    - 3a. Maintain and introduce habitat (BSUD1)
    - 3b. Facilitate dispersal (BSUD2)
    - 3c. Minimize threats and anthropogenic disturbances (BSUD3)
    - 3d. Facilitate natural ecological processes (BSUD4)
    - 3e. Improve potential for positive human-nature interactions (BSUD5)
4. Assess BSUD. (ASS)
5. Decide on BSUD actions. (DEC)

Figure 3. The deductive coding scheme derived from the Biodiversity Sensitive Urban Design framework (Garrard et al., 2018).

All interviews were coded according to the BSUD coding system to see how many BSUD-aligned biodiversity actions were reported by the companies when they described their operations. Once coding was completed, a basic frequency analysis was conducted on the codes to see which codes occurred the most. This type of analysis was chosen because it allowed for an effective analysis of whether the current ways of operating employed by the construction companies align with the BSUD principles — though it must be noted that as the BSUD principles were not directly included in the interview guide it is possible that the results do not entirely match reality as certain actions may have remained underreported.

4.2.2. Inductive Coding Approach

To support the deductive coding analysis and to answer research questions two and three, the deductive coding was followed by an inductive coding approach. The purpose of inductive coding, the more commonly used type of coding (Bryman, 2012; Galletta & Cross, 2013), is to use readings of raw data to find emerging themes and dominant information to generate findings (Chandra & Shang, 2019; Thomas, 2006). This was particularly useful in the context of this study where industry professionals were asked to detail how their companies approached biodiversity, how legislation affects them, and how their operations could be driven towards more sustainable practices – all questions with varying responses.

To analyze interview data inductively, all interviews were first coded using broad research question-based codes (R1-R3). Once this was carried out, all coded passages were given a thematic label based on their contents. Finally, the thematic labels were grouped into more specific themes to establish what the most frequent and important findings of the analysis were about (Galletta & Cross, 2013). All

thematic labels were counted, and the frequencies of each specific theme were analyzed to establish which ones came up more frequently.

5. Results

This section presents the results of the data analysis and answers the research questions posed by this thesis on the basis of the findings. Section 5.1. describes the results of the deductive coding analysis and seeks to answer the question of whether Finnish construction companies' operations align with the BSUD principles. Section 5.2. introduces the results of the inductive coding analysis, presenting research question specific answers in sections 5.2.1., 5.2.2, and 5.2.3.

5.1. Alignment with the Biodiversity Sensitive Urban Design Framework

The deductive coding for the BSUD framework's steps and principles returned mixed results. A total of 65 code-corresponding responses were identified and coded, suggesting that Finnish construction companies' current ways of operating include at least some aspects of the BSUD design ideal. Compared to the results of the inductive coding, however, 65 responses across five interviews is a relatively low number, meaning that while some aspects of BSUD are already being followed, they are either not regarded as key components of the companies' strategies or not commonly understood by representatives of the companies as important parts of their biodiversity-related operations.

Table 1. The results of the deductive coding using the BSUD-derived codes (from Figure 3). The most common codes in bold.

Code	Identifier	Frequency
DBV	**1**	**10**
IBO	**2**	**13**
BSUD	3	7
BSUD1	**3a**	**22**
BSUD2	3b	5
BSUD3	3c	4
BSUD4	3d	2
BSUD5	3e	1
ASS	4	1
DEC	5	0

A similar interpretation is suggested by the relative frequencies of each code, found in Table 1. Out of the 65 coded responses, the vast majority (N=45) concerned documenting biodiversity values, identifying biodiversity objectives, and the concrete action of maintaining or (re)introducing habitat during or after development. This suggests that companies are aware of the need to identify the ecological values of the areas they are developing and have some tentative expertise in habitat

maintenance, but also that this is the main extent of their biodiversity-related expertise and that other types of actions are not necessarily regarded as central to biodiversity.

Some companies reported having taken actions that facilitate natural dispersal (N=5) and that minimize threats and anthropogenic disturbances (N=4), mostly in the form of taking measures to prevent the spread of invasive species or by maintaining a specifically introduced habitat available for specific target species, but overall, these actions were quite rare. Even rarer were actions supporting natural ecological processes (N=2) and actions aimed to improve the potential for positive human-nature interactions (N=1), suggesting that companies are not aware of the biodiversity-impacting potential of these actions or lack the necessary skills or knowledge to produce them.

Examining each code more closely reveals a more complex picture of what companies already do and what they struggle with. Starting with Code 1, documenting biodiversity values, we see that companies do engage in this and that on many occasions existing external requirements mandate that they map out the ecological values of the plots that they are developing:

> *R1: "On the contrary, we often have a situation where our clients require us to include green factors and other such mechanisms, like 'create and bring some green here'."*
>
> *R1: "Often when we work with projects we develop ourselves, we always carry out environmental certification processes for them and they require us to do this and that guides our actions, and we have a higher level of ambition there than when we're just contractors."*
>
> *R2: "Even right now we're doing a lot of ecological surveying, but it starts out from finding out what is present in the area that we're taking up for development."*
>
> *R3: "We always carry out an ecological survey before starting operations on any project."*

However, some companies have found that documenting biodiversity values is not a straightforward process and can in some contexts require expert knowledge that the companies might not possess:

> *R1: "Of course, we've done this as well, and it has created some kind of environmental value at the premises, but we can't appraise it, and I think that would be the first thing with which to, that already guides our work."*

Code 2, identifying biodiversity objectives, paints a similar picture. With the exception of one company that did not identify this as something they do, all interviewed actors reported some form of biodiversity objective-setting:

> *R5: "That's at least the first thing that comes to mind, that it's good to set a measurable target that is well defined and then to make all plans surrounding that and to check that it's reached."*

R3: "Then we have, in a way, the plot's biodiversity targets. And those are for all of our projects."

R4: "We've done this for several years now, but it's always been project-specific and dependent on what the project team has been interested in and what they've seen as beneficial."

While considered a routine part of the development process, one actor also identified the need to make objective-identifying more inclusive by bringing in other stakeholders into the process to better incorporate it into sustainable urban planning:

R2: "Now we ought to change it so that the client wanting a certain outcome works together with the developers and thinks about how the project could be carried out so that it touches nature in the least possible amount together with the builders."

R2: "But then we need to think, conduct ecological surveys, where we feed the urban planners and the developers or the clients and builders information that, okay, according to the survey this area needs these and these actions supporting the nearby nature."

Code 3, identifying BSUD actions, mainly involved companies mentioning that they undertake concrete biodiversity actions at their project sites without going into specifics about what those actions are, while also including some overlap with code 2 in instances where interviewees talked about following project-specific objectives with concrete actions without going into detail. This code remained fairly unpopulated (N=7), but this was mostly due to the decision made during coding to include separate codes for each BSUD principle.

Code 3a, maintaining and introducing habitat, on the other hand, was the most populous code (N=22). Every interviewee mentioned habitat-introducing actions when detailing their company's approach to biodiversity. The concrete actions were diverse, including such actions as insect hotels, leaving decaying trees at project sites, using alkaline earths to create deciduous forest habitat, incorporating green infrastructure, choosing specific plant species to bring to plant in an area, removing existing plants and rock features for the duration of construction and later bringing them back, and returning to project sites later to ensure certain habitats remain.

Actions corresponding to code 3b, facilitating dispersal, were mentioned by two different interviewees. These actions mainly included actions targeted at enabling local species to spread to project areas:

R5: "And, as it happens, the mound was covered in green and had all kinds of, what we at home call weeds, and it was absolutely incredibly great-looking, a fresh green. Somehow the seed bank had activated when we had patted the area into a smooth brown."

R3: "We intend to create a kind of a natural pathway there…"

Code 3c actions, those minimizing threats and anthropogenic disturbance, were mentioned by three different interviewees. Two interviewees mentioned concrete actions taken to prevent invasive species from spreading, while one described a concrete measure a project had carried out to reduce noise pollution during birds' nesting season:

> *R3: "And in some places we arrange our building site barracks as a wall so that we don't disturb the area next to the site, especially if there's forest and nesting birds there. We use them as a noise barrier, kind of."*

Actions following code 3d, facilitating natural ecological processes, were mentioned by two interviewees. Both of these actions involved leaving a former project site in a state where natural processes could unfold and local flora and fauna could take over the area, with some level of oversight from the developer. Similarly, code 3e, improving potential for positive human-nature interactions, was only used once, in a context where an interviewee mentioned an instance where they left a tender for a project where they would only use half of the plot and leave the other half as green space to increase the amount of green in a highly urban neighbourhood lacking other green spaces.

Code 4, assessing BSUD, was also used only once, and even that one instance contained a negative statement where a developer admitted to not having necessary in-house competence to assess whether adding certain trees and other plants on project sites would improve biodiversity values or not.

Code 5, deciding on BSUD actions, returned no results. This is because no company employed the BSUD framework in their operations, nor did they mention choosing biodiversity-sensitive actions as a result of a design process together with other stakeholders. This result is partially misleading, however, as all companies did mention incorporating biodiversity-improving actions in their projects, and one interviewee specifically mentioned the need to broaden the objective-setting process to include other stakeholders. This result should thus be taken as a result of assessing the alignment of companies to the BSUD framework.

5.2. Research Question Specific Coding

The inductive coding carried out using the research questions as broader codes produced 272 coded passages. Divided between the three research questions, the coding process returned 179 responses to RQ1, 31 responses to RQ2, and 62 responses to RQ3, respectively. All of these, divided into themes according to the thematic labels given to each coded passage, can be found in Appendix 3.

5.2.1. Research Question 1

Coding for responses relating to the first research question, how construction companies approach biodiversity, resulted in 37 different thematic labels, grouped into 6 main themes. These main themes were *biodiversity action* (N=46), *biodiversity knowledge* (N=35), *corporate biodiversity awareness* (N=35), *company role* (N=29) , *resource use* (N=19), and *project requirements* (N=15).

Table 2. Coding results for the theme *biodiversity action*.

Theme	Thematic label	Label amount	Total amount
RQ1:			
Biodiversity action	Place-specific biodiversity improvements	15	46
	Providing habitat	11	
	Biodiversity experiments	9	
	Green infrastructure	3	
	Lacking action	3	
	Improving biodiversity vs. start of operations	2	
	Providing food	1	
	Environmental protection	1	
	Facilitating natural processes	1	

The theme *biodiversity action* overlaps heavily with the BSUD analysis. The thematic labels within this theme (Table 2) were *place-specific biodiversity improvements* (N=15), *providing habitat* (N=11), *biodiversity experiments* (N=9), *green infrastructure* (N=3), *lacking action* (N=3), *improving biodiversity vs. start of operations* (N=2), *providing food* (N=1), *environmental protection* (N=1), and *facilitating natural processes* (N=1). As can be seen, most of these were already present in the prior analysis. What is noteworthy is that many companies mentioned seeking place-specific biodiversity improvements and that many are already carrying out different kinds of small-scale biodiversity experiments at their project sites, showing that companies are genuine in their statements about action towards biodiversity improvements. Regardless, some companies also felt that concrete biodiversity action was still lacking and could be improved.

Table 3. Coding results for the theme *biodiversity knowledge*.

Theme	Thematic label	Label amount	Total amount
Biodiversity knowledge	Lacking biodiversity knowledge	18	35
	Biodiversity accounting	11	
	Learning	4	
	Spread of knowledge	2	

Biodiversity knowledge concerns what companies say about their current biodiversity-related knowledge and the lack thereof. The labels found (Table 3) were *lacking biodiversity knowledge* (N=18),

biodiversity accounting (N=11), *learning* (N=4), and *spread of knowledge* (N=2). The results show that companies are engaging in biodiversity accounting and that they report that learning about biodiversity and how to manage it is happening as they engage in these processes. Some innovations have even been used to train staff companywide even beyond Finland. However, all companies brought up the lack of biodiversity knowledge as a factor limiting their ability to improve their biodiversity impacts. Companies don't themselves have this knowledge and they report that using consultants is expensive and tricky. This also complicates biodiversity accounting in some instances, as companies report a lack of proper indicators and appraisal know-how.

Table 4. Coding results for the theme *corporate biodiversity awareness*.

Theme	Thematic label	Label amount	Total amount
Corporate biodiversity awareness	Biodiversity ambition	17	35
	Corporate agenda-setting	7	
	Early adoption	5	
	Biodiversity awareness	2	
	Desire to ideate	1	
	Immediate action	1	
	Biodiversity business	1	
	Corporate agenda-setting (no)	1	

The theme of *corporate biodiversity awareness* concerned the views and agendas companies held towards biodiversity. The labels here (Table 4) were *biodiversity ambition* (N=17), *corporate agenda-setting* (N=7), *early adoption* (N=5), *biodiversity awareness* (N=2), *desire to ideate* (N=1), *immediate action* (N=1), *biodiversity business* (N=1), and *corporate agenda-setting (no)* (N=1). As the labels show the interviewed companies, with the exception of one company, expressed ambitious attitudes towards biodiversity, setting corporate agendas and goals of reducing negative biodiversity impacts and adopting biodiversity-supporting actions early on. Companies also reported a share sectoral ambition towards improving the biodiversity impacts of the whole sector, as the trade association's biodiversity roadmap was seen as setting a baseline for the industry's overall level of biodiversity awareness and responsibility. One company had even experimented with turning biodiversity improvement into a business venture but had not yet achieved beneficial results.

Table 5. Coding results for the theme *company role*.

Theme	Thematic label	Label amount	Total amount
Company role	Developer role opportunities	6	29
	Limited possibilities	5	
	Sector responsibility	5	
	Co-operation with stakeholders	5	
	Big picture view	4	
	Urbanization vs. biodiversity	3	
	Industry vs. construction	1	

The theme *company role* conveys what companies had to say about the role of companies in the construction sector with regard to reducing biodiversity loss. Labels in this theme (Table 5) were *developer role opportunities* (N=6), *limited possibilities* (N=5), *sector responsibility* (N=5), *co-operation with stakeholders* (N=5), *big picture view* (N=4), *urbanization vs. biodiversity* (N=3), and *industry vs. construction* (N=1). Here companies relayed contrasting views. On the one hand, companies felt that their roles as actors simply carrying out construction limited their ability to make a positive impact on biodiversity and that in the big picture view individual biodiversity-supporting actions had a very small impact in a world where increasing urbanization reduces biodiversity. On the other hand, companies also acknowledged that they have more opportunities to create better biodiversity outcomes in projects where they have more responsibility and planning power and accepted the responsibility of construction companies in limiting biodiversity loss both alone and together with other stakeholders. Construction companies also noted that some bigger companies who run both construction and industrial operations, the latter mostly referring to infrastructure construction and raw material extraction, have more responsibility due to their larger overall impacts on biodiversity.

Table 6. Coding results for the theme *resource use*.

Theme	Thematic label	Label amount	Total amount
Resource use	Raw material impacts	11	19
	Re-using materials	5	
	Way of construction	2	
	Need of new raw materials	1	

Moving beyond the scope of the BSUD analysis, the theme of *resource use* brought up questions of raw materials and circular economy. The labels within this theme (Table 6) included *raw material impacts* (N=11), *re-using materials* (N=5), *way of construction* (N=2), and *need of new raw materials* (N=1). Here companies mentioned seeking to increase the percentage of recycled materials in their operations to reduce the impacts of their resource use — noting, however, that challenges related to this exist and that it might not be possible in all instances since raw materials are quite local and, due to monetary and climate concerns, impossible to transfer over long distances. Way of construction was also brought up, pointing how a transition towards more renovation and reconfiguration of existing buildings could reduce industry impacts.

Table 7. Coding results for the theme *project requirements*.

Theme	Thematic label	Label amount	Total amount
Project requirements	Environmental requirements	6	15
	Construction requirements	3	
	Price of projects	2	
	Difficulty in valuating biodiversity	2	
	Public pressure	2	

Lastly, the theme of *project requirements* contained labels (Table 7) related to different requirements affecting the biodiversity impacts of projects. These labels include *environmental requirements* (N=6), *construction requirements* (N=3), *price of projects* (N=2), *difficulty in valuating biodiversity* (N=2), and *public pressure* (N=2). Companies reported both self-set construction requirements and external environmental requirements in urban plans influencing how they operate, increasing their biodiversity considerations. Public pressure was also identified as a factor pushing companies towards more biodiversity-friendly operations. However, companies also reported having difficulties adopting broad biodiversity-supporting measures due to cost constraints of individual projects and due to having difficulty valuing certain biodiversity indicators over others.

5.2.2 Research Question 2

Responses addressing the second research question, the impact of European and national biodiversity legislation, generated 9 thematic labels, divided into 4 themes. These four themes were *Nature Restoration Act* (N=16), *CSRD* (N=11), *taxonomy* (N=3), and *EPD requirements* (N=1).

Table 8. Coding results for the theme *Nature Restoration Act*.

Theme	Thematic label	Label amount	Total amount
Nature Restoration Act	Lack of clarity	5	16
	Impacts on urban planning	4	
	Lack of strict national requirements	3	
	Impacts on environmental permits	2	
	Small companies untouched	2	

The theme *Nature Restoration Act* contains all labels related to discussions surrounding the EU's biodiversity strategy and related legislation, which in the context of the interviews was essentially the Nature Restoration Act. Labels included (Table 8) were *lack of clarity* (N=5), *impacts on urban planning* (N=4), *lack of strict national requirements* (N=3), *impacts on environmental permits* (N=2), and *small companies untouched* (N=2). Companies agreed that the Nature Restoration Act, should it eventually

be enacted, would have impacts on urban planning and environmental permits, thus improving biodiversity but forcing changes upon how companies currently operate. There is considerable lack of clarity, however, on how exactly this would come to pass as no national legislation has yet been drawn up and in its current form there is a lack of national requirements, drawing some ire from companies who want regulation to be the same for everybody. One company especially mentioned that they would be fine with even a very strict set of regulations, as long as the smaller companies in the sector also had to comply with them.

Table 9. Coding results for themes *CSRD, Taxonomy,* and *EPD requirements*.

Theme	Thematic label	Label amount	Total amount
CSRD	CSRD reporting pressure	10	11
	Circular economy requirement	1	
Taxonomy	Taxonomy criteria	3	3
EPD requirements	EPD requirements	1	1

Three of these themes related to different legislative and international standard-related requirements, *CSRD*, *taxonomy*, and *EPD requirements* contained only two, one, and one thematic labels, respectively (Table 9). *CSRD* labels included the themes of *CSRD reporting pressure* (N=10) and *circular economy requirement* (N=1), while the sole *taxonomy* label was *taxonomy criteria* (N=3) and the sole *EPD requirements* label was a self-titled one (N=1). Every company interviewed said that the CSRD requirements have been the biggest singular factor pushing companies to incorporate biodiversity accounting and reporting in their projects. Even one company that had not yet otherwise engaged in biodiversity actions said that the EU's corporate sustainability reporting directive (CSRD) was the reason why they had now begun to chart their own biodiversity impacts. Similarly, taxonomy and EPD requirements concerning the sustainability of raw materials used by construction companies push them to be more mindful value-chain impacts.

5.2.3. Research Question 3

Coding for the third research question, how the sector could be pushed to improve its biodiversity impact, found 14 thematic labels, further split into 5 main themes. The themes for this set of coding were *external requirements* (N=26), *financial push factors* (N=12), *legislation* (N=11), *internal drivers* (N=7), and *politics* (N=6).

Table 10. Coding results for the theme *external requirements*.

Theme	Thematic label	Label amount	Total amount
External requirements	Requirements from urban plans	9	26
	Requirements from clients	8	
	Co-operation with stakeholders	4	
	Societal awareness	4	
	Value chain reporting pressure	1	

External requirements labels (Table 10) were *requirements from urban plans* (N=9), *requirements from clients* (N=8), *co-operation with stakeholders* (N=4), *societal awareness* (N=4), and *value chain reporting pressure* (N=1). Interviewees agreed that pressure to take biodiversity into account from both clients and urban plans would push them to tackle the issue more. In a similar vein, most companies identified an enhanced co-operation capacity with urban planners and clients as a push factor that is currently lacking. Three interviewees also said that the societal and public awareness of biodiversity and its importance should be enhanced, as this would in turn affect construction companies. The role of value chain reporting standards was also brought up.

Table 11. Coding results for the theme *financial push factors*.

Theme	Thematic label	Label amount	Total amount
Financial push factors	Market incentives	7	12
	Market benefit for biodiversity action	4	
	Taxation	1	

Financial push factors brought up by representatives (Table 11) included the labels *market incentives* (N=7), *market benefit for biodiversity action* (N=4), and *taxation* (N=1). The first label refers to companies identifying that currently biodiversity actions are not beneficial in that they do not bring additional value to companies. Company representatives wished to see clients value biodiversity actions more, thus preferring to choose tenders where such actions were present. Market incentives, on the other hand, displayed company preferences for pricing-in biodiversity degradation and guiding company action by economically encouraging them not to degrade biodiversity and by giving them free hands to innovate with their own biodiversity actions. The one taxation label refers to one representative suggesting that new raw materials could be taxed heavier to push companies into avoiding them.

Table 12. Coding results for the theme *legislation*.

Theme	Thematic label	Label amount	Total amount
Legislation	Environmental legislation	10	11
	Legislating environmental reports	1	

Legislation labels (Table 12) include *environmental legislation* (N=10) and *legislating environmental reports* (N=1). All interviewees agreed that environmental legislation would be an effective way of making sure that biodiversity-supporting actions would be undertaken. Two of the interviewees however emphasized that legislation can only set specific requirements and that other, more effective ways of pushing companies into acting differently might exist. One representative was particularly fond of legislation and directly declared a preference for legislating environmental reporting standards for

construction sites. Another interviewee was hesitant but upon further consideration concluded that legislation would be the most effective way to influence urban planners, and therefore developers.

Table 13. Coding results for the theme *internal drivers*.

Theme	Thematic label	Label amount	Total amount
Internal drivers	Corporate pressure	4	7
	Numeric drivers	3	

The *internal drivers* theme (Table 13) contained two labels: *corporate pressure* (N=4) and *numeric drivers* (N=3). These were mainly industry-internal factors, referring to interviewees mentioning that the industry is a very engineer-led one where numeric targets and objectives drive action. They agreed that more corporate-set biodiversity objectives would mean more biodiversity action in the industry, as this has already been the case with some of the companies whose more biodiversity ambitious corporate headquarters are located outside of Finland.

Table 14. Coding results for the theme *politics*.

Theme	Thematic label	Label amount	Total amount
Politics	Political difficulty	4	6
	Ongoing discussion	2	

Finally, the *politics* theme (Table 14) contained the labels *political difficulty* (N=4) and *ongoing discussion* (N=2). These labels both described difficulties that the construction sector grapples with. The political difficulty of drafting biodiversity legislation was brought up, as interviewees expressed their frustrations with the national legislative bodies and the slowness of their processes. According to them, politicians have trouble creating concrete legislated targets because they would be politically unpopular. Similarly, the ongoing discussion label referred to mentions of legislative processes and stakeholder discussions where certain biodiversity-related themes were still being prepared, leaving the industry in the dark about what the future would bring and making it harder for them to prepare in advance.

6. Discussion

Unpacking how Finnish construction companies approach biodiversity and whether their approach is aligned with the BSUD framework, how they see current and upcoming legislation affecting them, and what means of pushing the sector towards decreasing their biodiversity impacts they identify, this section connects the results with literature to elaborate what the key findings signify.

Starting with the analysis of the BSUD framework in section 6.1., I argue that the results of this study show that while Finnish construction companies do not follow the BSUD framework in their operations their biodiversity actions and their ambitions nevertheless already partially align with BSUD ideals. Moreover, with further learning and increased biodiversity knowledge, companies in the sector could adopt more of the BSUD principles and increase their capacity for producing biodiversity-improving outcomes. I also suggest additions to the framework to make it better suited for contexts such as Finland where urban planning monopolies exist and where the freedom of developers is more limited by bringing in a governance component that is heretofore lacking in the model.

Section 6.2. in turn discusses the findings of the inductive coding and answers research questions 1-3. I note how companies feel the need to act and accept their responsibility but are limited by a lack of information and a lack of concrete requirements. I also touch upon the considerable role of resource use and challenges companies have identified with it. The role of EU legislation is considered, as companies have identified it as a meaningful driver. Similarly, national legislation and economic incentives are discussed as means of driving further inclusion of biodiversity in the sector's functioning.

Finally, section 6.3. briefly discusses the limitations of this study and how they may have affected the results.

6.1. On Biodiversity Sensitive Urban Design and its Applicability

The results of the analysis produce two main findings: (1) that companies, despite their reported ambitions, are not fully aligned with the BSUD principles; and (2) that regardless of this, construction companies do already follow some steps outlined in the framework, suggesting that potential for further inclusion of BSUD principles in their work may exist. Construction companies are restricted by the amount of biodiversity knowledge they possess, the requirements that they are legally bound to follow, and the cost of their projects.

The first main finding is clearly evidenced by data. While all of the interviewed companies do use ecological surveys to chart biodiversity values of their sites, all of them do not even follow that up with identifying specific biodiversity objectives for their projects. Out of the companies that do, the vast majority mainly engage in habitat management processes and only consider dispersal, the unfolding of

ecological processes, anthropogenic threats, and the potential of positive human-nature interactions sparsely in individual cases where project teams identify such approaches as fruitful and manageable to carry out. Companies also report difficulties in appraising biodiversity values accurately, as they lack ecologists or other biodiversity experts, and thus are sometimes incapable of assessing biodiversity and identifying biodiversity objectives for their project sites. Thus, we can conclude that Finnish construction companies do not closely follow the BSUD principles.

The primary reason appears to be a lack of information. The interviews show that the topic of biodiversity is a very recent one in the sector, with the earliest biodiversity strategies having been adopted in 2012 but most other companies only having begun focusing their attention to it in the last five years. Institutional learning and the spread of knowledge about biodiversity impacts and possible biodiversity solutions has thus had little time to unfold. This is perhaps best shown by the trade association's biodiversity roadmap, the first sector-wide approach to biodiversity, only having been published in late 2023. This is significant, because the construction sector, primarily an engineer-driven sector operating mainly in accordance with standards, has reportedly been slow in adopting environmental performance related measures due to lack of expertise and training (Gangolells et al., 2009).

Another key aspect identified by the interviews is the lack of external BSUD-aligned requirements. One interviewee emphasized the role of requirements and alluded to the price of projects as a main factor influencing companies:

> *R2: "And we also run into the fact that when we really go down from the big targets and ambitions to the level of singular projects, then we all of a sudden run into the euros and the needs of the site and different requirements and guidelines. So we're not… we're not yet talking about biodiversity here."*

When specific biodiversity-related targets are missing from urban plans and from clients' initial requirements, companies are primarily driven by profit-seeking motives, as also suggested by literature (Isaksson & Linderoth, 2018; Kay et al., 2022). This is a key finding, because the BSUD framework and other biodiversity-specific principles derived from the BSUD framework emphasize the need of stakeholder-cooperation in defining targets (Apfelbeck et al., 2020; Garrard et al., 2018; Kay et al., 2022). This was also reported by interviewees, many of whom expressed wishes for stricter external constraints to bind the companies to biodiversity. If BSUD-aligned target-setting was present in projects from the start, companies would likely follow the principles more closely.

The second main finding, that companies do nevertheless follow some BSUD principles, follows from this discussion. The interviewees reported that companies carry out ecological surveys and biodiversity-improving actions not only because the companies feel a sense responsibility over

biodiversity loss but also because it's required of them and because it helps them with sustainability reporting, suggesting that companies have strategic interests in following requirements (Cortés et al., 2023; Liu et al., 2020). If more was required of the companies, it follows the benefit-seeking logic of corporations for the companies to abide by these increased requirements and to accrue more relevant skills to be able to fulfil the objectives (Liu et al., 2020). The interviewed companies expressed that they would currently like to do more but are restricted by the availability of information and price constraints limiting the possibility of hiring external consultants. This thus raises the point that BSUD principles should be brought to urban planners in Finland and more broadly adopted as a set of biodiversity-supporting requirements in construction, which also provides an answer to one of the remaining questions that the original BSUD formulation had — namely, who should set targets and who should be responsible for them (Garrard et al., 2018)? If BSUD principles were directly set in urban plans, companies would have an easier time following them, relieving them from the pressures of needing to come up with challenging solutions to problems they don't have the expertise tackling themselves.

Finally, on a metatheoretical note, the analysis carried out by this thesis goes to show that the BSUD framework can also be utilized as a tool for analysis. Testing this was a secondary aim of this thesis, as the framework was originally conceptualized as a model for incorporating ecological knowledge into urban planning and construction and not functionally as a tool for analysis (Garrard et al., 2018). As the results have shown, using the separate BSUD principles and the concrete steps in the framework as separate parameters tested against observations returns results that can be analyzed for their contents and frequencies, making the framework suitable for analyzing biodiversity considerations in development projects, albeit in a limited capacity as the last two steps *Assessing BSUD* and *Deciding on BSUD actions* are unlikely to return results due to framework-specificity.

For similar future use of the BSUD framework, it might be appropriate to consider modifications of the framework. In its current form, the framework pre-assumes project-specific development planning (Apfelbeck et al., 2020; Garrard et al., 2018), which may not always be how development unfolds, especially in countries like Finland where municipal urban plan monopolies dictate how construction happens. Thus, specification of the urban planning context is needed for the application of this framework. Similarly, the approach is missing a governance dimension that would help the user determine whether developers have more freedom to seek alternative solutions or whether certain solutions or requirements are mandated by top-down processes, as they are in some contexts (Aina et al., 2019). It is also important to consider whether the use of BSUD is enough, as more critical views argue that sustainable design paradigms are not sustainable, as they primarily aim for "more good, less bad" relative to existing conditions as opposed to addressing large-scale biodiversity issues (Birkeland, 2022).

6.2. Company Biodiversity Considerations and the Role of Regulation

Moving on to the topic of this study's primary research questions, the results provide a comprehensive picture of how Finnish construction companies approach biodiversity. The main takeaway is that companies and the construction sector in general, through the trade association, are acutely aware of biodiversity loss as well as of the importance of promoting biodiversity and reducing negative biodiversity impacts, and that they already carry out project-specific biodiversity actions meant to chart, protect, and selectively improve the biodiversity values of their sites. Companies report feeling responsible for biodiversity loss as actors driving land-use change, and most larger companies have adopted biodiversity as a part of their corporate responsibility strategies and are actively seeking new ways of improving their impacts. As one interviewee put it:

> R3: "Right now we're trying to seek out our company-level nature footprint, kind of defining it together with a university, so that we could then start pushing the graph down like we've done with emissions…"

Companies are also welcoming to added urban planning and legislative requirements for biodiversity, stating that they would be open to doing even more than they are currently doing as long as the requirements were the same to the whole sector. However, the question of how far construction companies are willing to go remains. The biodiversity roadmap of the sector's trade association promotes the term nature-positive, calling for actors in the sector to strive to move towards that ideal (Rakennusteollisuus RT, 2023), but, as critical voices in academia have posited, true nature-positivity would require biodiversity net gain and a departure from traditional sustainable design paradigms and moving towards design philosophies that embrace biodiversity as a fully enfranchised stakeholder in urban settings (Birkeland, 2022; Hernandez-Santin et al., 2023; Milner-Gulland, 2022). Some companies already stated that their ability to reduce their material use and to decline certain severely biodiversity-decreasing projects was constrained by other corporate goals, such as climate targets and profit margins. One interviewee even expressed a clear preference for focusing on "low hanging fruits" first, and more fundamental concerns related to the amount of construction only after everything else was already done.

A key factor limiting companies' ability to engage in more biodiversity work is the lack of knowledge. Few companies have in-house ecological expertise, and expert networks in the sector are still quite lacking due to the topic of biodiversity being new to the industry, corroborating a finding from literature that describes urban development as disciplinarily siloed (Kay et al., 2022). Companies have identified this, however, and have started forming contacts with universities and other partners to improve their biodiversity knowledge and, subsequently, their impacts. This will take time, however, and it is still

unclear what the degree of contact vis-à-vis urban planners the companies can or even should have. The lack of information is also a problem in terms of carrying out biodiversity-improving actions. One big challenge is the context-specificity of knowledge. One interviewee pointed out that biodiversity is such a complex phenomenon that similar solutions may produce completely differing results in different localities, making the need of expert knowledge dire.

Another particularly notable biodiversity concern that was raised several times in the interviews was the role of resource use. Prior studies and life cycle analyses have established the resource use of construction as its main driver of biodiversity loss (Izaola & Akizu-Gardoki, 2024; Opoku, 2019; Zu Ermgassen et al., 2022), and the interviews reflected this with most participants identifying the resource use of their companies as the most burning question with regard to their biodiversity impacts. Regardless of this observation, however, addressing the biodiversity impact of resource use remains problematic for the industry, as interviewees reported already high levels of recycled material use — as high as 80% of all concrete for one company — and a general lack of opportunity for driving the need of new raw materials lower. Resource use is also problematic to companies because information about the biodiversity impacts from the original sources of many resources remains unknown and unreported. More information is needed if companies want to reduce the biodiversity impacts of their full value chains.

There is an external push factor towards more information acquisition in the form of EU's environmental legislation, specifically the EU's taxonomy and the CSRD, which mandate companies to report on the biodiversity improvements of their EU funded projects and to report about the biodiversity impacts of their actions, respectively (Regulation 2020/852; Directive 2022/2464). This is the main finding of the second research aim, exploring how Finnish construction companies view EU's biodiversity legislation and its impacts on them. Both the taxonomy and the CSRD exert pressure on companies to find out their environmental impacts, biodiversity included, and to report those yearly. One interviewee reported that these requirements have already begun to impact the available funding of their projects, with investors asking for specific information about impacts. This is in line with literature that suggests the taxonomy and other Green New Deal related legislation is expected to push companies to adopting sustainable reporting standards that influence their environmental impacts, resource use, and the funding available to them (Papari et al., 2024; Velte, 2024). Companies are generally satisfied with this direction, albeit some of them report having to spend considerable resources on reporting, which, as one interviewee put it, could perhaps be directed towards concrete action instead. Reporting alone won't solve negative biodiversity impacts either, as prior studies have established that it is demonstrably easy to report in ways that make industry impacts appear better than they really are (Boiral, 2016).

Companies were also asked about the EU's biodiversity strategy, and its national counterpart in Finland, as well as legislation related to it, such as the EU's Nature Restoration Act, but they reported limited impacts of these strategies as their view is that they will mostly concern the urban planners and not construction companies directly, especially in Finland where urban areas have a higher amount of relict nature due to old planning strategies (Yli-Pelkonen & Niemelä, 2005), and where the thresholds delineated in EU strategies are mostly exceeded. Insofar as urban planning changes, companies expect to have to abide by those changes, but beyond that the impacts are unclear. In general, companies report a high level of ambiguity with the legislative processes, as little information is available on how the processes are proceeding and what the ultimate impacts of those laws and strategies will be. There is also concern that the biodiversity strategies will be watered down, and that they won't require strict national adherence, in which case they may not lead to drastic biodiversity improvements. The same concern applies to the Finnish biodiversity strategy too, as one interviewee reported strong lobbying from the forestry industry in the country affecting how the strategy is being drafted.

On the topic of national regulation and how the construction sector could be pushed towards better biodiversity outcomes, the third research aim of this study, all interviewees agreed that more regulation is needed. However, there is considerable disagreement about how this should be implemented. Some interviewees favoured economic incentives, such as pricing-in land use and ecological values, taxation of raw materials and waste, and clients' biodiversity requirements for project proposals, whereas other interviewees were more skeptical of the strength of economic push factors and preferred legislative means like mandatory ecological surveys and biodiversity values instead. One interviewee pointed out that while the company was not averse to either means of regulation, economic regulation would only move the bigger actors in the sector seeking external funding and carrying out bigger projects, whereas legislative regulation would enforce the same rules upon everyone in the sector.

Regardless of which style of regulation, or combination thereof, is used, all interviewees agreed that the role of urban plans and urban planners is the most important factor to consider. All companies follow the urban plans, so the most direct way of affecting the companies' operations is through regulating the planning itself. This deviates from a stream of sustainable urban design literature where bottom-up strategies are preferred over top-down governance (Apfelbeck et al., 2020; Friedman, 2021; Garrard et al., 2018), instead suggesting that in contexts such as Finland where top-down mechanisms are already present those mechanisms can be given priority as tools driving sustainable transformations, as suggested by sustainable governance approaches (Aina et al., 2019).

This finding supports a multi-level governance view to sustainability where existing governance structures and power configurations are managed and navigated by actors by engaging in cooperation across levels of power and authority in order to deftly drive change without needing to dismantle existing institutions (Bulkeley & Betsill, 2005; Frantzeskaki et al., 2022; Patterson et al., 2017). Interviews indeed show signs of this kind of thinking, with companies stating the need to build better expert networks and engage in more stakeholder cooperation with urban planners and other parties to reach more comprehensive biodiversity outcomes, including the ability to tell clients and urban planners that developers think developing a particular area might not be prudent — something the companies currently cannot do for fear that other developers will agree to the suggested projects anyway, thus stealing them away from companies who prioritize biodiversity.

Companies also stressed the importance of public opinion, noting that the more public pressure surrounding biodiversity there is the more that pressure affects clients, urban planners, and companies themselves. When clients, planners, and companies are more aware of biodiversity loss and its challenges, biodiversity requirements find their way into funding and planning requirements, into the ways urban planners carry out their work, and into the corporate consciousness of company leadership, which then in turn encourages the adoption of biodiversity targets in company-internal processes. Thus, companies identified fostering a stronger biodiversity-consciousness across all levels of society as an important way to improve biodiversity action, an approach that studies have emphasized as well (Hooykaas et al., 2020).

6.3. Limitations

This study has several limitations that should be considered when assessing the validity of its results. First, as a qualitative study, this study has a difficulty of being replicated as such and may draw generalized conclusions that do not entirely reflect the reality of the Finnish construction sector (Bryman, 2012). Similarly, due to the sampling strategy chosen, and the small sample size that resulted from the strategy, the results of the interviews may not be entirely representative of the sector as a whole, though the inclusion of the trade association was done to decrease the likelihood of this. Due to the interview method, it is also conceivable that interviewees did not give an accurate account of the reality in the field but focused on certain aspects of it, which may have skewed the results (Bryman, 2012). Additionally, because the BSUD framework was included in a way that was not how it was originally designed, its use may have driven the analysis towards the appraisal of companies' biodiversity approaches through their biodiversity actions rather than through the analysis of what they otherwise communicated, affecting the focus of the analysis and thus biasing the results.

7. Conclusion

This thesis has studied how companies in the Finnish construction sector view and approach biodiversity, how current and upcoming EU biodiversity legislation affects their operations, and how the companies think that the sector could be pushed towards taking biodiversity into account better. It has done this by analysing five semi-structured interviews with representatives from large Finnish construction companies and the trade association for the construction sector, using both sustainable urban design literature and the Biodiversity Sensitive Urban Design framework as tools for analysis. A secondary research aim of testing how well the BSUD framework could be adapted into a tool of analysis was also chosen upon methodology selection.

The main findings of the thesis are that Finnish construction companies are aware of biodiversity loss and feel both a strong sense of responsibility and ambitions towards improving their biodiversity impacts, with many companies already engaging in biodiversity surveying and context-specific biodiversity supporting actions in their projects. Companies lack biodiversity knowledge, however, and this limits their capacity to improve their biodiversity impacts. This also applies to the biodiversity impact of companies' resource use, which they identify as their biggest challenge and their biggest source of negative biodiversity impacts. Regarding EU legislation, companies are pushed towards biodiversity reporting by the EU taxonomy and the CSRD, but the impacts of the biodiversity strategy and related legislation remain unclear. Nationally, construction companies identify both economic and legislative push factors that would positively influence the companies' biodiversity impacts; however, companies remain split between which forms of regulation they would prefer. A significant focus is on urban planning, as companies see changes to urban planning being the strongest driver influencing their actions. The thesis also proves the applicability of the BSUD framework as a tool of biodiversity analysis for development projects, but also finds that it is missing a governance aspect that could be included to inform users about the constraints of specific urban contexts.

In the future, further research attention should be directed towards how construction companies could minimize the biodiversity impacts of their resource use, as this is a major challenge for developers with the limits of circular economy and resource recycling being soon exhausted. Similarly, companies would benefit from advances in site-level knowledge regarding concrete biodiversity-supporting actions they could take, especially in terms of ecological dispersal and the facilitation of natural, ecological processes. Further knowledge would also be beneficial in multi-level biodiversity management, helping companies navigate existing power structures to engage in fruitful larger-scale biodiversity planning and habitat management.

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9. Appendix

9.1. Appendix 1

List of interviews:

Date	Company	Interviewee(s)
5.3.2024	NCC Suomi Oy, NCC Industry Oy	Sustainability Director, Development Director
6.3.2024	Rakennusteollisuus RT ry	Director
19.3.2024	SRV Oy	Development Director
20.3.2024	Construction Company 1	Environment, Health and Safety Manager
4.4.2024	Construction Company 2	Company representative

9.2. Appendix 2

Interview guide used in the interviews:

1) Background information/role of respondent

- (What is your role in the organization? / What do you do in the organization?)

- What is your connection to biodiversity in your role?

2) Corporate responsibility questions

- I know you have a corporate responsibility program/strategy:

  A) How is biodiversity reflected in that strategy program?

  B) Is biodiversity something you pay attention to otherwise?

3) Biodiversity-specific questions

- How does your organization view biodiversity? Biodiversity loss?

- In your organization's view, who is responsible for reducing biodiversity loss? (Regulators/planners/construction companies?)

- Are there certain actions that your organization already takes to reduce the biodiversity impact of your projects?

- Has your organization identified possible ways to reduce your biodiversity impacts? How could your organization achieve biodiversity impact reductions?

4) Questions about upcoming legislation

- Is your organization aware of the upcoming EU legislation concerning biodiversity and natural restoration?

- How does your organization see the upcoming legislation affecting operations?

5) Questions about company preferences

- Since regulation is on its way, what kind of regulation would best incentivize your organization to reduce its biodiversity impacts?

- Is there a way to encourage your organization to pay more attention to biodiversity through regulation?

- What kind of regulation would help your organization in managing the biodiversity impacts of your projects?

6) Concluding questions & remarks

- Is there anything else you would like to add? Have these questions missed something important?

- Thank you for participating!

- Reiterating where and when the results will be published.

9.3. Appendix 3

Themes of the inductive coding process, their thematic labels, and the frequencies of both.

Theme	Thematic label	Label amount	Total amount
RQ1:			
Biodiversity action	Improving biodiversity vs. start of operations	2	46
	Place-specific biodiversity improvements	15	
	Providing habitat	11	
	Providing food	1	
	Facilitating natural processes	1	
	Green infrastructure	3	
	Biodiversity experiments	9	
	Environmental protection	1	
	Lacking action	3	
Resource use	Re-using materials	5	19
	Raw material impacts	11	
	Need of new raw materials	1	
	Way of construction	2	
Corporate biodiversity awareness	Early adoption	5	35
	Biodiversity business	1	
	Desire to ideate	1	
	Immediate action	1	
	Corporate agenda-setting	7	
	Corporate agenda-setting (no)	1	
	Biodiversity ambition	17	
	Biodiversity awareness	2	
Biodiversity knowledge	Learning	4	35
	Biodiversity accounting	11	
	Lacking biodiversity knowledge	18	
	Spread of knowledge	2	
Project requirements	Construction requirements	3	15
	Environmental requirements	6	
	Price of projects	2	
	Difficulty in valuating biodiversity	2	
	Public pressure	2	
Company role	Limited possibilities	5	29
	Developer role opportunities	6	
	Industry vs. construction	1	
	Urbanization vs. biodiversity	3	
	Big picture view	4	
	Sector responsibility	5	
	Co-operation with stakeholders	5	

RQ2:			
CSRD	CSRD reporting pressure	10	11
	Circular economy requirement	1	
Taxonomy	Taxonomy criteria	3	3
Nature Restoration Act	Impacts on urban planning	4	16
	Impacts on environmental permits	2	
	Lack of clarity	5	
	Small companies untouched	2	
	Lack of strict national requirements	3	
EPD requirements	EPD requirements	1	1
RQ3:			
Legislation	Legislating environmental reports	1	11
	Environmental legislation	10	
Financial push-factors	Market benefit for biodiversity action	4	12
	Market incentives	7	
	Taxation	1	
External requirements	Requirements from clients	8	26
	Requirements from urban plans	9	
	Value chain reporting pressure	1	
	Societal awareness	4	
	Co-operation with stakeholders	4	
Internal drivers	Numeric drivers	3	7
	Corporate pressure	4	
Politics	Political difficulty	4	6
	Ongoing discussion	2	