Making Biodiversity Actionable

Managing Wood-Based Construction Supply Chains

Master's thesis in Design and Construction Project Management

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Abstract

Biodiversity loss is increasingly recognized as a major environmental and governance challenge, and the construction and real estate sector contributes significantly through land-use change, raw material extraction, and material supply chains. Despite growing strategic attention, biodiversity remains difficult to integrate into procurement and material-related decision-making. Existing procurement systems are largely shaped by standardized climate-focused assessment tools, while biodiversity impacts are context-specific and difficult to measure.

This study examines how real estate owners can address biodiversity impacts embedded in construction material supply chains through procurement practices. More specifically, it analyzes how biodiversity impacts are made visible and governed within procurement processes, and identifies barriers and leverage points for integration into material-related decision-making. The study is based on a qualitative single-case study of Vasakronan's ongoing construction project Kaj16 in Gothenburg, Sweden, with a focus on wood-based construction materials. The empirical material consists of document analysis and semi-structured interviews with 25 participants across multiple analytical levels.

The findings show that biodiversity remains weakly integrated into procurement practices due to limited visibility, weak governance mechanisms, and underutilized leverage points within procurement systems. Biodiversity is rarely translated into measurable procurement criteria, standardized indicators, or systematic supplier requirements, and is instead mainly addressed indirectly through certifications and broader sustainability frameworks. The study also identifies a misalignment between where biodiversity impacts occur and where decision-making authority is located. Biodiversity impacts primarily arise upstream in raw material extraction, while procurement influence is concentrated downstream in project planning and material selection. The study shows how visibility, governance mechanisms, and leverage points shape biodiversity governance in procurement. Practically, the findings indicate that improved traceability, clearer procurement requirements, stronger supplier governance, and earlier integration of biodiversity considerations in project planning are important for strengthening biodiversity integration in procurement practice.

Keywords: biodiversity, governance, sustainable procurement, supply chains, wood construction.

Att omsätta biologisk mångfald i praktiken
Styrning av träbaserade byggmaterials leverantörskedjor
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Sammanfattning

Biologisk mångfald har blivit en allt viktigare miljö- och styrningsfråga, och bygg- och fastighetssektorn bidrar i stor utsträckning till negativa konsekvenser för biologisk mångfald genom markanvändning, råvaruutvinning och byggmaterialens leverantörskedjor. Trots ett ökat strategiskt fokus är biologisk mångfald fortfarande svårt att integrera i upphandling och beslut om byggmaterial inom byggsektorn. Befintliga upphandlingssystem bygger i stor utsträckning på standardiserad och jämförbar miljöinformation, medan konsekvenser för biologisk mångfald ofta är platsberoende och svåra att mäta.

Syftet med studien är att undersöka hur fastighetsägare kan arbeta med biologisk mångfald i upphandling för att hantera de konsekvenser för biologisk mångfald som uppstår i byggmaterials leverantörskedjor. Studien analyserar hur biologisk mångfald synliggörs, styrs och hanteras inom upphandlingsprocesser samt identifierar hinder och möjligheter för att integrera biologisk mångfald i upphandling och materialrelaterat beslutsfattande. Studien bygger på en kvalitativ fallstudie av Vasakronans pågående byggprojekt Kaj16 i Göteborg, med fokus på träbaserade byggmaterial. Det empiriska materialet består av dokumentanalys och semistrukturerade intervjuer med 25 deltagare på system-, bolags-, projekt- och leverantörsnivå.

Resultaten visar att biologisk mångfald fortfarande är svagt integrerad i upphandling på grund av begränsad synlighet, svaga styrningsmekanismer och underutnyttjade påverkansmöjligheter inom upphandlingssystemen. Biologisk mångfald hanteras främst indirekt genom certifieringar och bredare hållbarhetsramverk snarare än genom tydliga upphandlingskrav och systematisk uppföljning. Studien identifierar också en obalans mellan var konsekvenser för biologisk mångfald uppstår och var möjligheterna till inflytande finns. Konsekvenserna uppstår främst uppströms vid råvaruutvinning och skogsbruk, medan de viktigaste påverkansmöjligheterna huvudsakligen finns nedströms i projektplanering, upphandling och materialval. Studien visar hur synlighet, styrningsmekanismer och påverkansmöjligheter tillsammans formar styrningen av biologisk mångfald inom byggupphandling. Resultaten pekar också på att förbättrad spårbarhet, tydligare upphandlingskrav, stärkt leverantörsstyrning och tidigare integrering av biologisk mångfald i projektplanering är viktiga för att stärka arbetet med biologisk mångfald inom upphandling och leverantörskedjor.

Nyckelord: biologisk mångfald, styrning, hållbar upphandling, leverantörskedjor, träbaserade byggmaterial.

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Alice Lundh & Josefina Skoglundh, Gothenburg, June 2026

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1
Introduction

Biodiversity loss is widely recognized as one of the most urgent environmental challenges of our time, as biodiversity is declining at alarming rates globally (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services [IPBES], 2019). Biodiversity refers to the variability among living organisms at genetic, species, and ecosystem levels, including the ecological interactions that support these systems (Millennium Ecosystem Assessment [MEA], 2005). Biodiversity forms the foundation of ecosystem functioning and provides essential ecosystem services such as climate regulation, water purification, and raw material provision, which are important for human well-being and economic activity. The World Economic Forum estimates that more than half of global gross domestic product (GDP) is directly or moderately dependent on well-functioning ecosystems (World Economic Forum [WEF], 2020). Dasgupta (2021) further emphasizes that economic systems are fundamentally dependent on and embedded in natural capital. Consequently, biodiversity loss is increasingly recognized not only as an environmental issue (Organisation for Economic Co-operation and Development [OECD], 2021), but also as an economic and governance challenge requiring structural changes in how decisions are made and implemented across sectors (IPBES, 2022).

The construction and real estate sector generates significant environmental impacts through land-use change, resource extraction, and material production (United Nations Environment Programme [UNEP], 2020). These processes are recognized as key drivers of biodiversity loss and often occur in upstream material supply chains, such as raw material extraction and early production stages, far beyond the project site (IPBES, 2019). International and national ambitions, including the 2030 Agenda for Sustainable Development, particularly Sustainable Development Goal 15 (United Nations, 2015), emphasize the need to halt biodiversity loss. However, systematic governance models for integrating biodiversity into construction-related decision-making, particularly within procurement processes, remain underdeveloped (Van Haaster et al., 2022).

A key challenge in integrating biodiversity into construction decision-making is methodological. Biodiversity is difficult to include in life cycle assessment (LCA) because it involves several ecological aspects and depends strongly on local site conditions (Sonnemann & Gemechu, 2017). This limits the usefulness of LCA as a comprehensive decision-support tool, particularly for capturing biodiversity-related impacts in procurement decisions. In the construction sector, LCA results are commonly communicated through environmental product declarations (EPDs). In practice, EPDs are primarily used to compare climate-related indicators, while biodiversity impacts remain only partly visible (Sonnemann & Gemechu, 2017). As a result, biodiversity risks in upstream material supply chains often receive limited attention in procurement and material selection processes (Gardner et al., 2019). This is particularly important, as many biodiversity impacts occur far beyond the project site, especially during raw material extraction and early production stages. Procurement decisions therefore often rely on standardized information systems that fail to clearly capture biodiversity-related land-use impacts.

In construction procurement, biodiversity impacts are mainly addressed indirectly through procurement requirements, supplier selection, and material specifications (Walker & Brammer, 2012). In addition to these structural and methodological challenges, organizational barriers further limit implementation. Even when real estate actors express positive attitudes toward nature-inclusive construction, implementation is often limited by fragmented responsibilities, a lack of established routines, and difficulties integrating biodiversity into procurement and decision-making processes (Van Haaster et al., 2022). Biodiversity ambitions are therefore often formulated at a strategic level, while practical ways of turning them into material-related procurement requirements remain underdeveloped.

Previous research has mainly examined biodiversity in construction through site-level ecological design and nature-inclusive planning (Van Haaster et al., 2022), while research on sustainable procurement has focused largely on climate performance and carbon-related metrics supported by tools such as LCA and EPDs (Kadefors et al., 2020). Against this background, there is limited knowledge of how biodiversity impacts in material supply chains can be translated into clear, verifiable, and actionable procurement requirements in construction projects. It also remains unclear how real estate owners can integrate biodiversity ambitions into decision-support systems and supplier requirements, particularly during early-stage material selection and the upstream product stage of the life cycle. This makes procurement a critical entry point for influencing biodiversity outcomes in construction projects. To address this gap, the study adopts a governance perspective to examine how procurement structures, decision-support systems, and supplier relationships influence biodiversity-related decision-making.

1.1 Aim & research question

The aim of this study is to examine how real estate owners can address biodiversity impacts embedded in construction material supply chains through procurement practices. More specifically, the study analyzes how such impacts are made visible, governed, and managed within procurement processes, and identifies key barriers and leverage points for integrating biodiversity considerations into material-related decision-making. By examining biodiversity as a governance challenge rather than solely an ecological issue, the study provides a structured perspective on how procurement practices can influence biodiversity outcomes.

The study addresses the following research question:

How can real estate owners integrate biodiversity considerations into procurement practices to address biodiversity impacts embedded in construction material supply chains?

To address the research question, the study is structured around three analytical dimensions: visibility, governance mechanisms, and leverage points. These dimensions are applied across four analytical levels of the supply chain: system, corporate, project, and supplier. Together, they guide the analysis of how biodiversity considerations are made visible, governed, and influenced within construction procurement and material supply chains. The analytical dimensions and their corresponding sub-objectives are presented in Table 1.1.

Analytical dimension	Sub-objective
Visibility	Analyze how biodiversity impacts in construction material supply chains are made visible within procurement processes
Governance mechanisms	Examine how biodiversity is addressed through procurement practices and governance mechanisms in material selection
Leverage points	Identify where and how procurement and supply chain interactions can influence biodiversity outcomes

Table 1.1: Analytical dimensions and corresponding sub-objectives.

The study applies a qualitative case study of Vasakronan's ongoing construction project Kaj16 in Gothenburg, Sweden. The case provides an empirical setting for examining how biodiversity considerations are addressed in practice, particularly within material-related procurement decisions and supply chain governance. This study is primarily relevant for real estate owners and procurement professionals involved in material selection and supply chain decisions.

The study contributes in three ways. First, it contributes theoretically by conceptualizing biodiversity as a governance object whose visibility depends on decision-support tools, procurement structures, and supply chain transparency. Second, it contributes empirically through an in-depth case study of how biodiversity considerations are translated from corporate strategy into project-level procurement practices and supplier interactions. Third, it contributes practically by identifying key barriers and leverage points for integrating biodiversity into procurement and material-related decision-making.

The study examines whether biodiversity considerations are translated into concrete procurement mechanisms such as traceability of raw material origin, certification related to land-use practices, disclosure of geographic sourcing, and supplier responsibility for forest management. The study does not assess ecological net gain or quantify biodiversity outcomes. Instead, it examines how biodiversity is integrated into procurement systems through formal requirements, decision-support tools, and supplier governance practices.

1.2 Limitations

This study is limited to a qualitative single-case study of Vasakronan's ongoing construction project Kaj16. The case was selected to enable an in-depth analysis of procurement practices, material flows, and governance mechanisms within a real project context. The empirical part of the study is conducted in a Swedish context, where procurement practices and regulatory conditions shape how biodiversity is addressed in practice. Some material supply chains in the case study extend beyond Sweden through international sourcing. The findings should therefore primarily be interpreted in relation to similar organizations and procurement contexts, rather than generalized across the entire construction sector.

The study is further limited to new construction projects. Refurbishment, renovation, and existing building stock are not included, although such projects may also have significant biodiversity impacts. New construction was selected because it involves larger flows of new materials, clearer procurement structures, and greater influence over material selection during early project stages. From a life cycle perspective, the analysis is limited to the product stage, A1 to A3. The product stage A1 covering raw material extraction, A2 consists of transport to manufacturing, and A3 includes manufacturing processes. Other life cycle stages are excluded. This stage was selected because it captures land-use change and resource extraction in global material supply chains, which are key drivers of biodiversity loss and align with the study's focus on procurement decisions.

Although the initial screening of material flows identified mineral-based materials, particularly concrete, as representing the largest share of total embodied mass, the in-depth analysis focuses on wood-based materials. This delimitation is motivated by wood's direct dependence on forest ecosystems and forest management practices, which are closely linked to biodiversity loss through land-use change and habitat alteration. The study does not provide a comprehensive assessment of the project's total biodiversity footprint. Instead, it focuses on governance mechanisms within forest-based supply chains. The assessment is based on existing documentation and semi-structured interviews rather than original quantitative life cycle calculations or ecological field assessments.

Finally, the study adopts a governance perspective. Other dimensions of biodiversity, such as site-based ecological design and landscape-level planning, are addressed only to a limited extent. The study does not seek to assess biodiversity impacts comprehensively or evaluate ecological outcomes. Instead, it focuses on governance structures and procurement mechanisms that shape how biodiversity is addressed in material supply chains. The study therefore aims to bridge the gap between strategic biodiversity ambitions and their practical implementation in procurement.

2
Literature

This chapter reviews literature relevant to how biodiversity considerations can be integrated into procurement practices and material-related decision-making in the construction and real estate sector. It focuses on biodiversity as a governance challenge, impacts embedded in construction material supply chains, decision-support tools used in material selection, and procurement as a governance mechanism. Together, these perspectives form the foundation for the analytical framework used in this study, focusing on visibility, governance mechanisms, and leverage points, which are used to analyze how biodiversity is integrated into procurement practices.

2.1 Biodiversity as a governance challenge

Biodiversity refers to the variability within species, between species, and of ecosystems (Secretariat of the Convention on Biological Diversity, 1992). It includes genetic, species, and ecosystem diversity, all of which support ecosystem functioning and the delivery of ecosystem services. The importance of these links between biodiversity and ecosystem functioning is highlighted in the MEA and further developed by IPBES (IPBES, 2019; MEA, 2005). Essential ecosystem services include climate regulation, water purification, soil formation, and raw material supply. Biodiversity loss can therefore reduce ecosystem resilience and weaken the long-term capacity of ecosystems to support human well-being and economic activity.

In this study, governance refers to how biodiversity-related decision-making is organized, coordinated, and influenced within construction material supply chains. The concept is used to describe the structures, processes, and mechanisms through which actors govern biodiversity-related issues in practice, including procurement practices, certification systems, organizational routines, standards, and supplier relationships. Governance therefore extends beyond formal regulation and focuses on how biodiversity considerations are translated into material-related decision-making and procurement processes.

A key challenge in integrating biodiversity considerations into procurement and material-related decision-making is that biodiversity impacts are often site-specific, multidimensional, and dependent on local ecological conditions. Unlike climate impacts, which are commonly expressed through standardized indicators such as global warming potential (Sonnemann & Gemechu, 2017), biodiversity impacts are more difficult to represent through a single comparable metric (Verones et al., 2017).

Previous research shows that biodiversity creates challenges for sectors that rely on standardized and comparable environmental information. This has been described as a misalignment between the nature of biodiversity and the information systems used in organizational decision-making. Accordingly, environmental aspects that can be quantified and compared are more easily integrated into formal decision-support tools, while more context-specific impacts may remain less visible (Sonnemann & Gemechu, 2017). In construction procurement, biodiversity may therefore be recognized at a strategic level, but remains difficult to translate into material selection criteria, supplier requirements, and follow-up mechanisms in procurement contexts.

As attention to biodiversity loss increases, the concept of nature positivity has become more common in policy and business contexts. It is often described as going beyond reducing harm to nature and instead supporting the protection, restoration, and long-term improvement of ecosystems (WEF, 2020; World Wide Fund for Nature [WWF], 2020). However, translating this ambition into procurement practice remains challenging, as baselines, measurement approaches, and responsibilities for upstream impacts are still under development (WEF, 2020). In this study, nature positivity is treated as an approach to governance rather than a quantified target, and is used to frame how biodiversity considerations are integrated into procurement practices, supplier requirements, and material-related decision-making.

2.2 Biodiversity in construction and real estate supply chains

The construction and real estate sector affects biodiversity through both direct and indirect impacts. Direct impacts arise through land-use change, urban expansion, and infrastructure projects that transform or fragment habitats, while indirect impacts occur through the extraction, processing, and transportation of construction materials, often far beyond the project site (UNEP, 2020). Since land-use change and resource extraction are central drivers of biodiversity loss (IPBES, 2019), material choices are therefore central to understanding biodiversity impacts embedded in construction material supply chains.

Construction projects are typically organized through project-based structures involving developers, contractors, consultants, suppliers, and subcontractors (Kadefors et al., 2020). Previous research describes construction projects as involving fragmented decision-making and distributed responsibility across the value chain (Erridge & McIlroy, 2002). While real estate owners may define strategic biodiversity ambitions, these must be translated into concrete project requirements, procurement criteria, material specifications, and supplier relationships to influence practice. Previous research shows that many environmental impacts of buildings are determined during early project stages, when decisions about structural systems, material choices, and building concepts are made (Bribián et al., 2011). Once design and procurement decisions have been made, opportunities to influence environmental performance are significantly reduced.

Environmental decision-making in construction is often shaped by standardized assessment tools, especially LCA and EPDs. These tools provide structured and comparable environmental indicators, particularly related to climate impacts. As discussed by Sonnemann and Gemechu (2017), climate impacts often become more visible and operational in procurement processes than biodiversity impacts, which are more difficult to standardize. This suggests that biodiversity remains less visible in construction decision-making, rather than being unimportant.

Supply chain fragmentation makes biodiversity governance more challenging. Raw material extraction and early production often take place far from the final construction project. This makes it difficult for downstream actors to identify where environmental impacts occur and how they are managed. Transparency and traceability are therefore central issues in global material supply chains (Gardner et al., 2019). Without information about material origin, land-use practices, and supplier responsibility, biodiversity impacts embedded in construction materials may remain difficult to identify and evaluate.

Recent industry-oriented research in a Nordic context shows the importance of supply chain perspectives for understanding biodiversity impacts. A Danish study of building projects indicates that a large share of biodiversity impacts may occur in upstream value chains, particularly in relation to material extraction and production stages (AP Pension et al., 2025). The study identifies material use, procurement requirements, and traceability as important areas for reducing biodiversity impacts in construction. However, it also points to the need for better data on material origin and more systematic approaches to transparency.

The literature indicates that biodiversity governance in construction cannot be understood only through site-level ecological measures. It also requires attention to how environmental information is generated, communicated, and used across material supply chains. This is particularly relevant for procurement, where decisions about materials and suppliers are often based on standardized documentation, supplier requirements, and certification schemes, rather than on direct and site-specific information about biodiversity impacts.

2.3 EPDs as decision-support tools

EPDs are among the most widely used decision-support tools in the construction sector (Sonnemann & Gemechu, 2017). An EPD is a standardized and third-party verified document based on life cycle assessment, following the principles of Type III environmental declarations under ISO 14025 (International Organization for Standardization, 2006a). The underlying LCA is carried out according to ISO 14040 and ISO 14044, which define how environmental impacts are assessed across a product's life cycle (International Organization for Standardization, 2006b, 2006c). The purpose of EPDs is to provide transparent and comparable information about the environmental performance of products. While EPDs are widely used for this purpose, their ability to capture complex environmental dimensions, such as biodiversity, remains limited (Verones et al., 2017).

For construction materials, EPDs are structured according to the European standard EN 15804. This standard defines how LCA results should be reported, including system boundaries, life cycle stages, environmental indicators, and calculation rules (European Committee for Standardization, 2019). In construction procurement and design, EPDs provide a structured basis for comparing materials and documenting environmental performance. Their main strength is that they offer consistent and comparable environmental information. However, EPDs should be understood as tools for reporting selected environmental indicators rather than as comprehensive sustainability assessments. As EPDs are based on a defined set of standardized indicators, some environmental aspects become more visible than others. Climate-related indicators, especially global warming potential, are well established and widely used in procurement and regulatory contexts. In contrast, biodiversity impacts are more difficult to capture in a comparable way, as they are site-specific, multidimensional, and closely linked to land-use practices (Verones et al., 2017).

These limitations are particularly relevant in procurement processes, where environmental indicators that can be quantified and compared are easier to include in evaluation criteria (Igarashi et al., 2013). Consequently, impacts that lack standardized indicators may receive less attention in procurement decision-making. While standardization can make environmental information easier to use, it may also reduce sensitivity to complex and site-specific biodiversity impacts. In this context, EPDs support environmental decision-making by providing structured and comparable indicators, but they do not provide enough information to assess biodiversity outcomes. Together, these studies suggest that biodiversity impacts may remain less visible in procurement processes that rely on standardized environmental information.

2.3.1 Biodiversity limitations in EPDs

To further specify these limitations, EPDs are often closely associated with climate performance because global warming potential is a central and standardized LCA indicator. Climate indicators are well developed, widely understood, and relatively easy to compare across materials. As discussed by Sonnemann and Gemechu (2017), LCA-based decision-support tools tend to emphasize environmental categories that are quantifiable and standardized, while more complex dimensions, such as biodiversity, remain more difficult to apply in practice.

More specifically, biodiversity impacts in life cycle assessment are often linked to land use, land transformation, and changes in ecosystem conditions (Verones et al., 2017). These dimensions are also recognized as key drivers of biodiversity loss more broadly (IPBES, 2019). At the same time, they are not directly captured by climate-based indicators such as global warming potential. As highlighted in previous research, a material can have low carbon emissions while still be linked to biodiversity risks, for example through habitat transformation, forestry practices, or land-use change.

This limitation is not related to the value of EPDs, but to how their standardized structure shapes which environmental effects are made visible. Certain indicators, such as land use or resource use, may have indirect relevance for biodiversity, but they do not capture localized ecological consequences in a comprehensive way (Verones et al., 2017). Environmental indicator systems are designed to simplify complex environmental information into measurable categories that support comparison and decision-making. This simplification can also reduce the visibility of context-specific impacts such as biodiversity (OECD, 2003).

In construction procurement, these limitations are particularly relevant. If procurement processes rely mainly on EPD data, biodiversity risks remain only partly visible. Standardized environmental information alone is often not enough to consider biodiversity in procurement decisions. Instead, how such information is interpreted, complemented with additional information, and translated into procurement requirements becomes important (Igarashi et al., 2013). Accordingly, procurement can be understood as a governance mechanism through which biodiversity considerations may be integrated into material-related decision-making.

2.3.2 Governance tools beyond EPD

Since EPDs provide limited information about biodiversity impacts, other governance tools are often used to address biodiversity risks in material supply chains. These tools include third-party certification schemes, chain-of-custody systems, information on geographic origin, supplier policies, and requirements related to land-use practices (Gardner et al., 2019). These mechanisms do not directly measure biodiversity outcomes, but they can contribute to clarifying responsibility, improving transparency, and reducing ecological risks in upstream production. Some studies describe certification as a practical governance tool, while others point to its limitations in capturing site-specific biodiversity impacts.

At a broader institutional level, the EU Taxonomy includes biodiversity as one of six environmental objectives and addresses the protection and restoration of ecosystems and natural habitats (European Parliament and Council of the European Union, 2020). However, biodiversity is less developed in construction practice than climate-related objectives. Climate targets are supported by established indicators and reporting systems, particularly through tools such as LCA and EPDs (Sonnemann & Gemechu, 2017). Biodiversity, in contrast, lacks similarly standardized methods (Verones et al., 2017). The literature suggests a misalignment between broader regulatory ambitions and the tools currently available to address biodiversity impacts in procurement practice.

In forest-based material supply chains, certification schemes are among the most widely used governance mechanisms. The Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC) set standards for forest management, including requirements related to biodiversity protection, harvesting practices, regeneration, and responsible sourcing (Forest Stewardship Council, 2023; Programme for the Endorsement of Forest Certification, 2023). Through chain-of-custody systems, certified wood can be traced across different stages of the supply chain, allowing downstream actors to verify that raw materials originate from certified sources (Overdevest & Rickenbach, 2006).

Certification can function as an indirect tool for biodiversity governance (Overdevest & Rickenbach, 2006). It allows buyers to rely on standardized assurances when direct ecological assessment is not available (Gardner et al., 2019). At the same time, certification should not be seen as a complete measure of biodiversity outcomes, as it may not capture site-specific impacts. Certification schemes are often based on defined standards, showing whether these are met rather than providing detailed, site-specific information (Gulbrandsen, 2004). This makes certification relevant in procurement, but also highlights the importance of how it is used, interpreted, and followed up in practice.

2.4 Sustainable procurement as a governance mechanism

Procurement plays a central role in shaping environmental outcomes in construction and real estate. Through procurement processes, strategic sustainability ambitions are translated into requirements, evaluation criteria, contracts, supplier selection, and follow-up practices (Walker & Brammer, 2012). In project-based construction contexts, procurement also influences which actors are involved, which materials are selected, and how responsibilities are distributed across the value chain (Erridge & McIlroy, 2002). Construction-specific studies similarly highlight the role of procurement in coordinating actors and decisions in fragmented project structures (Kadefors et al., 2020). The effectiveness of procurement depends on the clarity of requirements and the availability of measurable indicators. Previous research shows that clear requirements support implementation, while vague requirements limit their impact (Igarashi et al., 2013). Verification and follow-up mechanisms are also important for ensuring that sustainability objectives are implemented in practice (Sönnichsen & Clement, 2020).

Building on this, sustainable procurement research highlights requirement-setting as a key mechanism through which clients can influence supplier behavior (Igarashi et al., 2013). Suppliers often adapt their practices to customer demand, tender requirements, and contractual expectations. In this process, procurement requirements shape how environmental considerations are translated into supplier responses and material choices. Where such expectations are absent or weak, incentives for suppliers to develop corresponding capabilities may remain limited. This is particularly relevant for biodiversity, as many biodiversity impacts occur outside the direct control of downstream actors. Procurement becomes important when organizations seek to influence sustainability outcomes beyond their own boundaries. Through decisions related to sourcing materials, supplier requirements, documentation, and certification, downstream actors may indirectly influence upstream practices (Gardner et al., 2019). The extent of this influence depends on how requirements are defined, how these are verified, and how follow-up is carried out, as highlighted in previous research (Sönnichsen & Clement, 2020).

In construction procurement, environmental criteria are often based on measurable and comparable indicators. Climate-related requirements are common, as tools such as LCA and EPDs are widely available and provide quantifiable metrics that can be incorporated into procurement systems (Sonnemann & Gemechu, 2017). Biodiversity, by contrast, lacks similarly established indicators and is therefore often addressed indirectly through broader sustainability principles, certification, or regulations (Van Haaster et al., 2022).

Procurement is often described as more than an administrative process. It functions as a governance mechanism that shapes what becomes visible, which requirements are prioritized, how responsibility is assigned, and how influence is exercised across the supply chain (Kadefors et al., 2020). In this process, some environmental issues become concrete and can be implemented, while others remain expressed as general ambitions. Whether biodiversity becomes part of procurement practice depends not only on strategic sustainability goals, but also on how these are translated into requirements (Igarashi et al., 2013). It also depends on how these are verified and followed up in practice (Sönnichsen & Clement, 2020).

2.5 Real estate owners' role in biodiversity governance

Real estate owners play an important role in construction procurement, as they can influence project ambitions, procurement strategies, contractor requirements, and material-related decision-making. Unlike temporary project actors, real estate owners often have long-term responsibility for buildings and land. This gives them an important role in translating strategic sustainability objectives into project-level implementation.

Research on construction and real estate development shows that organizational factors, such as attitudes, internal capacity, and external expectations, affect whether biodiversity-related practices are adopted (Van Haaster et al., 2022). Biodiversity is increasingly discussed in relation to risk management, long-term value creation, and nature-positive business strategies (WEF, 2020). However, its use in practice varies. Biodiversity is often addressed in broad and qualitative terms, while climate performance is more frequently supported by clear quantitative targets, established indicators, and monitoring systems.

Frameworks such as those developed by the Taskforce on Nature-related Financial Disclosures aim to increase transparency regarding how companies depend on nature, as well as their impacts, risks, and opportunities (Taskforce on Nature-related Financial Disclosures, 2023). They reflect growing expectations for companies to consider biodiversity not only within their direct operations, but also across value chains. For real estate owners, this involves attention to material supply chains, procurement practices, and supplier responsibility. At the same time, their ability to influence biodiversity is largely indirect, as they are typically not involved in raw material extraction or land management practices in upstream supply chains. Instead, their influence depends on how biodiversity is incorporated into early project decisions, procurement requirements, supplier selection, documentation systems, and follow-up routines. This positions real estate owners as key actors in biodiversity governance, particularly in how strategic ambitions are translated into procurement practice.

A recurring challenge in the literature is the gap between strategic ambitions and how these are implemented in practice. Biodiversity may be included in sustainability strategies, but it often remains difficult to integrate into procurement systems. Previous research shows that indicators are limited and responsibilities are fragmented (IPBES, 2019), while sector-specific studies point to a lack of guidance for implementation (Van Haaster et al., 2022). This gap becomes more pronounced when procurement systems are based on standardized and climate-focused indicators (Sonnemann & Gemechu, 2017). Previous research suggests that biodiversity risks may remain less visible in procurement processes when they are not reflected in requirements, verification procedures, and follow-up mechanisms.

2.6 Synthesis and research gap

The reviewed literature shows that biodiversity is increasingly recognized as an important sustainability issue. However, it remains difficult to integrate into procurement practices and material-related decision-making. Biodiversity impacts are context-specific and closely linked to land use, ecosystem conditions, and upstream material production. At the same time, construction procurement relies heavily on standardized information, comparable indicators, and requirements. This points to a misalignment between the ecological complexity of biodiversity and the standardized decision-making structures used in procurement.

Existing literature provides important insights into biodiversity loss, life cycle assessment, EPDs, sustainable procurement, and supply chain transparency. However, these perspectives are often addressed separately in the literature. Research on biodiversity highlights ecological complexity and the importance of land-use impacts, while research on procurement emphasizes requirement-setting and supplier governance. Less attention has been given to how biodiversity is translated into procurement practice across construction material supply chains.

Based on this, a research gap can be identified. Limited research has examined how real estate owners integrate strategic biodiversity ambitions into procurement practices, supplier requirements, and material-related decision-making across multiple analytical levels, including system-level standards, corporate sustainability strategies, project-level procurement practices, and supplier-level supply chains. In particular, there is limited knowledge of how biodiversity becomes visible in procurement, which governance mechanisms are used to address it, and where real estate owners may exercise influence in fragmented supply chains.

Based on the reviewed literature, this study develops an analytical framework structured around three dimensions: visibility, governance mechanisms, and leverage points. These dimensions are selected as they reflect governance challenges identified in the literature. The framework builds on the idea that biodiversity needs to become visible in decision-making, be translated into procurement and supplier governance mechanisms, and be linked to points where actors can exercise influence.

2.7 Analytical framework

Drawing on research on environmental governance, supply chain transparency, and sustainable procurement, this study understands biodiversity not only as an ecological issue but also as something that is shaped by organizational decision-making structures and information systems. Previous research highlights that environmental issues become part of organizational decision-making when they are translated into requirements and supplier management practices (Igarashi et al., 2013). More broadly, sustainable procurement research also highlights the role of purchasing functions in including environmental concerns in decision-making (Walker & Brammer, 2012).

In the construction sector, decision-making often relies on standardized environmental information to compare material performance. Climate impacts have therefore become highly visible through tools such as LCA and EPDs, which provide measurable indicators that can be incorporated into procurement decisions (Sonnemann & Gemechu, 2017). In contrast, biodiversity impacts are more difficult to apply in practice because they are site-specific and depend on local ecological conditions (IPBES, 2019). Previous research suggests that biodiversity impacts embedded in construction material supply chains may remain less visible in procurement processes.

To examine how biodiversity is integrated into construction material supply chains, this study applies an analytical framework structured around three interconnected dimensions: visibility, governance mechanisms, and leverage points. These dimensions are applied consistently across four analytical levels (system, corporate, project, and supplier), enabling both within-level analysis and comparison across levels. Together, they provide a basis for examining how biodiversity becomes visible in decision-support systems, is translated into organizational decision-making (Walker & Brammer, 2012), and is addressed through procurement and supply chain governance (Gardner et al., 2019).

Figure 2.1 presents the analytical framework used in this study. The framework presents biodiversity governance as a multi-level process involving system-level structures, corporate sustainability strategies, project-level practices, and supplier-level supply chains. The system level refers to broader institutional structures, including certification schemes, assessment systems, and industry standards that shape how biodiversity is addressed across supply chains.

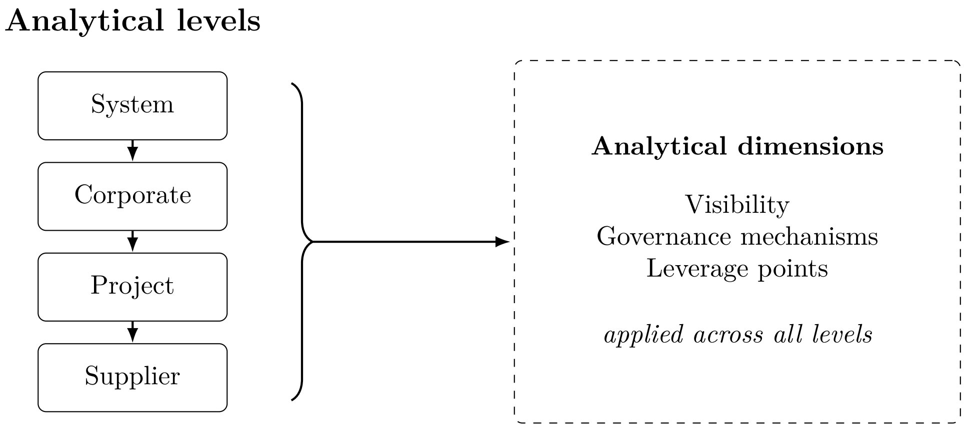

Figure 2.1: Analytical framework illustrating biodiversity governance across four analytical levels.

As shown in Figure 2.1, the empirical material is organized across four analytical levels, with the same three dimensions applied throughout the framework. The dimensions are defined in Table 2.1 and further elaborated in the subsections below.

Table 2.1: Analytical dimensions applied across the four analytical levels.

Dimension	Definition	Analytical focus
Visibility	How biodiversity impacts become visible in decision-making	Environmental information, certification, material selection
Governance mechanisms	How biodiversity is integrated into procurement and decision-making	Procurement requirements, standards, supplier management, verification
Leverage points	Where actors can influence biodiversity outcomes	Points of influence across system, corporate, project, and supplier levels

Together, these dimensions provide the analytical structure used to examine how biodiversity is integrated into procurement practices across the different analytical levels.

2.7.1 Visibility of biodiversity in procurement

Visibility refers to the extent to which biodiversity impacts become visible and are included in procurement decision-making. Biodiversity impacts embedded in construction material supply chains are often difficult to identify because they depend on local ecological conditions (IPBES, 2019) and on land-use practices (Verones et al., 2017). Existing decision-support systems tend to make climate-related impacts more visible, as these are supported by standardized and comparable indicators (Sonnemann & Gemechu, 2017).

In this study, visibility refers to whether biodiversity impacts can be documented, linked to specific production processes or geographical origins, and included in procurement requirements or supplier evaluation criteria. This dimension makes it possible to examine whether biodiversity is included as a concrete factor in procurement decision-making or remains a broader sustainability issue.

2.7.2 Governance mechanisms in procurement

Governance mechanisms refer to the tools and practices used to define expectations, assign responsibilities, verify claims, and follow up environmental performance in supply chains. Sustainable procurement research shows that environmental objectives are often translated into procurement requirements and evaluation criteria (Igarashi et al., 2013), while other studies highlight the role of contracts and supplier management (Walker & Brammer, 2012). Supplier evaluation and verification are also important for integrating sustainability objectives into procurement practice (Sönnichsen & Clement, 2020).

In this study, governance mechanisms refer to how biodiversity-related expectations are defined, verified, and followed up in procurement and supply chains. This includes how requirements are formulated in procurement documents, technical specifications, and contracts. It also includes how biodiversity-related claims are verified. Previous research highlights the role of certification and environmental documentation in this process (Gardner et al., 2019). In addition, it includes how requirements are monitored and implemented in practice, for example through supplier dialogue and audits.

2.7.3 Leverage points in the supply chain

Leverage points refer to positions in the supply chain where actors may influence biodiversity-related outcomes. Real estate owners are not usually directly involved in raw material extraction or production, but they may influence upstream practices through procurement decisions, procurement requirements, supplier selection, and supplier engagement (Gardner et al., 2019).

In this study, leverage points are used to examine where actors have leverage to shape biodiversity-related decision-making across system, corporate, project, and supplier levels. This includes mechanisms such as procurement requirements, standards, client demands, documentation expectations, and supplier dialogue. Leverage points are also used to examine how procurement structures shape the ability of real estate owners to govern biodiversity-related considerations in the early life cycle stages of construction materials, particularly modules A1 to A3.

Together, visibility, governance mechanisms, and leverage points provide the analytical framework for examining how biodiversity is integrated into procurement practices and material supply chains. Within this framework, a nature-positive orientation is understood in terms of whether biodiversity becomes visible in decision-making, is integrated into procurement and supplier governance, and is supported by verification and follow-up.

3
Methods

Understanding how biodiversity can be integrated into procurement requires attention to how strategic ambitions, project-level decisions, and supplier practices interact across material supply chains. To examine these dynamics in a real-world setting, this study adopts a qualitative case study approach centered on the ongoing construction project Kaj16 by Vasakronan. This approach allows for an examination of how biodiversity considerations are shaped at the corporate level, translated into project practices, and addressed by suppliers in upstream supply chains.

3.1 Research design

This study adopts an interpretive qualitative research approach (Bryman, 2016) and is designed as a single embedded case study (Yin, 2018) of Vasakronan's ongoing project Kaj16, which examines multiple analytical levels within a single case. The interpretive approach is appropriate as the study aims to understand how biodiversity is addressed and interpreted in procurement practices, rather than to measure ecological outcomes. An abductive research approach was adopted (Saunders et al., 2019), allowing for an iterative process between theory and empirical findings. This approach is well suited to the exploratory nature of the study, as it makes it possible to analyze complex governance processes across multiple organizational levels.

The empirical investigation is structured across four analytical levels: system, corporate, project, and supplier. While the corporate, project, and supplier levels are directly linked to the Kaj16 case, the system level captures broader institutional conditions shaping procurement practices. The study can therefore be understood as an embedded case study complemented by system-level interviews, enabling analysis of both project-specific practices and wider industry structures. The analysis is guided by the analytical framework presented in Chapter 2, which structures the examination of visibility, governance mechanisms, and leverage points across all analytical levels.

This study aims for analytical rather than statistical generalization (Yin, 2018), contributing to a deeper theoretical understanding of biodiversity governance in construction procurement. An interpretive and abductive research approach is combined with an embedded single-case study design and a multi-level analytical framework, closely aligned with the aim of examining how biodiversity is governed across procurement and material supply chains. Through the case study approach, an in-depth analysis of a real-world project becomes possible, while the multi-level design allows for examination of how biodiversity considerations move between strategic, operational, and supply chain levels. Interviews and document analysis are used to capture both formal governance structures and the perspectives of actors involved in procurement processes, enabling a context-sensitive, multi-level analysis of biodiversity governance while also supporting analytical generalization beyond the specific case.

3.2 Case study

Kaj16 is an ongoing commercial construction project in Gothenburg, developed by Vasakronan (Vasakronan, n.d.). The project is procured as a design–build contract, where the contractor is responsible for both design and construction. This procurement form is particularly relevant, as it places significant responsibility on the contractor to translate client requirements into design solutions, material choices, and supplier interactions.

The case was selected through purposive sampling (Bryman, 2016), as it represents a contemporary project with explicit sustainability ambitions and structured procurement processes. This makes it well suited for examining how environmental considerations are addressed in practice. Kaj16 is also developed within Vasakronan's broader sustainability framework, where environmental goals related to climate performance, resource efficiency, and sustainable urban development have been established. These include targets related to climate performance and material sustainability (Vasakronan, 2025).

The project involves substantial material flows in the early life cycle stages of construction, particularly modules A1 to A3. These stages include raw material extraction, transport, and manufacturing, and are closely linked to upstream supply chains where biodiversity impacts may occur. By focusing on these stages, the study can examine how procurement decisions influence environmental impacts beyond the physical project site.

Kaj16 is further characterized by formal procurement procedures and established sustainability governance structures. This provides a suitable context for analyzing how strategic environmental ambitions are translated into procurement requirements, supplier selection, and material specifications in practice. The project also involves actors across multiple organizational levels, including corporate sustainability management, project-level decision-making, and upstream material suppliers. This allows for an analysis of how biodiversity considerations are interpreted and operationalized across the governance chain. Overall, Kaj16 provides a valuable case for examining biodiversity governance in construction supply chains.

3.3 Data collection

Data were collected through document analysis and semi-structured interviews, capturing both formal governance structures and actor perspectives across the supply chain. The use of multiple data sources and analytical levels enabled methodological triangulation, which contributes to the credibility of the study by allowing comparison between documented practices and actor interpretations across the governance chain.

3.3.1 Document analysis

Document analysis was used to examine how biodiversity is represented and put into practice within procurement-related governance structures (Bowen, 2009). In qualitative research, documents such as policy reports, standards, guidelines, and organizational publications are important sources of data. They reflect institutional priorities and show how environmental issues are clearly described and addressed. In this study, documents are treated as representations of how organizations understand and manage environmental issues. This approach is in line with the aim of examining how biodiversity is governed through procurement and material supply chains.

The analysis included several types of environmental and governance documentation related to construction material supply chains. These documents were selected based on their relevance for how environmental impacts are evaluated, communicated, and managed within procurement processes. The analyzed documents included EPDs for selected materials used in Kaj16, including CLT, glulam, Accoya-modified wood, and interior panels. The material also included project-related documentation from Kaj16, such as sustainability requirements, procurement procedures, and environmental documentation used in material selection. In addition, material assessment databases used in the Swedish construction sector, including Byggvarubedömningen, were analyzed together with certification standards for forest-based materials, including FSC and PEFC. Furthermore, corporate sustainability reports, procurement guidelines, and policy documents were reviewed to provide contextual understanding of the organizational framework within which the project was developed.

The document analysis complemented the interview data and allowed for triangulation across different sources of empirical material. Documents were selected based on their relevance to material selection, supplier governance, and decision-making related to biodiversity. The analysis focused on how environmental indicators, certification systems, traceability mechanisms, and supplier responsibilities are used to address biodiversity-related risks in material supply chains. It also examined how biodiversity considerations are represented, prioritized, or overlooked in procurement requirements, certification systems, and environmental reporting structures.

The document analysis followed a deductive coding approach based on the analytical framework presented in Chapter 2. Coding was guided by the key concepts of visibility, governance mechanisms, and leverage points, enabling systematic comparison between documentary material and interview data. In addition, the documents provided contextual insights that supported the interpretation of the interview findings. To strengthen credibility, findings from the document analysis were continuously compared with interview data to identify both converging and diverging patterns.

The analyzed documents vary in purpose, scope, and level of standardization, which affects their validity as sources of information. For instance, EPDs are standardized and verified, but provide limited insight into site-specific ecological impacts and biodiversity conditions. Corporate reports and procurement documents may reflect strategic intentions and formal compliance rather than actual practices. To address these limitations, document findings were critically assessed and triangulated with interview data, allowing comparison between formal representations and actor perspectives.

3.3.2 Interviews

Semi-structured interviews were the primary method for data collection (Bryman, 2016), aiming to capture how biodiversity is interpreted and addressed across procurement and material supply chains. In total, 25 participants were included in the study. One representative from HyBridge participated in interviews related to both the CLT and glulam supply chains due to the company's involvement in both material categories within the project. Participants were selected through purposive sampling (Bryman, 2016) based on their relevance to sustainability governance, procurement, project implementation, material supply, and industry-level decision-support structures. Interviewees connected to the case were chosen for their direct involvement in the Kaj16 project or its material supply chains, while system-level participants were selected based on their broader institutional roles within the construction and real estate sector.

Selected participants represent key roles in the governance and implementation of construction procurement and material supply chains. Their positions provided access to both strategic decision-making and operational practices. This enabled a comprehensive understanding of how biodiversity considerations are interpreted and addressed across different stages of the supply chain. The number of interviews was sufficient to capture variation across the analytical levels, and no substantially new insights emerged in the later stages of data collection.

To reflect the study's aim of examining how biodiversity is governed across procurement processes and material supply chains, the interview sample was structured across four analytical levels: system, corporate, project, and supplier. An overview of the interview participants is provided in Table 3.1.

Table 3.1: Overview of interview participants.

Material	**Company**	**Level**	**Department**	**Code**
	Göteborgs universitet	System	Business Development	INT1
	Byggvarubedömningen	System	Environmental Assessment	INT2
	Byggherrarna	System	Executive Management	INT3
	Fastighetsägarna	System	Development and Sustainability	INT4
	Byggföretagen	System	Innovation and Sustainability	INT5
	Vasakronan	Corporate	Urban and Real Estate Development	INT6
	Vasakronan	Corporate	Sustainability	INT7
	Vasakronan	Corporate	Sustainability	INT8
	Vasakronan	Corporate	Procurement	INT9
	Vasakronan	Project	Project Management	INT10
	Akuro	Project	Sustainability	INT11
	Vestia	Project	Project Engineering	INT12
	Vestia	Project	Business Development	INT13
CLT	Södra	Supplier	Project Management	INT14
CLT	Södra	Supplier	Product Development	INT15
Glulam / CLT	HyBridge	Supplier	Project Management	INT16
Glulam	Martinsons	Supplier	Project Management	INT17
Glulam	Martinsons	Supplier	Sales	INT18
Glulam	Holmen	Supplier	Sustainability	INT19
Glulam	Holmen	Supplier	Forestry	INT20
Accoya	Fasadglas	Supplier	Technical Sales	INT21
Accoya	Bäckegårds	Supplier	Executive Management	INT22
Accoya	Accsys	Supplier	Procurement	INT23
Accoya	Buildpro Group	Supplier	Executive Management	INT24
Interior panels	Frapont	Supplier	Sales	INT25

The interviews covered all four analytical levels. Representatives from system-level organizations, including the Göteborg Center for Global Biodiversity Studies (GGBC) at Göteborgs universitet, Byggvarubedömningen, Byggherrarna, Fastighetsägarna, and Byggföretagen, provided contextual insights into how biodiversity is understood, prioritized, and addressed within the Swedish construction and real estate sector. Corporate level interviews focused on strategic sustainability governance and procurement. At the project level, interviews were conducted with directly involved actors in Kaj16, including project managers and sustainability coordinators. These interviews provided insight into how sustainability ambitions are translated into procurement decisions and material choices in practice. Supplier-level interviews were conducted with representatives of selected material supply chains, including CLT, glulam, Accoya, and interior panel. These interviews addressed raw material sourcing, certification systems, traceability, and responses to biodiversity-related procurement requirements. The interviews followed material flows upstream in the supply chain, covering stages such as raw material sourcing, processing, manufacturing, and distribution. This approach, referred to as supply chain tracking, allowed analysis of how biodiversity considerations are addressed at different stages of material production, while also capturing variation in supply chain structures and access to relevant actors.

Five interviews were conducted physically on site, while the remaining interviews were conducted digitally to facilitate the participation of geographically dispersed interviewees, particularly supplier representatives located outside the immediate project area. All participants who were successfully contacted agreed to participate and no invited participant explicitly declined. One planned interview could not be conducted at the final upstream stage of the interior panel supply chain, as the identified respondent did not respond despite repeated contact attempts within the study period. This limitation may have affected the completeness of the supply chain mapping, particularly at the most upstream stage, where biodiversity impacts are most directly related to land-use practices. As a result, certain aspects of biodiversity governance in the raw material extraction stage rely on indirect accounts rather than direct empirical data. The interviews were conducted between February and April 2026, lasted approximately 45 to 60 minutes, and were recorded with the consent of the participants.

System-level interviews were analyzed using the same thematic framework as case-related material and were used to provide contextual and analytical insight into broader institutional conditions shaping procurement and biodiversity governance. Both interview transcripts and relevant documentary material were coded using the same analytical framework to identify recurring patterns related to visibility, governance mechanisms, and leverage points. This enabled systematic comparison across data sources and analytical levels, while the multi-level structure of the interview sample allowed comparison of how biodiversity is understood and addressed across system, corporate, project, and supplier levels.

The interview guides were developed based on the analytical framework presented in Chapter 2. Although adapted to each analytical level, the guides covered comparable themes, including biodiversity risks, decision-support tools, procurement requirements, traceability, and perceived barriers and opportunities. The semi-structured format and open-ended questions enabled participants to elaborate on their experiences while allowing emerging themes to be explored during the interviews. The interviews provided in-depth insight into how biodiversity is interpreted, negotiated, and operationalized across different organizational levels. This made it possible to capture variations in understanding, priorities, and practices that are not visible in formal documentation, as well as to identify tensions between strategic ambitions and practical implementation.

3.4 Selection and delimitation of materials

To identify relevant supply chains for analyzing biodiversity governance in construction materials, the study began with an overall mapping of the material composition of the Kaj16 project. This mapping focused on life cycle modules A1 to A3, as these stages capture upstream parts of the value chain where land use, resource extraction, and associated biodiversity impacts are most likely to occur. The initial screening was based on compiled material quantity data from the project and was used to identify dominant material flows within these early life cycle stages. The mapping indicated that mineral-based materials, particularly concrete, represent the largest share of total embodied mass in the project. However, as the purpose of this study is not to quantify the building's total biodiversity footprint but to examine governance mechanisms within material supply chains, embodied mass was not used as the sole selection criterion. This selection strategy ensures alignment with the study's aim of examining how biodiversity is governed across different stages of construction material supply chains.

Instead, the material selection was guided by three analytical criteria. First, materials were assessed in relation to their dependence on land use during raw material extraction. Second, materials were evaluated based on their relevance for biodiversity-related governance mechanisms within supply chains, including certification systems, traceability mechanisms, supplier requirements, and procurement influence. Third, variation in supply chain structure and geographical sourcing was considered in order to capture different governance conditions and contexts. Based on these criteria, four wood-based material categories were selected for detailed analysis: CLT, glulam beams, Accoya-modified wood used in facade applications, and interior panels. These materials represent different types of forest-based products and reflect variation in supply chain structure, traceability systems, certification practices, and geographical sourcing, ranging from relatively regional supply chains to more complex and globally distributed production structures.

For each selected material category, the supply chain was traced upstream from the construction project towards raw material extraction, enabling inclusion of actors across multiple stages of the value chain, including processing, manufacturing, and raw material sourcing. This mapping also informed the selection of supplier-level interviewees and supported the analysis of how biodiversity considerations are shaped across different stages of material production. Figure 3.1 illustrates the investigated material supply chains and indicates which stages were covered by interviews.

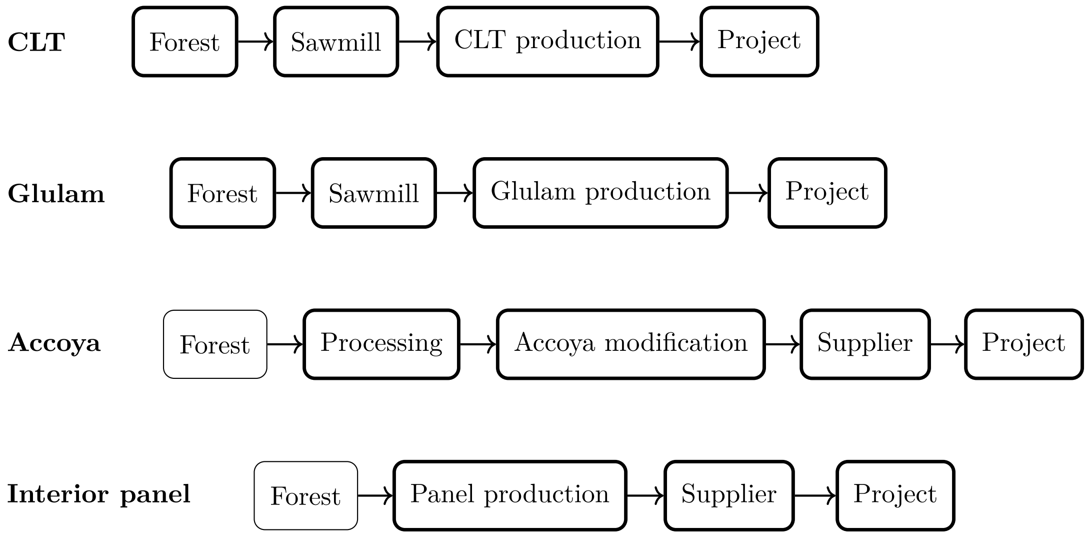

Figure 3.1: Material supply chains included in the study and interview coverage.

As shown in Figure 3.1, the empirical material captures multiple stages of the value chain, particularly processing, manufacturing, and supplier-level activities. Some upstream stages could not be fully accessed due to practical constraints related to data availability and access to actors in global supply chains. The figure therefore clarifies both the scope of the empirical material and the boundaries of the study.

Together, the selected materials represent different stages and configurations of forest-based supply chains. This includes variation in supply chain structure, certification systems, traceability mechanisms, supplier arrangements, and geographical sourcing. Such variation is important, as biodiversity impacts are closely linked to location-specific ecological conditions and land-use practices. It also enables a focused and analytically rich examination of how biodiversity considerations are addressed within construction material supply chains.

3.5 Data analysis

The interviews were analyzed using thematic analysis following Braun and Clarke (2006).The analysis initially followed an inductive coding approach to identify patterns emerging from the interviews and later developed into a more abductive process, where the coding was interpreted and refined in relation to the study's analytical framework. Coding was guided by the three analytical dimensions, visibility, governance mechanisms, and leverage points, which were applied consistently across the system, corporate, project, and supplier levels.

The analysis began with repeated readings of interview transcripts and selected documents to build familiarity with the empirical material and identify preliminary patterns. Coding was conducted iteratively through close reading and systematic annotation of both interview and document data, and coding decisions and theme development were documented throughout the process to enhance transparency and analytical rigor. The coding process was guided by three analytical questions: how biodiversity becomes visible or remains invisible in procurement processes, which governance mechanisms are used to address biodiversity-related risks, and where potential leverage points exist within construction material supply chains. Coding was conducted collaboratively by both authors to strengthen analytical consistency and reduce individual interpretation bias, with interpretations continuously discussed and refined.

Following the approach outlined by Braun and Clarke (2006), the analysis progressed through familiarization with the data, generation of initial codes, and development and refinement of themes. An initial coding structure was derived from the three analytical dimensions. Additional sub-themes, such as traceability, certification systems, procurement requirements, and supplier dialogue, emerged inductively and were organized within the overarching framework. Although the analytical framework guided the coding and interpretation process, attention was also given to empirical themes emerging outside the predefined analytical dimensions during the iterative analysis.

The analysis was conducted in two stages. In the first stage, each analytical level was examined separately to develop an in-depth understanding of how biodiversity is interpreted and addressed within different parts of the governance structure. In the second stage, findings were compared across levels to identify alignments, gaps, and tensions within the governance chain. This comparative approach enabled analysis of how biodiversity-related concerns move between strategic ambitions, procurement practices, decision-support systems, and supplier activities. By combining analysis across multiple analytical levels, including both case-related and system-level material, the study provides a multi-level understanding of biodiversity governance in construction procurement. This makes it possible to examine how biodiversity considerations are interpreted within a specific project context while also situating these practices within broader sectoral and institutional conditions.

3.6 Trustworthiness and ethical considerations

In qualitative research, trustworthiness is commonly assessed in terms of credibility, dependability, confirmability, and transferability (Lincoln & Guba, 1985). These criteria guided the evaluation of methodological quality in this study, alongside ethical considerations that were central throughout the research process, particularly as the study involved interviews with industry professionals and organizational material related to procurement and sustainability governance.

Credibility was strengthened through triangulation of data sources and analytical levels. By combining document analysis with interviews and comparing perspectives from system, corporate, project, and supplier actors, the study reduced reliance on a single interpretive standpoint. The use of semi-structured interviews further supported credibility by allowing participants to elaborate on their experiences and provide rich, detailed accounts. Dependability and confirmability were enhanced through iterative coding procedures, collaborative analysis, and systematic documentation of analytical decisions. Regular discussions between the authors were used to reflect on interpretations, challenge assumptions, and reduce the influence of individual researcher bias. Given the interpretive nature of the analysis, findings are inevitably shaped by the researchers' perspectives, which was addressed through continuous dialogue and joint coding throughout the analytical process.

Transferability was supported by providing detailed descriptions of the case context, material selection, and governance structures, enabling readers to assess the applicability of the findings in similar settings. As the study is based on a single case and a limited number of interviews, the findings are intended to be analytically rather than statistically generalizable.

All interview participants were informed about the purpose of the study, the voluntary nature of their participation, and informed consent was obtained prior to conducting and recording the interviews. Respondents were anonymized in the presentation of results, and sensitive organizational and supplier-specific information was handled confidentially. Interview recordings, transcripts, and related research material were stored on password-protected devices and were accessible only to the authors, and personal data were handled in accordance with applicable GDPR principles and retained only for as long as necessary for the purposes of the study. Special care was taken to present findings in ways that do not expose, misrepresent, or disadvantage individual participants or organizations. A key ethical challenge involved balancing transparency with the protection of commercially sensitive information, which was addressed through anonymization, aggregation of findings across analytical levels, and careful consideration of the level of organizational detail presented.

The study also raises broader ethical considerations related to biodiversity governance. Environmental impacts often occur far from the project itself and may affect ecosystems and communities not directly represented in procurement decisions. This raises questions concerning responsibility, transparency, and the distribution of environmental impacts across global supply chains. There is also a risk that complex biodiversity issues are reduced to simplified indicators or certification-based compliance. The study therefore adopts a critical perspective on existing governance mechanisms and does not assume that formal compliance necessarily reflects positive ecological outcomes.

3.6.1 Methodological limitations

Several methodological limitations should be acknowledged. First, access to interview participants was partly facilitated through existing organizational networks and availability, which may have introduced selection bias and influenced which perspectives were included in the study. In particular, actors with established sustainability roles may be overrepresented compared to less visible actors within supply chains. As interviews constitute a primary data source, there is a risk that respondents present their organizations and practices in a favorable manner, particularly in relation to sustainability issues. This potential bias was addressed by triangulating interview data with documentary sources and by including perspectives from multiple organizational levels.

Second, the study relies on interview data and documentary material, meaning that the findings are based on reported practices and formal representations rather than direct observation of procurement processes or supply chain operations. As a result, there is a risk that practices are described in ways that reflect organizational intentions or formal compliance rather than actual implementation. Access to upstream supply chain actors was also limited, particularly at the raw material extraction stage. While the study traces material flows across several stages of production, not all parts of the supply chain could be fully captured. This limitation is especially relevant for more complex and globally distributed supply chains, such as Accoya, where visibility decreases further upstream.

Finally, the study focuses on a single case project, Kaj16, which limits the empirical scope. Although the case was selected as an information-rich and relevant example, the findings should not be interpreted as representative of all construction projects or procurement contexts. These limitations were addressed through triangulation of data sources, inclusion of multiple analytical levels, and systematic comparison between interview and document data. The aim of the study is therefore analytical rather than statistical generalization, contributing to theoretical understanding of biodiversity governance in construction procurement.

3.6.2 Use of Artificial Intelligence

Artificial intelligence (AI) tools were used during the research process as supportive tools for language improvement, text editing, structural refinement, and idea generation. Their primary function was to support grammar, readability, academic phrasing, and text organization. AI tools were also used for brainstorming purposes, such as suggesting headings, improving paragraph transitions, and clarifying methodological descriptions.

AI tools were not used to generate empirical data, conduct interviews, perform coding, analyze findings, or draw conclusions. All analytical processes and interpretations were carried out independently by the authors. AI-generated outputs were critically reviewed and revised or rejected where appropriate. Examples of prompts used include *"Improve the academic tone of this paragraph"*, *"Rewrite this section for clarity and conciseness"* and *"Suggest a clearer structure for the methodology chapter."*. The authors retained full responsibility for all methodological decisions, theoretical choices, analysis, and conclusions. AI was therefore limited to a supportive role and did not replace the authors' critical thinking or scholarly judgment.

4
Findings

This chapter presents the findings of the study, structured around three main themes: the visibility of biodiversity across the supply chain, governance mechanisms in material selection and procurement, and leverage points for influencing biodiversity. The findings are based on interviews conducted across system, corporate, project, and supplier levels, complemented by document analysis, and are supported by examples and quotations from respondents.

4.1 Visibility of biodiversity across the supply chain

Across the interviews and documents, biodiversity is rarely mentioned as an operational decision-making parameter within the construction material supply chain. Instead, it is primarily addressed indirectly within broader sustainability efforts. As one system-level respondent explains, "They are long value chains. You do not see your own role, and you do not always understand the connections" (INT1, system level). Respondents highlight biodiversity impacts as difficult to trace in complex value chains.

Although sustainability is presented as an important basis for decision-making across organizational levels, biodiversity is not included in indicators or decision-support tools, and is therefore not used as a parameter in material evaluations. This pattern is also reflected in EPDs, where climate indicators are standardized, while biodiversity is not included as a separate parameter (EPD International AB, n.d.). Interviewees consistently present climate-related factors as more concrete and easier to apply in practice. As one respondent from the project level notes, "And above all, the CO_2 footprint has been the most important factor in KAJ 16" (INT10, project level). Climate-related metrics are presented as providing a standardized basis for comparing material alternatives, while biodiversity is not represented in a comparable way.

Respondents describe variations in visibility across the supply chain depending on context. System-level respondents emphasize a lack of common definitions, indicators, and working methods across the sector. At the same time, biodiversity appears more visible in site-specific contexts. As one respondent explains, "the most direct and visible impact occurs in property management, particularly in outdoor environments" (INT4, system level). In contrast, biodiversity appears less visible in upstream material flows.

This limited visibility is also reflected across organizational levels. Within companies, corporate documents and interviews frame biodiversity as a strategic ambition rather than an operational parameter. This is reflected in corporate sustainability reporting, where biodiversity is presented as a priority but remains abstract and is not supported by clearly defined indicators for decision-making (Vasakronan, 2025). In project settings, biodiversity is also not included in evaluation criteria. Among suppliers, biodiversity-related information is rarely requested. Instead, decision-making is described as being shaped by factors such as price, delivery times, and technical specifications.

Across the empirical material, several recurring aspects related to the visibility of biodiversity can be identified. These include limited availability of biodiversity-related data, reliance on certification, underutilized traceability and transparency, and low demand for biodiversity-related information. Together, these aspects describe how biodiversity is currently addressed in decision-making processes across the supply chain.

4.1.1 Limited biodiversity data in decision-making

Respondents commonly present biodiversity as difficult to define, measure, and compare. System-level respondents emphasize the absence of standardized indicators and shared methodologies. As one respondent explains, “it is very complex. It is difficult to find a uniform number and metric” (INT1, system level). Interviewees contrast biodiversity with climate-related impacts, which are associated with established and widely used indicators. As one respondent states, “there is a very concrete metric for climate data. It is CO_2 equivalents. And for these other issues, it is more a matter of thinking in terms of risk” (INT2, system level). In the interviews, biodiversity is consistently framed in qualitative or risk-based terms, rather than through standardized measures.

Across corporate and project contexts, this is reflected in a stronger focus on environmental aspects that are easier to measure and compare, particularly climate impact. This reflects a contrast between climate-related metrics, which are standardized, and biodiversity, which is not represented through comparable indicators (EPD International AB, n.d.). In project settings, standardized tools such as EPDs are used to compare alternatives primarily based on climate-related indicators. In the project-level interviews, biodiversity does not function as a parameter in these evaluations (INT11, project level).

A similar pattern is observed in assessment tools such as Byggvarubedömningen, where environmental impacts are evaluated through predefined criteria, but biodiversity is not represented as an independent indicator (Byggvarubedömningen, n.d.). Among suppliers, biodiversity also appears difficult to measure and compare.

As one respondent explains, "Biodiversity is significantly more complex to manage than climate change" (INT19, supplier level). This limits the ability to include biodiversity as a comparable parameter in decision-making.

4.1.2 Certification as a simplified proxy for biodiversity

In the absence of measurable biodiversity indicators, certification systems are widely used as a primary mechanism for addressing biodiversity. Rather than measuring biodiversity directly, they translate ecological aspects into standardized requirements. Respondents also explain that certification shifts responsibility for verification to independent third-party auditors, rather than being assessed directly by the actors involved. As one respondent explains, "we do rely and depend on the auditors to do their job" (INT23, supplier level). At the same time, respondents point out that certification captures only part of biodiversity impacts. As one respondent notes, "Certifications function as a minimum level… but they are not sufficient on their own" (INT7, corporate level).

Across the empirical material, certification is described as shaping how biodiversity is made visible across the supply chain. At a system level, biodiversity is addressed indirectly within broader assessment frameworks rather than through a separate and clearly defined indicator (INT2, system level). At the corporate level, certifications such as FSC and PEFC are used as minimum requirements in procurement and material selection, while more specific biodiversity-related requirements are not currently in place (INT8, corporate level). In project settings, certifications are mainly used as verification tools, where decision-making focuses on meeting predefined requirements rather than assessing biodiversity outcomes. Among suppliers, certification is generally described as sufficient to meet client expectations, as clients are perceived as satisfied once products are certified (INT17, supplier level).

4.1.3 Underutilized traceability and transparency

The findings show that traceability and transparency are technically possible but are only used to a limited extent in decision-making. This limitation is also reflected in chain-of-custody systems, where traceability ensures that materials come from certified sources but does not provide detailed information about biodiversity impacts (Programme for the Endorsement of Forest Certification, 2020). This limits the visibility of biodiversity conditions at specific sites. Respondents also highlight that traceability becomes more limited at the product level, as materials from multiple sources are mixed in production (INT14, supplier level).

Across levels, respondents also describe that detailed supply chain information is rarely requested or used in practice. Within corporate contexts, such information is described as difficult to access, while in project settings it is not included in decision-making. Among suppliers, it is rarely requested. As one respondent explains, "I have never experienced that anyone in this industry has asked for it" (INT17, supplier level).

4.1.4 Limited demand for biodiversity-related information

A central finding is that biodiversity-related information is rarely requested across the supply chain. As one respondent explains, "I perceive that the primary issue is that the topic is not sufficiently demanded..." (INT5, system level). Interviews indicate a lack of external drivers, such as regulation, standardized metrics, and industry-wide guidelines. This is reflected in policy frameworks such as the EU Taxonomy for Sustainable Activities, where biodiversity is included as an objective but primarily addressed through high-level and non-operational criteria (European Parliament and Council of the European Union, 2020).

This limited demand is reflected across organizational levels. Within companies, biodiversity appears as a strategic priority, but is not translated into concrete requirements (Vasakronan, 2025). In project settings, biodiversity is not included as an evaluation parameter, and among suppliers, biodiversity-related information is rarely requested. One supplier-level respondent notes that "there is quite a strong interest from the client side. But our closest customers are often contractors, and the interest is not as strong there" (INT14, supplier level). Another respondent similarly explains, "Very few people unfortunately care about origin and that kind of information" (INT25, supplier level). Biodiversity-related information is therefore not prioritized consistently in procurement-related interactions.

4.1.5 Synthesis

Across the empirical material, biodiversity has low visibility in decision-support tools and procurement processes. Together, the findings indicate that biodiversity is not consistently integrated into decision-making, as it lacks standardized data, is addressed through indirect mechanisms such as certification, and is neither actively requested nor used in procurement processes.

4.2 Governance mechanisms of biodiversity in material selection and procurement

The empirical material indicates that biodiversity is mainly addressed through certifications and broader sustainability frameworks, while governance efforts focus on climate-related targets and standardized indicators. Biodiversity is not described as a separate aspect of governance in the empirical material and is not translated into concrete governance tools or procurement requirements. Across all levels of the supply chain, a similar pattern can be observed and is also reflected in policy frameworks such as the EU Taxonomy for Sustainable Activities, where biodiversity is included as an objective but addressed through high-level and non-operational criteria (European Parliament and Council of the European Union, 2020).

At a system level, respondents emphasize the absence of clear guidelines, standardized approaches, and coordinated governance structures. Within companies, biodiversity is presented as part of overall sustainability ambitions but is not translated into specific governance tools or practices. As one respondent explains, "we have not really landed on how we should work with it concretely" (INT8, corporate level). In project settings, biodiversity is not included in procurement requirements or decision-making, and among suppliers, biodiversity-related information is rarely requested in procurement processes.

Based on interviews and document analysis, five recurring aspects can be identified across the analytical levels: the absence of explicit requirements, reliance on client-driven governance, uneven translation across levels, fragmented responsibility, and the use of certification as a governance mechanism.

4.2.1 Absence of explicit biodiversity requirements

Across all levels of the supply chain, biodiversity is rarely translated into clear and binding requirements. System-level respondents describe both a lack of incentives and limited follow-up mechanisms. As one respondent explains, "Requirements are often set but not followed up... and therefore have no consequences" (INT5, system level). Existing requirements are therefore described as not being consistently followed up or leading to concrete consequences.

Within companies, biodiversity is not translated into governance tools such as procurement criteria, performance indicators, or contractual requirements. This is also reflected in corporate sustainability reporting, where biodiversity is described as a strategic level but not expressed in operational terms or linked to concrete actions (Vasakronan, 2025). Procurement decisions in projects are guided by predefined requirements, and biodiversity is therefore rarely considered. As one respondent states, "it would require clearer requirements for it to have an impact" (INT13, project level). Among suppliers, biodiversity-related aspects are generally not requested, and practices are shaped by existing procurement criteria. Overall, biodiversity is not reflected in formal procurement requirements.

4.2.2 Governance driven by client requirements

Governance within the supply chain is consistently presented as being strongly influenced by client requirements, with project settings highlighted as central to how governance is implemented in practice. Respondents identify the client as the main actor setting requirements. As one respondent explains, "the client ultimately sets the requirements and makes the decisions" (INT12, project level). Requirement-setting is presented as the main form of governance.

Respondents further note that requirements are defined early in the process. When biodiversity is not included at this stage, it is not introduced later in the project. The inclusion of biodiversity therefore depends on how requirements are defined at the beginning of procurement processes. This pattern is also reflected among suppliers, where practices are linked to client and market demands. Respondents explain that suppliers adjust their work based on what is requested in procurement, and adapt their practices as expectations change (INT23, supplier level).

From a system-level perspective, respondents point to a lack of coordinated governance structures and broader drivers for integrating biodiversity. Approaches are described as being based on individual initiatives rather than shared practices across the supply chain. As one respondent explains, "there is a clear need for incentives driven by legislation" (INT2, system level). Across the empirical material, governance appears to be largely driven by client-defined requirements and market demand.

4.2.3 Translation and implementation across levels

The findings show that biodiversity-related governance is unevenly translated across the supply chain, with biodiversity interpreted differently across actors and variations in how it is understood and applied in practice. At a system level, respondents point to a lack of shared frameworks and coordinated approaches, and governance is described as not being standardized across the sector.

Within companies, governance is defined at higher levels and then translated into practice in projects. As one respondent explains, "the goals are set at the corporate level and then translated within the organization" (INT7, corporate level). At the same time, biodiversity is described as part of overall sustainability ambitions but not supported by clearly defined operational criteria. As one respondent notes, "the direction is clear, but how it should be implemented is not always specified" (INT6, corporate level). Governance is therefore not consistently translated into concrete practices.

In project settings, governance is implemented through procurement processes and decision-support tools. Since biodiversity is not included in these systems, it is not reflected in procurement practices. Project organizations are described as working within predefined requirements, where the focus is on fulfilling existing specifications (INT12, project level). Among suppliers, governance is shaped by client requirements and certification standards, and introducing new requirements at later stages is described as difficult. As one respondent explains, "it is difficult to introduce new requirements in the middle of the supply chain" (INT16, supplier level). Biodiversity-related governance is therefore not consistently translated across levels.

4.2.4 Fragmented responsibility across the supply chain

Responsibility for biodiversity is repeatedly described as fragmented across the supply chain, with no clearly defined allocation of ownership between actors. Across all levels of the supply chain, biodiversity-related issues appear to be shared among multiple actors without a clear division of roles. At a system level, respondents point to the absence of coordinated governance structures and clear role definitions. Existing frameworks do not specify how responsibilities are distributed, resulting in unclear expectations. Within companies, roles are mainly linked to setting strategic ambitions, while operational responsibilities are less clearly defined. As one respondent explains, “we do not control material choices that are handled by the project organization” (INT9, corporate level).

In project settings, responsibilities are primarily linked to implementing predefined requirements rather than shaping biodiversity-related decisions. Project actors are described as working within given conditions, where their role is tied to delivering according to specifications (INT10, project level). Among suppliers, responsibility is located further upstream, particularly in relation to raw material extraction. At the same time, requirements are described as being passed along the supply chain across different material contexts. As one respondent explains, “we pass on the requirements from the client to our suppliers” (INT16, supplier level). Responsibility is therefore distributed and transferred across the supply chain, without a clearly defined point of ownership.

4.2.5 Certification as a governance mechanism

Certification functions as a key mechanism through which biodiversity is governed in procurement and sourcing practices across the supply chain, as it translates biodiversity-related concerns into standardized and verifiable criteria. In practice, certification is often treated as a minimum requirement, with procurement and sourcing decisions based on compliance with certification criteria rather than direct assessment of biodiversity impacts. This is reflected in systems such as FSC and PEFC, where biodiversity is addressed through predefined requirements that can be verified and applied in procurement processes (Forest Stewardship Council, 2023; Programme for the Endorsement of Forest Certification, 2023).

Among suppliers, certification is described as sufficient to meet client expectations. As one respondent explains, “...they buy PEFC and are satisfied with that” (INT17, supplier level). At the same time, respondents note that certification provides limited information about biodiversity outcomes. As a result, biodiversity is mainly addressed through compliance with standardized criteria rather than through detailed assessment of ecological conditions.

4.2.6 Synthesis

From the empirical material, biodiversity is not translated into explicit requirements or governance tools in procurement and material-related practices. Governance is primarily exercised through client requirements and certification systems, while responsibility remains distributed across multiple actors without a clearly defined point of ownership. Biodiversity is addressed within existing governance structures but is not operationalized as a separate aspect of governance.

4.3 Leverage points for influencing biodiversity

The findings show that actors' leverage to influence biodiversity varies across stages of the construction material supply chain. This section presents empirical findings on how leverage is described across actors and project stages. Biodiversity impacts mainly occur upstream, particularly in land use and raw material extraction, while decisions are largely made downstream through procurement and requirement-setting processes. As one respondent explains, "the greatest impact is in raw material extraction" (INT20, supplier level).

Respondents describe a separation within the supply chain between where biodiversity impacts occur and where decisions are made. This is linked to how the supply chain is organized, where actors involved in procurement and project delivery are distanced from upstream stages. As one respondent explains, "it influences, but it is not a governing factor" (INT6, corporate level). Differences in influence are linked to actor position and how decision-making processes are structured. Four recurring leverage points are identified: upstream production processes, requirement-setting within companies, early project stages, and limited influence among downstream actors.

4.3.1 Upstream impact in raw material extraction

Respondents consistently identify upstream stages as the primary point where biodiversity impacts occur. These impacts are closely linked to land use, ecosystem conditions, and habitat transformation. As one respondent explains, "the largest impact occurs through exploitation and land use" (INT1, system level). Another respondent similarly notes that "the greatest impact is in forestry, in how the forest is managed and harvested" (INT22, supplier level). Biodiversity outcomes are shaped by forestry practices, harvesting methods, and regeneration processes. As one respondent explains, "Everything happens in the forest. It does not happen on the way from the forest to the finished raw material or product" (INT15, supplier level). Overall, biodiversity impacts are concentrated in raw material extraction and related upstream activities.

These stages are also described as being separated from downstream procurement and decision-making processes. In project and supplier contexts, responsibility for biodiversity is often located further upstream. As one respondent explains, "the forest and raw material extraction lie entirely with our suppliers" (INT14, supplier level). The stages where biodiversity impacts occur are distinct from those where procurement and design decisions are made.

4.3.2 Corporate requirement-setting as a leverage point

Despite limited direct influence over upstream production activities, respondents across system, corporate, and project contexts identify the corporate level, particularly clients and developers, as a key leverage point through requirement-setting. Influence is described as taking place through procurement criteria, sustainability strategies, and project requirements. As one respondent explains, "setting requirements is very important. That is how the market works, what the market demands is what the market delivers" (INT3, system level).

Supplier practices are shaped by what is requested in procurement processes. The findings show that requirements related to documentation, certification, and performance influence how suppliers act and what they prioritize. A similar pattern is reflected in procurement-related documents, where requirements are primarily formulated through standardized criteria and certifications rather than biodiversity-specific indicators (Byggvarubedömningen, n.d.). Respondents and documents describe procurement as a mechanism through which upstream activities may be indirectly influenced.

However, this leverage is not consistently reflected in current practices. Biodiversity is addressed at a strategic level but not translated into concrete decision-making parameters. As one respondent explains, "the direction is clear, but how it should be implemented is not always specified" (INT7, corporate level). The corporate level therefore plays a central role in shaping how biodiversity is addressed through requirement-setting, while biodiversity is not consistently included in procurement criteria or decision-support tools.

4.3.3 Early project stages as a leverage point

The findings show that the ability to influence biodiversity is closely linked to the early stages of a project, where key decisions regarding material selection, design, and technical solutions are made. In project settings, the greatest opportunity to influence biodiversity is described as occurring before the design phase begins. As one respondent explains, "the biggest opportunity to influence it for real is actually before we even enter the design phase" (INT10, project level). Once design choices and material specifications have been established, the scope for introducing biodiversity-related considerations becomes more limited.

Across the supply chain, project actors operate within predefined requirements, while suppliers respond to specifications defined earlier in the process. As one respondent explains, “we relate to the requirements that are already defined when we enter the project” (INT18, supplier level). Biodiversity is more likely to be addressed when included in early-stage requirements. When such considerations are not incorporated at this stage, they are generally not introduced later in the project. Leverage is therefore dependent on timing within the project process.

4.3.4 Limited influence of downstream actors

Actors further downstream in the supply chain have limited ability to influence biodiversity. Among suppliers, influence is constrained by predefined requirements, market conditions, and procurement frameworks. As one respondent explains, “our influence… in the forestry process… is probably quite minimal” (INT24, supplier level). Decision-making is shaped by factors such as price, delivery times, and technical specifications. As one respondent explains, “price and delivery times often drive the dialogue” (INT21, supplier level). Biodiversity is not a primary parameter in procurement-related interactions.

In project and corporate contexts, actors operate within existing procurement structures, where biodiversity is not consistently reflected in requirements. At the supplier level, respondents also highlight limited opportunities to act beyond available tools. As one respondent explains, “there are no steering tools today other than purchasing certified material” (INT22, supplier level). Downstream actors therefore operate within predefined conditions that limit their ability to influence biodiversity-related outcomes independently.

4.3.5 Synthesis

Across the empirical material, influence is mainly exercised indirectly, through requirements and procurement decisions rather than direct control over upstream activities. Influence is also dependent on early project stages, where key decisions are defined. Once requirements and design choices are established, the ability to introduce biodiversity considerations becomes limited. Downstream actors therefore operate within predefined conditions, with limited opportunities to influence outcomes independently. The findings indicate that the ability to influence biodiversity is uneven across the supply chain and limited by both the timing of project stages and how procurement decisions are organized.

4.4 Cross-level findings

Across the empirical material, consistent patterns can be observed in how biodiversity is addressed across system, corporate, project, and supplier levels. According to respondents, biodiversity has low visibility in decision-making, is mainly governed through existing structures such as certifications and client-defined requirements, and is associated with fragmented responsibility across the supply chain. Across levels, biodiversity is therefore present in strategic and general terms, but rarely translated into operational criteria, procurement requirements, or decision-support tools.

The ability to influence biodiversity varies across the supply chain. Biodiversity impacts are mainly linked to upstream stages, while influence takes place downstream through requirement-setting and procurement. Influence is also concentrated in early project stages, while later-stage actors operate within predefined conditions. Table 4.1 summarizes how these patterns appear across analytical levels, focusing on visibility, governance mechanisms, and leverage points across the supply chain.

Table 4.1: Summary of key findings across the analytical levels.

Level	Visibility	Governance mechanisms	Leverage points
System	Abstract definitions and limited indicators	Limited coordination and operational frameworks	Standards, policies, and industry initiatives
Corporate	Strategic focus with weak operational integration	Weak translation into procurement requirements	Requirement-setting and sustainability ambitions
Project	Not included in material evaluation or selection	Limited biodiversity focus in predefined requirements	Strong influence in early project stages
Supplier	Biodiversity information rarely requested	Addressed through certifications and requirements	Limited influence within market structures

As shown in Table 4.1, similar patterns are observed across all levels, although they manifest differently depending on actor position. Across the supply chain, biodiversity is acknowledged at a strategic level but not translated into operational criteria. Governance is described as primarily exercised through indirect mechanisms, while influence varies across actors and project stages.

5
Discussion

This chapter discusses the empirical findings in relation to the analytical framework and previous research. The discussion is structured around the three analytical dimensions used throughout the thesis, visibility, governance mechanisms, and leverage points. Each section analyzes how the findings relate to previous literature, what implications they have for procurement practice, and how they contribute to the current understanding of biodiversity governance in construction material supply chains. The chapter concludes with a synthesis of how the three dimensions interact and how this affects the integration of biodiversity into procurement practices.

5.1 Visibility of biodiversity

Biodiversity remains weakly visible in the procurement and decision-making related to materials throughout the construction supply chain. The findings show that this limited visibility is not only related to the availability of biodiversity-related data, but also to how procurement systems are structured. Procurement processes are highly dependent on standardized, comparable and quantifiable environmental indicators to support decision-making. Procurement systems therefore tend to prioritize environmental information that can be standardized, verified, and compared across suppliers and projects. As a result, biodiversity is rarely translated into concrete procurement criteria and remains largely absent from indicators, evaluation systems, and decision-support tools. Instead, it is primarily addressed indirectly through broader sustainability initiatives, certification systems, and general environmental requirements.

This misalignment between biodiversity and procurement logic is also reflected in previous research. As emphasized by IPBES (2019), biodiversity is context-specific and depends on local ecological conditions, while Verones et al. (2017) highlight the difficulties of representing biodiversity within standardized life cycle assessment frameworks. Similarly, Sonnemann and Gemechu (2017) argue that decision-support tools tend to prioritize environmental impacts that can be quantified and compared, particularly climate-related indicators. The empirical findings support these perspectives, as climate-related information was consistently prioritized within procurement processes due to its measurability and comparability. In contrast, biodiversity was rarely requested or operationalized in procurement decisions.

However, the findings also demonstrate that methodological limitations alone do not explain the weak visibility of biodiversity. Biodiversity-related information, such as material origin, traceability, and ecological impacts, was rarely requested at the corporate, project, and supplier levels. The findings therefore contribute to previous research by showing that biodiversity visibility depends not only on methodological challenges, but also on organizational priorities and procurement practices. This challenges the assumption in parts of the literature that improved measurement methods alone will increase biodiversity integration. Instead, the findings suggest that visibility depends on the interaction between available tools and organizational demand. Procurement systems are largely built around information that can be compared, measured, and verified, which makes standardized environmental indicators easier to use across suppliers and projects. In line with OECD (2003), environmental indicators can therefore be understood not only as representations of environmental impacts, but also as mechanisms that shape what becomes manageable in practice. Climate-related impacts become easier to govern because they are measurable, requested, and comparable, while biodiversity remains weakly governed because it lacks the same visibility.

Another factor limiting biodiversity visibility concerns supply chain transparency and traceability. The findings show that traceability was technically possible in some cases, but was rarely sufficient to provide detailed information on biodiversity impacts and upstream ecological conditions. In the case of the Accoya material sourced from New Zealand, it was not possible to establish contact with a specific forest owner connected to the material used in the project, partly because the material originated from multiple forest owners. Similarly, for the interior wood panel sourced from Spain, no detailed information could be obtained about the exact logging locations or production conditions. Although EPDs and other environmental documentation were available, these mainly provided standardized environmental data and offered limited insight into site-specific biodiversity conditions. This reduced the ability of procurement actors to assess biodiversity-related risks, compare suppliers, and formulate biodiversity-related procurement requirements.

Importantly, the limited ability to trace materials also represents a finding in itself. During the research process, difficulties in accessing upstream actors and information initially appeared to be a methodological limitation. However, these difficulties also reflect the conditions under which procurement actors operate. If upstream information is difficult to access in a research setting where it is actively requested, it is likely to be similarly difficult to access in procurement practice. The findings demonstrate that limited traceability should not only be understood as a limitation of the study, but also as an empirical finding that helps explain why biodiversity remains difficult to integrate into procurement decision-making. This also highlights a limitation in parts of the sustainable procurement literature, which often assumes that relevant environmental information is available and can be incorporated into decision-making processes.

Overall, the findings show that biodiversity remains structurally disadvantaged within current procurement systems. Since biodiversity is neither systematically measured nor explicitly requested in procurement criteria, decision-making continues to prioritize factors such as price, technical performance, delivery reliability, and climate-related indicators. This creates a structural imbalance that risks reinforcing problem shifting, as discussed by Sonnemann and Gemechu (2017). Stronger biodiversity integration therefore depends not only on improved methods and indicators, but also on creating organizational demand for biodiversity-related information and embedding such information more explicitly into procurement practices.

5.2 Governance mechanisms for biodiversity

The findings show that governance mechanisms for sustainability are present throughout the construction supply chain, yet biodiversity remains weakly integrated into these structures. In practice, biodiversity is mainly addressed through certification schemes and broader sustainability frameworks. Clear procurement requirements, systematic follow-up mechanisms, and clearly allocated responsibilities remain largely absent. This suggests that biodiversity is governed indirectly rather than operationalized as a distinct environmental objective within procurement processes, which ultimately limits its influence on procurement outcomes.

This finding confirms previous research emphasizing that procurement practices influence supplier behavior through procurement requirements and evaluation criteria. However, the findings also suggest that this influence depends on whether biodiversity is translated into concrete procurement requirements. Walker and Brammer (2012) and Igarashi et al. (2013) show that environmental priorities become operational when translated into procurement requirements. The findings support this, as suppliers consistently adapt to what is requested. Where biodiversity is not included in procurement requirements, it is also largely absent from supplier practices. Procurement requirements therefore emerge as a central governance mechanism.

At the same time, the findings extend this literature by demonstrating a gap between strategic ambition and operational implementation. Biodiversity is frequently highlighted in corporate sustainability strategies and policy frameworks, but is rarely translated into contractual requirements, material specifications, or measurable follow-up systems. This indicates that biodiversity governance may remain symbolic rather than operational in practice. This extends previous research, which often assumes that sustainability strategies are translated into practice through procurement structures. The findings instead indicate that such translation depends on whether specific environmental issues, such as biodiversity, are integrated into procurement requirements. Existing research emphasizes the importance of procurement as a governance tool, but the findings show that this potential is limited unless biodiversity is explicitly included in procurement practices.

Certification schemes such as FSC and PEFC function as the main governance mechanism in practice. Gulbrandsen (2004) argues that certification enables downstream actors to influence upstream practices through standardized rules and verification systems. The findings partly confirm this, as certification reduces uncertainty and provides a manageable way to address biodiversity within procurement processes. However, the findings also suggest that certification has important limitations as a form of biodiversity governance. In practice, certification functions primarily as a proxy rather than as a direct measure of ecological outcomes. It translates complex ecological conditions into standardized criteria, which facilitates implementation but reduces sensitivity to local variation. Compliance with certification standards may indicate that minimum requirements are fulfilled, but it does not necessarily provide detailed information about habitat quality, ecological conditions, or long-term biodiversity impacts. This suggests that certification may conceal important differences in biodiversity performance within procurement decision-making.

This creates an important tension within current governance systems and highlights a key limitation of certification-based governance, specifically its limited ability to capture context-specific ecological conditions. Certification makes biodiversity easier to integrate into procurement processes, but may also narrow biodiversity governance by prioritizing what can be standardized and verified. As a result, biodiversity risks becoming something that is evaluated through certification requirements rather than actively managed in relation to local ecological conditions. The findings therefore suggest that current governance challenges are linked not only to limited tools or ambition, but also to a misalignment between existing governance systems and the ecological complexity of biodiversity.

Another important finding concerns fragmented responsibility. While biodiversity is described as a shared responsibility, no actor is assigned clear responsibility for implementation. Erridge and McIlroy (2002) describe construction as a fragmented, project-based industry, and the findings confirm this structure. However, the study extends this perspective by showing how fragmentation specifically weakens biodiversity governance. Responsibility is distributed across actors and passed along the supply chain, which makes it difficult to ensure implementation and follow-up. When responsibility is shared across many actors without clear allocation, biodiversity risks receiving limited attention in practice.

In addition, biodiversity governance is constrained by weak feedback mechanisms. Even where biodiversity is acknowledged, systems for monitoring outcomes, evaluating supplier performance, and integrating lessons learned into future procurement processes remain limited. This reduces opportunities for learning and continuous improvement and reinforces a more compliance-oriented approach to governance. As a result, biodiversity governance remains focused on fulfilling formal requirements rather than improving ecological outcomes over time.

The consequence is that biodiversity remains weakly integrated into procurement practices. Governance structures for sustainability exist, but they are not fully aligned with the complexity and context-specific nature of biodiversity. More effective biodiversity integration would therefore require governance mechanisms that move beyond general sustainability ambitions and certification-based compliance, and instead include clearer procurement requirements, clearer allocation of responsibility, and more systematic follow-up. This suggests that biodiversity governance needs to become more operationalized within procurement processes in order to influence decision-making in practice.

5.3 Leverage points in the supply chain

The findings reveal a structural misalignment between where biodiversity impacts occur and where governance capacity is located within construction supply chains. Biodiversity impacts mainly arise upstream through raw material extraction and land-use change, while decision-making authority is largely concentrated downstream in procurement and project planning. Biodiversity governance in construction is therefore shaped by geographical and organizational distance, as actors responsible for procurement decisions are often far removed from the ecosystems and production processes most directly affected.

Although the study formally addressed product stage processes (A1 to A3), the empirical material consistently emphasized upstream sourcing, forestry practices, and raw material extraction as the primary areas of biodiversity concern. Multiple respondents described biodiversity impacts as being concentrated in forestry and land-use related activities, while transportation and manufacturing processes were perceived as less central from a biodiversity perspective. This empirical emphasis also contributed to the analysis becoming more concentrated on A1-related dynamics within the broader A1 to A3 system boundary.

The findings confirms previous research on global supply chains. Gardner et al. (2019) highlight that environmental impacts often arise upstream while downstream actors retain influence through procurement and requirement-setting. The findings support this, as biodiversity is consistently associated with early production stages, while developers and project actors operate at a distance from the affected ecosystems. The findings also extend this literature by showing that such downstream influence depends heavily on the availability of relevant information and explicit procurement requirements. In this sense, downstream influence is more limited in practice than the literature often suggests, as this distance creates practical challenges for biodiversity governance. Limited visibility into upstream production conditions reduces the ability of downstream actors to evaluate biodiversity impacts, even where sustainability ambitions exist. While procurement provides a structural source of influence, this influence depends on whether biodiversity is translated into explicit requirements. Without such requirements, procurement influence does not lead to changes in upstream practices. Influence therefore exists structurally, but does not necessarily result in changes in practice.

Procurement nevertheless represents a significant leverage point. Igarashi et al. (2013) show that procurement decisions influence supplier behavior, and the findings confirm that suppliers respond to client requirements. However, biodiversity is rarely included in these requirements. Procurement processes are therefore primarily shaped by cost, delivery performance, and climate-related indicators rather than biodiversity outcomes. This indicates that procurement influence must be operationalized through explicit requirements, organizational routines, and measurable expectations in order to shape biodiversity-related outcomes in practice. The findings also extend existing literature by showing that leverage depends not only on position in the supply chain, but also on the timing of decision-making. Bribián et al. (2011) argue that environmental outcomes are largely determined during early project stages, and the empirical material strongly supports this. The ability to influence biodiversity is greatest before design choices and material specifications are decided. Once projects move into later stages, the opportunities to introduce biodiversity considerations become more limited.

The findings therefore show that leverage in construction supply chains is related both to position in the supply chain and to the timing of decision-making. This contributes to existing literature by showing that influence is not only shaped by where actors are positioned in the supply chain, but also by when decisions are made. Actors may have influence because of their position, but this influence depends on whether biodiversity is included in early project stages and procurement processes. Real estate owners and clients are particularly influential because they define early project requirements, where important decisions regarding materials and procurement are made.

This creates a governance paradox in which actors with the greatest influence are often furthest from the biodiversity impacts, while actors closer to the impacts have more limited influence over procurement decisions. The findings therefore indicate an imbalance between where biodiversity impacts occur and where procurement influence is concentrated. Biodiversity governance consequently depends on how downstream procurement requirements are translated into upstream practices across fragmented supply chains. As a result, existing leverage remains underutilized. While procurement structures provide opportunities to influence biodiversity outcomes, these opportunities are not systematically used in practice. Biodiversity remains weakly integrated not because influence is absent, but because biodiversity is rarely included in procurement requirements and decision-making processes. The findings therefore suggest that biodiversity needs to be integrated earlier and more explicitly into requirement-setting and procurement decisions in order for existing leverage to influence biodiversity outcomes.

5.4 Synthesis and implications

Across the empirical material, the findings related to visibility, governance mechanisms, and leverage points are closely interconnected and mutually reinforcing. Rather than representing isolated challenges, these three dimensions collectively explain why biodiversity remains weakly integrated into procurement and material-related decision-making processes. The study therefore suggests that biodiversity governance in procurement depends strongly on visibility, as environmental impacts that can be standardized, quantified, and verified become easier to integrate into procurement systems. In contrast, context-specific biodiversity impacts remain considerably more difficult to operationalize within existing governance and procurement structures.

The findings on limited biodiversity data, reliance on certification, underutilized traceability, and low demand for biodiversity-related information show that biodiversity has low visibility in procurement decision-making. This limits the ability to define concrete requirements, as procurement decisions rely on information that can be compared and evaluated. As shown in the governance-related findings, biodiversity is therefore not translated into explicit procurement criteria, but remains embedded within broader sustainability ambitions and certification systems. At the same time, governance is largely driven by client requirements and existing procurement structures. Since biodiversity is not included in these requirements, it is not systematically addressed by suppliers. This reinforces the pattern observed in the visibility findings, where biodiversity-related information is rarely requested. The absence of explicit requirements therefore contributes to maintaining low visibility across the supply chain.

The findings on leverage further reinforce this relationship. Procurement and requirement-setting are identified as important leverage points, particularly in early project stages and at the corporate level. However, this influence is rarely used in relation to biodiversity. Since biodiversity is not translated into procurement requirements or decision-support tools, procurement processes generate limited demand for biodiversity-related information. This in turn contributes to the low visibility of biodiversity within procurement decision-making. Overall, the findings indicate a reinforcing relationship between low visibility, weak governance, and limited use of existing leverage within procurement systems. Biodiversity-related information is rarely requested because biodiversity is not included in procurement requirements, while biodiversity is not included in procurement requirements because relevant information is often unavailable or difficult to use in decision-making. This contributes to maintaining existing patterns in which biodiversity remains weakly integrated into procurement practices.

This constitutes the main conceptual contribution of the study. The findings suggest that biodiversity integration is constrained not by isolated barriers, but by the interaction between visibility, governance mechanisms, and leverage points across procurement and material supply chains. In this way, the study contributes to existing literature by showing how informational, organizational, and structural conditions interact within procurement systems rather than operating as separate mechanisms. The findings show that biodiversity remains difficult to integrate not only because biodiversity impacts are difficult to standardize and measure (Verones et al., 2017), but also because biodiversity-related information is rarely requested, operationalized, or connected to procurement requirements and governance structures. This also supports the argument by Sonnemann and Gemechu (2017) that environmental decision-support systems tend to prioritize impacts that can be more easily quantified and compared.

A further contribution of the study is the analytical framework developed to examine biodiversity governance across organizational levels and material supply chains. By connecting visibility, governance mechanisms, and leverage points, the framework helps explain why some sustainability issues become operationalized within procurement systems while others remain weakly integrated. In line with OECD (2003), the findings suggest that governance is shaped not only by the availability of environmental information, but also by what procurement systems are designed to measure, compare, and prioritize in practice. The framework therefore contributes to understanding how informational, organizational, and structural conditions together shape sustainability governance within procurement systems.

Although the framework was developed in the context of biodiversity governance in construction procurement, it may also be relevant in other sustainability contexts characterized by fragmented supply chains, multiple organizational actors, and difficulties in translating sustainability ambitions into operational procurement practices. The framework could therefore be applied in future research examining issues such as social sustainability, circularity, climate adaptation, resource use, or human rights in procurement and supply chain governance. In this way, the framework may contribute to a broader understanding of why some sustainability issues become integrated into procurement and supply chain governance, while others remain weakly prioritized despite increasing strategic attention.

The findings also extend previous research on sustainable procurement. Walker and Brammer (2012) emphasize the role of procurement requirements in advancing sustainability objectives. However, the findings of this study show that such requirements depend on both the availability of relevant information and organizational demand for sustainability-related knowledge. Similarly, Igarashi et al. (2013) highlight the importance of integrating sustainability into procurement practices, while the findings demonstrate that biodiversity-related concerns remain difficult to operationalize when they are not connected to measurable indicators and governance structures. Furthermore, Gardner et al. (2019) emphasize the importance of supply chain transparency, whereas the findings indicate that transparency only becomes meaningful when it is actively integrated into procurement processes and linked to governance mechanisms capable of influencing decision-making. As a result, biodiversity currently has limited influence on material selection and procurement decisions in practice.

The findings further suggest that individual mechanisms, such as certifications or indicators, have limited effect when used separately. Certification may support governance, but it does not replace the need for traceability and biodiversity-related information. Similarly, indicators may increase visibility, but they are unlikely to influence procurement decisions unless they are integrated into procurement requirements and evaluation processes. Current procurement systems therefore only partly support a nature-positive approach, as they tend to prioritize standardized and measurable forms of sustainability performance over biodiversity impacts that are more difficult to standardize and compare.

From the perspective of the research question, how can real estate owners integrate biodiversity considerations into procurement practices to address biodiversity impacts embedded in construction material supply chains, this requires changes across all three dimensions. Increasing visibility requires improved indicators, greater use of traceability, and stronger demand for biodiversity-related information. Strengthening governance requires translating biodiversity into explicit procurement requirements, assigning clearer responsibility, and improving follow-up systems. Activating leverage requires integrating biodiversity into early project stages, where key decisions are made.

Overall, the findings suggest that biodiversity becomes difficult to govern within procurement systems that primarily rely on standardized and climate-oriented environmental information. Biodiversity governance therefore depends not only on environmental ambition, but also on the ability of procurement systems to make biodiversity visible and operational within fragmented material supply chains. From a practical perspective, the findings suggest that improving biodiversity integration requires coordinated interventions across multiple dimensions. Procurement processes need to include explicit biodiversity requirements, stronger traceability requirements, and earlier integration of biodiversity considerations within project planning and material-related decision-making. Without such coordinated changes, improvements in individual areas are unlikely to result in substantial change. The findings also suggest that existing sustainable procurement frameworks may overestimate the ability of procurement systems to address complex environmental issues without changes to how information, responsibility, and decision-making are structured within procurement processes.

6
Conclusion

This study examined how real estate owners can integrate biodiversity considerations into procurement practices in order to address biodiversity impacts embedded in construction material supply chains. Through a qualitative case study of the Kaj16 project, the study analyzed biodiversity governance across system, corporate, project, and supplier levels, focusing on how biodiversity becomes visible in procurement processes, how it is governed through procurement mechanisms, and where leverage points for influence are located.

The findings show that biodiversity remains weakly integrated into procurement and material-related decision-making. Rather than resulting from a single barrier, this is shaped by the interaction between limited visibility, weak governance mechanisms, and underutilized leverage points within procurement systems. Together, these dimensions influence whether biodiversity becomes actionable within construction procurement.

The study demonstrates that biodiversity has low visibility in procurement and decision-support systems. Biodiversity impacts are rarely operationalized through measurable indicators, procurement criteria, or standardized assessment tools. Instead, biodiversity is mainly addressed indirectly through broader sustainability ambitions and certification systems, which limits its influence on procurement outcomes and material selection decisions. The findings further indicate that this low visibility is linked not only to methodological challenges associated with measuring biodiversity impacts, but also to organizational and structural conditions such as limited demand for biodiversity-related information and insufficient supply chain transparency.

In addition, the findings show that governance mechanisms for biodiversity remain largely indirect and weakly operationalized. Although sustainability is increasingly integrated into procurement structures, biodiversity is rarely translated into explicit procurement requirements, systematic verification procedures, or follow-up mechanisms. Governance is instead shaped through certifications and general sustainability frameworks that simplify complex biodiversity issues into standardized forms of compliance. While these mechanisms may support traceability and minimum levels of responsibility, they provide limited capacity to address biodiversity impacts comprehensively and consistently.

The study also identifies structural limitations related to leverage points within biodiversity governance and procurement systems. A key challenge is the misalignment between where biodiversity impacts occur and where decision-making authority is located. Biodiversity impacts primarily arise upstream in forestry practices, raw material extraction, and land-use change, while procurement influence is concentrated downstream in project planning and material selection processes. Although procurement has the potential to function as an important leverage point for biodiversity governance, this potential remains underutilized because biodiversity considerations are rarely translated into concrete procurement criteria or supplier requirements.

Taken together, the findings suggest that biodiversity integration is shaped by the interaction between limited visibility, weak governance mechanisms, and underutilized leverage points. Biodiversity-related information is not systematically requested because it is not included in procurement requirements, while biodiversity requirements remain weak due to limited standardized and actionable information within existing decision-support systems. As a result, biodiversity continues to have a limited role in routine procurement practices despite increasing strategic attention at both corporate and policy levels.

The main contribution of this study is the conceptualization of how biodiversity governance in procurement is shaped by visibility, governance mechanisms, and leverage points. The findings show that these dimensions are interconnected and together influence how biodiversity is addressed in procurement and material-related decision-making. By connecting these dimensions across multiple analytical levels, the study contributes to a broader understanding of why biodiversity remains difficult to integrate into construction procurement and supply chain governance. The analytical framework was useful for examining how biodiversity governance operates across organizational levels and how procurement structures are linked to supply chain dynamics. In addition, the framework may have broader applicability beyond biodiversity governance, as the interaction between visibility, governance mechanisms, and leverage points could also be relevant for analyzing other sustainability-related issues in procurement and supply chain contexts.

From a practical perspective, the study highlights the important role of real estate owners in driving biodiversity integration through procurement. The findings may be particularly relevant for procurement managers, sustainability professionals, and decision-makers within the construction and real estate sector. Since procurement structures shape supplier expectations, material selection, and decision-making priorities, real estate owners have the ability to influence biodiversity governance beyond the direct project site. The findings indicate that improving biodiversity integration requires increased use of traceability systems, stronger demand for biodiversity-related information, clearer procurement requirements, and more systematic follow-up mechanisms. The findings further suggest that biodiversity considerations should be integrated earlier in the project process, especially during strategic planning and material selection. These stages offer the greatest potential to influence supply chain outcomes. In this regard, the study also contributes to ongoing sustainability transitions within the construction sector by highlighting how procurement structures can support the integration of biodiversity considerations into decision-making and supply chain governance.

At the same time, the findings should be understood in relation to the scope and limitations of the study. Since the study is based on a qualitative single-case study within a Swedish construction context, the findings are context-specific and cannot be statistically generalized. However, the study may still provide relevant insights for similar procurement and supply chain contexts within the construction and real estate sector.

Overall, the study shows that biodiversity remains weakly integrated into procurement not because of a lack of awareness or strategic ambition, but because existing procurement systems are not fully aligned with the characteristics of biodiversity governance. Without better alignment between visibility, governance mechanisms, and procurement leverage points, biodiversity is likely to remain a secondary consideration in procurement decision-making despite increasing sustainability ambitions within the construction and real estate sector.

7
Future research

This study highlights several areas where further research could contribute to a better understanding of biodiversity governance in construction procurement and material supply chains. Since biodiversity remains difficult to integrate into existing procurement systems, future studies could examine how biodiversity-related requirements can be translated into clearer and more standardized procurement criteria. In particular, further research is needed on how biodiversity indicators can be integrated into existing decision-support systems and environmental assessment tools used within the construction sector. Additional research could also examine how traceability systems, certification schemes, and supplier governance mechanisms can be developed to improve transparency regarding biodiversity impacts within material supply chains. Since this study identified limited visibility and unclear distribution of responsibility as central governance challenges, further research on supply chain transparency and verification practices would be valuable.

In addition, comparative studies across different construction projects, material categories, organizations, and national contexts could contribute to a broader understanding of how biodiversity governance differs across procurement settings and supply chain structures. Comparative research could also contribute to testing and refining the analytical framework proposed in this study across other sustainability-related issues and procurement contexts. Future studies could, for example, examine how visibility, governance mechanisms, and leverage points shape issues such as circularity, social sustainability, climate adaptation, or human rights across procurement and supply chain systems.

Further research could also explore how biodiversity considerations can be integrated with existing climate-focused procurement systems. Since current procurement practices are strongly influenced by climate-related indicators and assessment methods, future studies could examine how biodiversity and climate objectives can be addressed simultaneously within material-related decision-making and sustainability governance. Studies following projects over time could also provide deeper insight into how biodiversity ambitions are translated from strategic sustainability goals into operational procurement practices and supplier relationships. Such research could contribute to a better understanding of how biodiversity governance develops in practice and how procurement systems may evolve to address biodiversity more systematically in the future.

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