



What Makes a Good Reuse Supplier?

Challenges, Characteristics and Capabilities in Circular Construction

Master's thesis in civil engineering

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Abstract

The construction industry in Sweden is a major contributor to national carbon emissions and waste generation, leading to increased attention towards sustainable practices such as reused construction materials. This thesis investigates the role of traditional suppliers in the emerging reuse market. By combining a comprehensive literature review with the empirical findings from 17 interviewees across both construction materials suppliers and contractors, the study explores the challenges, expectations and capabilities required for suppliers to effectively integrate reused materials into their operations.

The results show that reused materials differ from new materials in terms of supply predictability, quality assurance and regulatory clarity. While traditional suppliers possess logistical and procurement infrastructure, they often lack the systems and standards needed to manage reused materials. Clients are increasing their demand for circular products, yet the current sourcing of reused materials remains fragmented, informal and unsystematic. Contractors emphasised early planning, standardisation and clearer definitions of what reuse entails, distinguishing between “saved” materials and “pure” reuse.

The report identifies key supplier characteristics needed to compete in this field, such as the ability to offer reliable quality assurance and collaboration in early design and deconstruction phases. Additionally, suppliers must develop capabilities for managing certifications, logistics and proactive sourcing through partnerships. The thesis concludes that while challenges remain, traditional suppliers can play an important role in scaling up reuse, provided they invest in internal capabilities and strategic alignment with client demands and circular construction goals.

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Term	Definition
Reuse	The process of using construction materials again in their original form, without significant reprocessing. Helps extend material lifespan and reduce the need for virgin resources.
Recycling	Reprocessing waste materials into new products, often involving energy-intensive methods. Differs from reuse in that the material is altered.
Circular Economy	An economic model focused on reducing waste and reusing resources. In construction, this involves maximizing the lifecycle of building materials.
Construction and Demolition Waste (CDW)	Waste generated from construction, renovation, and demolition activities. A major contributor to total national waste in Sweden.
Material Passport (MP)	A digital documentation tool that records information on a material's composition, origin, and reuse potential. Enhances transparency and traceability.
Quality Assurance	The process of verifying that reused materials meet safety, environmental, and technical standards.
Construction Materials Supplier	Companies that provide building products to contractors. Key actors in enabling wider adoption of reused materials.
Strategic Fit	The alignment between a company's supply chain capabilities and the demands/uncertainties of the market it serves.
Implied Demand Uncertainty	The uncertainty in demand caused by varying customer requirements such as lead times, product variety, and service levels.
Logistical Drivers	Core components of supply chain logistics (facilities, transportation, inventory, sourcing) that influence efficiency and responsiveness.

Digital Marketplace	Online platforms for buying and selling reused building materials. Improve visibility, coordination, and supply chain efficiency.
Environmental Certification (e.g. Svanen, Miljöbyggnad)	Labels or standards that assess the environmental performance of buildings and materials. Often incentivize the use of sustainable materials like reused products.
Regulatory Barriers	Legal constraints or unclear regulations that hinder the use or classification of reused materials. Examples include CE marking requirements or unclear waste/product distinctions.
Contractor	A construction company that carries out building projects. A key customer group driving demand for reused materials.
Pilot Project	A trial initiative used to test reused materials in real projects before full-scale implementation.

1. Introduction

In Sweden, the construction industry is one of the largest consumers of raw materials, as well as a significant contributor to the environmental impact in the country (Boverket, 2025a). The sector generates approximately 40% of the total waste in the country, where the construction and demolition activities produce 13.6 million tons of waste annually. In addition to this, the industry stands for 22.1% of Sweden's total carbon emissions, which makes it a key sector for sustainability efforts (Boverket, 2025b). To combat this, reuse of construction materials has emerged as a strategy. Reuse extends the lifespan of the materials, and thus reduces the demand for virgin resources, leading to minimised emissions associated with manufacturing (Boverket, 2024). Compared to recycling, which is often energy-intensive, reuse keeps the original form of the material, which can then reduce the environmental impact (Naturvårdsverket, n.d).

Despite the potential benefits, reuse of building materials is generally an uncommon practice. This stems from the lack of a well-established reuse market which makes it difficult for contractors to source the reused materials reliably (Inanloo, 2024). The supply chains that exist today are designed for new materials, with their own standardised procurement, logistics and quality assurance systems (Citraningrum, et al., 2023). However, these do not yet accommodate reuse efficiently. Despite this, the demand for reused materials is increasing. Due to stricter regulatory pressures, such as EU's Corporate Sustainability Reporting Directive (CSRD), companies are being pushed to reduce their environmental footprint (Kaarsberg & Kress, 2023). As the contractors are adhering to this, the suppliers who can provide reliable access to reused materials can gain a competitive advantage.

For suppliers, this increase in demand for reused materials creates challenges as well as business opportunities. Traditional suppliers have well established procurement systems, networks and logistical expertise, putting them in a good position to integrate reuse into their already existing operations (Debacker & Manshoven, 2016). This does not come without its challenges, such as additional sourcing strategies, improved quality

assurance and investment in logistics infrastructure for the handling, storing and distribution of the reused products (Knoth, et al., 2022).

Currently, the reuse market is dominated by niched specialised suppliers; however, traditional suppliers could expand their operations to be part of the growing reuse sector. By doing so, it would allow them to differentiate themselves in a changing marketplace (Debacker & Manshoven , 2016). If reuse is integrated into their competitive priorities, suppliers could both support the circular construction and enhance their competitiveness and long-term profitability.

1.1. Distinction between reuse and recycling

Recycling and reuse are two key strategies for promoting circularity in the construction sector; however, they have a significant difference in processing, environmental impact and regulatory considerations (Knutsson, 2023). Reuse is when existing building components or materials are being used again for their original purpose, with minor alterations (Boverket, 2024). Recycling, on the other hand, refers to the reprocessing of waste materials into new products (Naturvårdsverket , n.d). This process often involves significant energy consumption as well as possible loss of the material quality. Also important from a legal perspective is the classification of waste contra product, as it determines how it will be handled. If material is classified as waste, it will be subject to stricter environmental and chemical safety regulations, which potentially discourage its reuse. Consequently, clear regulatory frameworks are required when distinguishing reusable materials from possible waste and in order to streamline quality certification processes for reused products (Boverket, 2025a).

1.2. The importance of reuse for sustainability

The construction sector contributes to Sweden's environmental impact, both through greenhouse gas emissions and in terms of waste generation. In 2022, the construction industry stood for 22,1% of the total carbon emissions in the country (Boverket, 2025b). The sector also contributes to substantial emissions through its imported goods, which is estimated at around 6,9 million tons CO₂-eq. The total emissions amount to 17,7 million tons CO₂-eq. In 2022, the sector produced approximately 13,6 million tons of primary

construction and demolition waste (Boverket, 2025a). This accounts for about 39% of all the generated waste in Sweden and 20% of hazardous waste, excluding mining waste. However, between the years 2008 and 2022, there has been a reduction of 12,2% in emissions in the sector which indicates a positive trend towards a decreased environmental impact (Boverket, 2025b).

To mitigate these environmental impacts, reuse plays a crucial role (Rahul & Neha, 2023). By extending the lifespan of building materials, it reduces the demand for virgin resources, which then lowers the greenhouse gas emissions associated with production. It also minimises waste generation. Studies have suggested that a 20% reduction in resource consumption with the use of reuse, it can result in a 10 million ton decrease on CO₂ emissions across the Nordic Countries (Sand & Høibye , 2018). Simultaneously, due to the regulatory pressures and sustainability commitments, client demand for reuse is also increasing (RISE, n.d). Under the European Union's Corporate Sustainability Reporting Directive (CSRD), large companies must assess as well as disclose their environmental impacts, incentivising the use of low-carbon materials, such as reused construction materials (Kaarsberg & Kress, 2023). Additionally, in Sweden, the Fossil-Free Sweden initiative is an initiative that promotes circularity through a roadmap targeting net-zero emissions by year 2045 (Naturvårdsverket, 2025).

1.3. Construction materials market in Sweden

The construction materials industry in Sweden has a turnover of approximately 12 billion euros and employs around 21,000 people (Byggmaterialhandlarna, 2025). This market is dominated by a few large actors, all of whom have similar functions, capabilities and characteristics. These co-operate through the trade association Bygghandlarna, where they develop common goals for sustainability, attractiveness and digitalisation. This enhanced collaboration allows construction materials suppliers stay informed of developments in the industry, promoting fair competition and standardising practices (Byggmaterialhandlarna, 2025).

1.4. Aim

The aim of this thesis is to provide traditional construction material suppliers with an insight into the challenges of entering the market of reused materials. The research will also examine the characteristics of an effective supplier of reused materials and explore how suppliers and contractors can co-operate to make reuse a more accessible and viable option within the industry.

A key focus is to define what a circular supplier of reused materials is and to identify the existing challenges that hinder broader adoption. This includes analysing what characteristics contractors require from suppliers to successfully integrate reused materials into construction projects, as well as what suppliers themselves need to change to maintain a stable, efficient, and profitable circular business. The study will also assess the key capabilities suppliers must develop, such as logistical efficiency, material processing, and quality assurance, to support increasing demand for reuse.

Through cross-analysis of scientific literature and empirical results, the thesis aims to identify the challenges which suppliers face when integrating reuse and to close these gaps, and propose the capabilities needed. The report will contribute to a broader understanding of how the industry can efficiently integrate reuse and create a more sustainable way for material sourcing.

1.5. Research question

The main aim of this report is to identify how traditional construction suppliers can contribute to sustainability in the construction industry by entering the market for reused materials. To achieve this, the project is divided into two objectives which follows:

1. What are the current characteristics and expectations for suppliers of construction materials in general, and reused materials in particular? This includes an analysis of the industry standards, role of suppliers within the construction value chain, as well as the contractor requirements. In addition to this, it examines why suppliers should or should not enter the reuse market.

2. What capabilities and actions are needed for the suppliers to efficiently integrate reused construction materials in their value chains? This considers skills and the processes necessary to ensure a stable and efficient supply.

To meet these objectives, the following research question has been formulated to help guiding the research:

What are the characteristics of a 'good' reuse supplier? What capabilities and competencies are needed to bridge existing market gaps and make reuse a more accessible and viable option for construction contractors?

1.6. Delimitations

The thesis will focus on the processes and strategies required to integrate reused materials into possible business models, rather than the specific materials or their quality assurance. No detailed economic analysis of construction projects with reuse or specific material pricing will be considered in this study. However, when relevant, the overall profitability aspect connected to materials purchasing will be discussed to some degree.

The report will primarily focus on suppliers with a large product range, as these types of companies will more likely influence the market towards integrating reuse on a broader scale. Due to this, smaller suppliers or niche ones will not be included in the report. Additionally, when discussing suppliers in the report, it will refer to more general material suppliers rather than the providers specialising in specific reused materials.

In the report, the term reused materials refers specifically to materials that have previously been installed in a construction project and later dismantled with the intention of being reused again. Materials that have never been installed, such as returns, leftovers and surplus stocks are referred to as saved materials. This distinction was introduced in the report in order to provide a clearer framework for categorising the findings and discussions throughout the report.

Finally, the thesis will look at reuse from a Swedish market perspective, which means that the findings and recommendations will be based on the Swedish market conditions,

regulations and industry practices. Some insights may be applicable to other regions; however, the research does not aim to generalise the results beyond the Swedish context. The thesis will not include an empirical evaluation of any proposed methodologies or strategies, as the time restraint and resources available do not allow for their practical implementation.

1.7. Societal and ethical considerations

This thesis examines how construction materials suppliers can integrate reused materials in their value chains and fill gaps in the market effectively and efficiently. This aim entails a primary focus on questions regarding market demand and the sourcing, processing and logistics related to meet said demand. However, the primary purpose of reusing construction materials is to prevent usable materials from being discarded, thereby promoting environmental sustainability. To maximize the sustainability benefits of reuse, suppliers must ensure that the collection, processing, and distribution of reused materials do not generate excessive emissions, thereby maintaining the expected Global Warming Potential (GWP) savings. Additionally, any discussed method must be scrutinized to avoid greenwashing.

Since the thesis is being conducted in collaboration with Derome AB, it is imperative that Derome's contributions to this thesis are fully disclosed. Derome AB provides access to client network and industry insights. However, all analyses and conclusions remain independent, ensuring objectivity in the study's findings. Full transparency regarding Derome's involvement is essential to uphold academic integrity, ensure the objectivity of the research, and provide a clear distinction between independent analysis and external input. Additionally, proper acknowledgment of Derome's contributions will help maintain ethical research practices and reinforce the credibility of the thesis. However, some information provided by Derome may be confidential and cannot be shared and is therefore not used in analysis. Examples of such information include trade secrets and sensitive operational, financial or strategic information.

The ChatGPT AI and Chalmers' AI portal will be used as tools in writing this thesis. To ensure that it is used in an ethical manner, certain considerations must be weighed. For this thesis, the AI will be used as a supplementary tool rather than a substitute for actual

research. Therefore, the use of AI in this thesis will be limited to interview data processing, i.e. translating interview transcripts, as a grammar and spell checking and as a search engine for where to find documents for the literature review. Any work produced by ChatGPT will be rigorously analysed and fact-checked to avoid producing incorrect or misleading text. AI will not be used in other ways than highlighted above, and all analytic work will remain human-driven.

2. Theoretical framework

This chapter provides an overview of the existing literature, which is relevant to reused construction materials, with a focus on the role of suppliers. The key themes include industry practices, supply chain structures, certifications & quality assurance, economic & logistical challenges and definition ambiguities. The knowledge found serves as a theoretical framework for the empirical study, and for further analysis of the results.

2.1. Established practices of reuse in construction

As mentioned in the introduction, due to its possibilities to reduce environmental impacts, reuse has gained attention in the construction industry. Reuse involves salvaging, processing and reintegration materials into new construction projects from deconstructed buildings (Deweerd & Mertens, 2020). The regulatory frameworks, market dynamics and logistical constraints for reuse can vary, but generally they follow structured processes to ensure that the material quality and effective integration into new projects (Knoth, et al., 2022).

2.1.1. Salvaging and processing reused materials

Reuse begins with deconstruction, which is a method that contrasts with the traditional demolition through prioritizing careful dismantling of structures to preserve materials for future use (Inanloo, 2024). First there is an identification of materials with high reuse potential and then the materials are retrieved, stored and processed to maintain their structural integrity and usability. After the materials are salvaged, they undergo cleaning, resizing and quality testing to ensure the compliance with safety and performance standards (Deweerd & Mertens, 2020). Based on the material type, the level of processing varies. For instance, timber can be graded based on the structural integrity, while brick instead undergoes strength testing (Inanloo, 2024). To support material traceability, Material Passports (MPs) have been used as a documentation system which tracks the material's life cycle, leading to enhanced transparency and standardization in reuse practices (Wilson, et al., 2023). However, despite the benefits, there are remaining challenges in ensuring reuse meets regulatory and safety standards (Inanloo, 2024). In the EU, certification frameworks are emerging to validate the durability of reused

materials and reduce the uncertainty among the contractors and developers (Sand & Høibye, 2018). Nonetheless, discrepancies in quality standards and inconsistent supply and logistical barriers continue to hinder broader adoption (Rahul & Neha, 2023).

2.1.2. Supply chain and distribution

In comparison to new materials, the supply chain for reused materials is not as standardized and involves multiple actors, including reuse retail platforms, specialized reclaimers and contractors who source materials directly from the demolition sites (Debacker & Manshoven, 2016). In Sweden, reuse centres and trading platforms are often provided by the suppliers, but the lack of a centralised marketplace remains as a barrier to establish reuse in practice (Citraningrum, et al., 2023).

An approach which has shown promising signs for improving material flow is the integration of standardised digital materials passports, which includes traceability and certification for reused materials (Wilson, et al., 2023). Through enhancing transparency and providing key data on the material's origins and conditions, the tool can help contractors make informed decisions about the use of reused materials. The MPs however still have challenges with the varying quality standards, inconsistent material supply and logistical constraints. Another emerging strategy is the establishment of material reuse centres, which serve as a link between deconstruction and new construction projects (Brukman, et al., 2022). The centres can both improve distribution logistics and enable efficient reuse. Through coordinating these reuse efforts, they can enhance the supply chain efficiency and increase accessibility to reused materials (Granat & Farzad, 2022).

When looking from a logistical perspective, the suppliers must be able to navigate through fluctuating availability, transportation constraints and quality assurance requirements. Solutions, such as digital tracking systems that improve inventory management and enable real-time traceability allows for more efficient reuse integration within the construction industry (Rahul & Neha, 2023).

2.1.3. Overview of how reuse is currently integrated into construction projects

In construction, reuse has become an effective strategy to reduce generated waste and landfill disposal, however, the implementation remains as a challenge due to the logistical, regulatory and market changes (Citraningrum, et al., 2023). The lack of an established infrastructure for reuse creates complex hurdles, as there are very few mechanisms that can systematically repurpose building materials across urban areas (Knoth, et al., 2022). In addition, legal barriers further hinder the adaptation as it can complicate the material ownership transfers and lack standardised regulations (Citraningrum, et al., 2023).

A primary issue in implementing reuse stems from the lack of standardised infrastructure for reclaiming and redistributing materials (Granat & Farzad, 2022). Compared to new materials who follow well-established procurement and quality assurance processes, reclaimed materials require additional storage, handling and certification before they can be integrated in the construction projects (Ghyoot, et al., 2022). In addition to this, the fragmented supply chain and inconsistent availability of reused materials can limit the large-scale adoption which then highlights the need for digital tools and centralised marketplaces which streamline the reuse operations (Knoth, et al., 2022).

2.2. Role and functions of the construction materials supplier

The demand for environmentally friendly materials to lower carbon emissions and move toward circularity is partly due to financial and investor incentives and marketing purposes, and partly top-down initiatives from regulatory bodies such as the European Union and state governments (Tokbolat, et al., 2020). In many cases, targeted environmental certifications like LEED or BREEAM are stipulated in contracts between real-estate investors, contractors and materials suppliers. Environmental requirements are commonly set as thresholds for individual projects (USGBC, 2024; Sweden Green Building Council, 2023), hence the responsibility of lowering the environmental impact is falls to the managing party of the project, commonly a lead architect or a project manager. The managing party must then work with designers, engineers, contractors and suppliers to reach environmental targets.

Under the EU's Environmental Impact Assessment (EIA) Directive, all construction projects must be assessed for environmental impact (European Union, 2016). This is applied through the European Standard EN15978:2011, requiring A1-A5 life cycle phase assessment for all new larger construction projects (European Committee for Standardization, 2011). As seen in Figure 1, these phases are mostly connected to the embodied impacts, i.e. impacts related to the chosen materials. This in turn puts pressure on materials suppliers to provide low carbon footprint products.

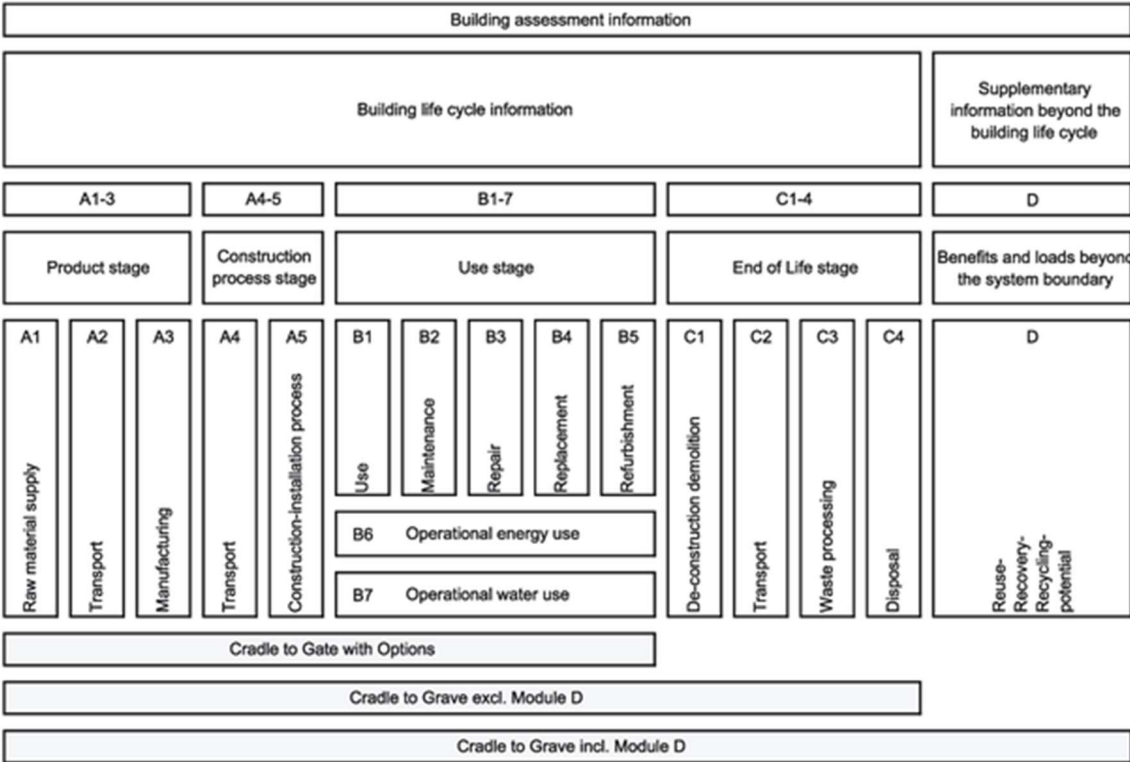


Figure 1. Modules in building life cycle assessments according to EN 15978 (Anderssen, et al., 2021).

A construction materials supplier company in general must maintain a multitude of functions to deliver a competitive service. One of the main functionalities needed is the ability to source and procure materials for retail (Adamides & Mouzakis, 2024). This includes establishing relationships with material manufacturers to provide a wide product range, negotiating prices to ensure profitability and ensuring that material quality and environmental standards are met.

Another important aspect of materials suppliers are their logistical and inventory management capabilities (Parmigiani, et al., 2011; Jia, 2025). A construction materials supplier who cannot fulfil an order is not viable. This requires the supplier to keep

sufficient stock, have the capability to procure and deliver the material without causing delays or optimally have both capabilities (Jia, 2025). For the first option to be profitable the supplier must have efficient forecasting, optimized storage solutions, and material quality control solutions that negate degradation. For the second option, the supplier must have a responsive and flexible supply chain network with a variety of materials sources that can produce or deliver fast (Parmigiani, et al., 2011). In general, decreasing lead times mean increased costs, so a balance must be found where certain profitability targets are met while delivering materials at attractive costs and lead times.

As construction materials suppliers' income is based on sales revenues, they must have the properties that allows them to be an attractive choice for construction contractors. Some competitive priorities that are common among suppliers include low pricing, short lead times, large product ranges, and high-quality products (Seth, et al., 2018). In addition to these general requirements, suppliers must now attain environmental certifications to meet market demands, both for their own practices but also for the materials they sell, often called "green sourcing" (Adamides & Mouzakis, 2024). While green sourcing is a common practice, it mostly relates to procuring sustainably manufactured new materials, and reused materials are not commonly sold by traditional suppliers.

2.3. Supply chain considerations

Supply chain management operations are a core activity conducted by construction materials suppliers (Al-Werikat, 2017). In order to win orders, suppliers must provide quality products at competitive prices in a timely manner. In addition, new market demands require suppliers to provide green-sourced materials, and sustainable business practices such as energy efficiency and waste reduction (Aylin & Jean, 2024). While maintaining these capabilities, the supply chain must also be managed in a way that results in a profit for the supplier.

2.3.1. Construction industry supply chain characteristics

In the construction industry, the supply chain is generally fragmented, meaning construction contractors and suppliers act mostly independent of each other, outside of the project duration. (Al-Werikat, 2017). The fragmented nature can cause issues

pertaining to material viability, in particular relating to discontinuous demand and frequent changes in specification. This then leads to excess stock and product obsolescence, creating waste product both in supplier warehouses and on project sites. In summary the construction supply chain can be seen as rather inefficient in terms of cost and resource management (Al-Werikat, 2017). While the construction supply chain can be seen as inefficient, introducing reuse may be an option to decrease waste and retain value (Brukman, et al., 2022). As reused materials entail a set of challenges as described in 2.4, a new type of supply chain will have to be created for reused supplies.

2.3.2. Strategic fit

In supply chain management, a well-functioning supply chain strategy is one that is achieves strategic fit with the competitive strategy of the company or product group (Chopra & Meindel, 2019). This requires first determining the competitive strategy of reused construction materials. Chopra and Meindel describe a three-step process of achieving strategic fit: understanding the customer and supply chain uncertainty, understanding the supply chain capabilities, and achieving strategic fit.

Understanding the customer and supply chain uncertainty means identifying the needs of the customer being served, in terms of quantities, tolerated response times, product variety needed, service level required, price of the product, and desired rate of innovation of the product (Chopra & Meindel, 2019). These customer needs can then be translated into *implied demand uncertainty*, meaning demand uncertainty attributed to the supply chain due to the various needs it must satisfy. Types of impact from customer needs on implied demand uncertainty can be seen in Table 1.

Table 1. Impact of customer needs on implied demand uncertainty.

Customer need	Impact on demand uncertainty
Increase of required quantity	<i>Increase due to greater variance in demand</i>
Decrease in lead time	<i>Increase due to less time to react to orders</i>
Increase of product variety	<i>Increase due to less predictability in demand per product</i>



Increase in number of channels of which to acquire product (online, physical etc.)	<i>Increase due to less predictability in demand per purchasing channel</i>
Rate of innovation increase	<i>Increase due to uncertainty of demand for new products</i>
Service level increase	<i>Increase due to unusual surges in demand</i>

The implied demand uncertainty of the construction industry is high, due to its discontinuous demand and project based nature, as well as strict demands regarding lead times, product variety and an increased demand for “green” (innovative) products (Al-Werikat, 2017; Adamides & Mouzakitis, 2024; Chopra & Meindel, 2019).

Chopra and Meindel (2019) add that implied demand uncertainty often correlates with other properties of demand. For instance, products with uncertain demand, often tend to have high margins, but it also causes difficulty to match supply and demand, causing both oversupply and stockouts. In addition, markdowns for products with implied demand uncertainty are common because of oversupply.

In addition to demand uncertainty, it is also important to consider supply uncertainty, which is based on the capabilities on the supply chain (Lee, 2002). Supply uncertainty adds another dimension of complexity in achieving strategic fit. Some supply source properties that increase supply uncertainty include frequent breakdowns in the supply chain, quality issues and limited or inflexible supply capacity (Lee, 2002).

Understanding the supply chain capabilities is about meeting the demand despite the uncertainty of the supply chain (Chopra & Meindel, 2019). The supply can be categorized based on the characteristics mentioned in the previous paragraphs. First, a supply chain is measured by its responsiveness, i.e. its capability to respond to implied demand uncertainty and supply uncertainty. Secondly, a supply chain is measured by its efficiency, i.e. its cost effectiveness. Responsiveness and efficiency are the inverse of each other, meaning higher responsiveness means lower efficiency, and vice versa (Chopra & Meindel, 2019). The lowest possible cost for a given level responsiveness is called the *cost-responsiveness efficient frontier* and is illustrated in Figure 2.

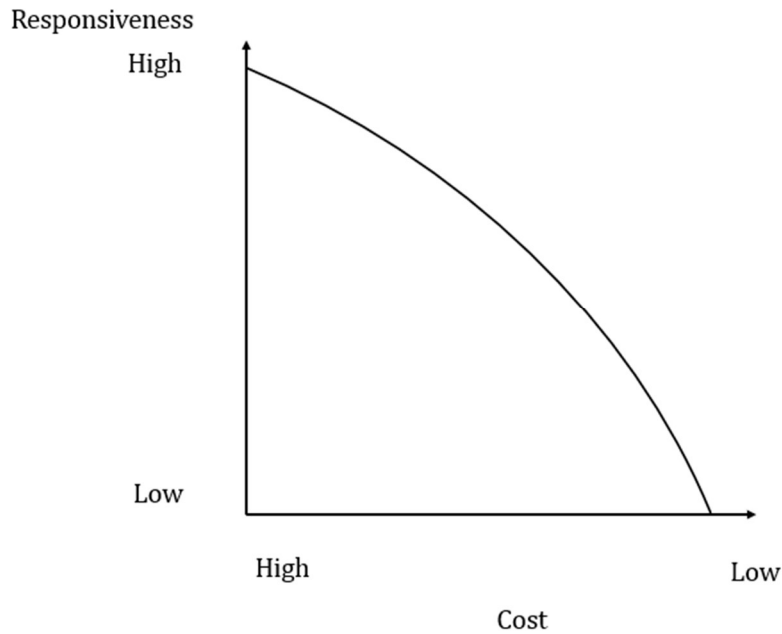


Figure 2. The cost-responsiveness efficient frontier. Adapted from Chopra & Meindel (2019).

Lastly, strategic fit is achieved by matching the responsiveness level with the implied demand uncertainty (Chopra & Meindel, 2019). This is done by changing the level of responsiveness, i.e. investing in a flexible and fast supply chain to increase it or making the supply chain more efficient, for example by utilizing economies of scale. Figure 3 illustrates the relationship between responsiveness and implied uncertainty.

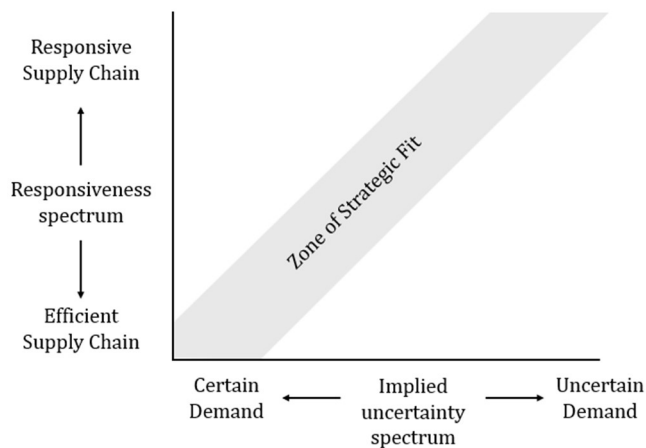


Figure 3. "The Zone of Strategic Fit". Adapted from Chopra & Meindel (2019).

Reused construction materials, as described have many of the product characteristics that imply high demand and supply uncertainty, much more so than traditional construction

materials. Consequently, introducing reused materials to their product catalogues would necessitate designing of new, more responsive supply chains to achieve strategic fit.

2.3.3. Logistical drivers

Important to consider in designing the supply chain are decisions regarding logistics; of which facilities, transportation and inventory, information and sourcing are key factors to consider (Chopra & Meindel, 2019). Designing and optimizing these to achieve the required responsiveness at the lowest possible cost is key to a profitable supply chain.

Facilities, categorized as either production facilities, warehouses or distribution centres, are crucial to supply chain management (Chopra & Meindel, 2019; Faharani, et al., 2014). Decisions regarding facilities ultimately boil down to what number of facilities are needed, what capabilities and capacities are needed, and where to place them. Increasing the number and capabilities of the facilities increase supply chain responsiveness but also comes with additional cost (Chopra & Meindel, 2019). On the contrary, having fewer and larger facilities at centralised locations often decreases costs, but also supply chain responsiveness.

Transportation is characterized by decisions regarding transportation mode, as well as routes and locations related to the route (Chopra & Meindel, 2019). Typical metrics to consider regarding the efficiency and effectiveness of the transportation network include inbound and outbound costs per unit or shipment, as well as shipment sizes. Additionally, in the context of construction materials, delay of material delivery is a particularly common and costly occurrence (Fredriksson, et al., 2022). Therefore, measuring and minimizing delay is of high importance.

Inventory is the result of mismatched demand and supply (Chopra & Meindel, 2019). However, inventory serves a purpose in avoiding stock-outs and improving supply chain responsiveness. Inventory incurs additional costs due to the costs of facilities required, as well as de-valuation of material. It also ties up capital in the stored goods.

Reused construction materials are of a circular nature and must therefore be sourced differently than conventional construction materials (Deweerd & Mertens, 2020). Common for all material or product reuse regardless of industry is the need for quality control- and certification (Kaarsberg & Kress, 2023). For a material to be allowed to be built in to a structure according to Swedish law, they must either be CE-certified, factory controlled in accordance with provisions in chapter 8 22-23§§ of The Planning and Building Act (PBL) or been certified by an accredited organisation¹ (Boverket, 2011). For reused construction materials however, it is unclear if reused materials are covered by mandatory CE-marking or if they are subject to national legislation (Kaarsberg & Kress, 2023). Materials from demolition and disassembly are often older than the CE-certification itself, causing further confusion. As for leftover construction materials, they do not need further certification provided it has not already been classified as waste (Kaarsberg & Kress, 2023).

2.4. Challenges for suppliers in implementing reuse

Despite the potential benefits of reused materials, the integration in the Swedish construction sector faces significant challenges which can hinder the adoption. A primary issue is the absence of a professional reuse market, which can complicate the sourcing and distribution of reused materials (Gerhardsson, et al., 2020). The lack of structured marketplace then leads to difficulties when matching the supply with demand, creating hindrances for the widespread adoption for reused practices. New materials are often favoured in the construction industry due to the existing regulatory, logistical, market as well as cultural barriers (Nordic Sustainable Construction, 2024). These preferences often result in a fragmented market for reused materials, which further pushes the development of a unified trade platform back. Additionally, the measurable economic incentives are often absent, which discourages the stakeholders from engaging in reuse initiatives (Gerhardsson, et al., 2020). Without a clear view of the financial benefits, there is little motivation when prioritising the reused materials over the new ones.

¹ According to Regulation (EC) No 765/2008 of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93.

2.4.1. Internal challenges for suppliers

One of the primary challenges that suppliers are facing internally is managing the logistics of reused materials (Citraningrum, et al., 2023). Reused materials require dedicated areas for sorting and safekeeping before they are integrated into new projects, creating storage space constraints. Compared to new projects, where the material is delivered in time for construction, the reused materials must be stockpiled which increases the costs and logistical complexity. The storage spaces need to be strictly regulated, as exposure to moisture and dust as well as improper handling of material can degrade the materials, reducing their viability for reuse (Granat & Farzad, 2022). Another challenge is quality control, as assessing the condition of products which has previously been used is complex (Inanloo, 2024). The lack of standardised grading systems or certifications makes it challenging to guarantee the safety and performance of the reused materials, which can make the suppliers hesitant to invest in them (Debacker & Manshoven, 2016). However, it is important to have a balance between liability requirements and economic feasibility. Certification processes and mandatory quality assurance, which are beneficial for reliability, could increase the cost for second-hand construction products which can potentially discourage the existing market. Suppliers of reused floor tiles and interior doors warn that such measures could make their products very expensive. Thus, it is very important to find an equilibrium between the quality assurance and maintaining affordability.

There are also financial concerns which impacts the suppliers' willingness to use reuse practices (Citraningrum, et al., 2023). The processes of transporting, sourcing, deconstructing and cleaning of materials often leads to higher costs in comparison to the direct procurement of new materials. Suppliers often rely on profits from sales and installation of new products, consequently making them less inclined to integrate reuse, as it can threaten their traditional business models (Joseph & Chandran, 2023). The fluctuating supply also creates uncertainties (Knoth, et al., 2022). The availability of reused products depends on demolition schedules and salvage operations, rather than a controlled production. Consequently, suppliers struggle to maintain a steady inventory.

2.4.2. External challenges for suppliers

Client resistance can be a major barrier for suppliers, as the construction industry operates largely with a preference for new materials due to them being perceived as of higher quality and reliability (Citraningrum, et al., 2023). A concern from the clients is the lack of guarantees that reused products have. New products come with warranties; however, reused material often lack certifications or documents on performance data, making the clients more hesitant to use them (Sand & Høiby, 2018). The reused material also requires additional processing, testing and sorting. Therefore, the project timelines can be extended leading to more hesitancy among the contractors and developers. If the clients are not educated of the benefits of reuse, they may be unwilling to take on these risks that are associate with reused materials.

In addition to the client resistance, regulatory barriers add another layer of complexity for suppliers. Current regulation varies widely across different regions, resulting in inconsistencies that complicate the process (Knoth, et al., 2022). There have been some cases where a permit has been required to use reused materials (Citraningrum, et al., 2023). Furthermore, most of the existing building codes are designed with new materials in mind (Kozminska, 2019). This makes it difficult for reuse to meet compliance requirements. Without regulatory support that promotes reuse, the motivation to adopt circular economy practices decreases.

Finally, market fragmentation and the lack of standardisation further drive the challenges for suppliers. The market for reuse is currently underdeveloped where it lacks a centralised platform where suppliers and buyers can efficiently trade reused materials (Knoth, et al., 2022). The absences of standardised grading systems and quality assurance makes it harder to guarantee the reliability of the products which creates further uncertainty.

2.5. Digital tools and trading platforms for reuse

Digital platforms have an important role in facilitating the reuse of materials through addressing key challenges in the supply chain transparency, material availability and transaction efficiency. Transitioning from the traditional linear model, from extracting to

producing, using and disposing, to the circular model requires innovative digital solutions to streamline reuse processes and improve material accessibility (De Wolf, et al., 2024). However, entire workflows of digital innovations for reuse are very seldom used on a full building scale. Due to this, a viable digital circular construction management system needs to be developed.

As mentioned previously, a major challenge for reuse is matching supply with the demand, ensuring that the right number of reused materials will be available at the right time and at the right quantity. With the help of digital solutions, companies can better manage the reused materials, as it can reduce the inefficiencies and ensuring compliance with the sustainability goals.

2.5.1. Digital marketplaces for reused materials

To supply the new construction projects from the demolition's sites, digital marketplaces and material banks are essential (City Loops, n.d). The platforms enhance the visibility through offering real-time information on the material location, cost, quantity and quality. They act as intermediaries which allows for the materials to be found easier and at the same time ensuring transparency. When the direct transactions between the suppliers and procures is enabled, digital marketplaces reduce inefficiencies, minimise waste and supports the broader adoptions of circular economy principles (City Loops, n.d). The management of the marketplace varies, as some are independently managed by private companies, while some are integrated within the public-private initiatives overseen by local authorities. Digital platforms, however, do not have to be developed by the local authorities, as many are already headed by private companies. It is recommended to plug into existing marketplaces due to the time and financial resources that are required to develop new platforms.

The digital marketplaces can also address the logistical challenges, through improved coordination and stored management (City Loops, n.d). Secondary material storage as well as the logistics around them remain as a barrier, especially as the demolition and construction timelines do not always align. The physical material banks and digital marketplaces helps to connect the materials from the demolition sites with the

construction projects. In addition to this, they provide a clear view to the material availability, ensuring quality tracking and support an efficient matching process between the suppliers and buyers.

3. Methodology

This section outlines the approach taken to achieve the aim and objectives of this thesis. It details the activities conducted to develop an in-depth understanding of the reuse of construction materials, including its challenges, current market limitations, and future potential.

To examine how reused materials can be integrated into construction and to what extent they are currently used, a literature review was conducted to create a theoretical framework. This gave context to the results of the empirical interview study. To gain insights into the strategies and capabilities of construction materials suppliers, interviews with materials suppliers were conducted to understand supplier capabilities, perspectives on client demands, and the requirements they have for clients to supply reused materials effectively. Understanding the supplier's role alone is insufficient; therefore, construction contractors – the key clients of suppliers – was also studied. Interviews were conducted with two distinct groups within contracting firms, those working with long term strategy, and those with experience of procuring and using construction materials. Finally, the results of the empirical findings were cross analysed with the theoretical framework to provide insight into the characteristics of suppliers of reused construction materials and the capabilities needed to enter the market.

3.1. Literature review

To create a theoretical framework for the empirical study a literature review was conducted. The primary objective of the literature review was to gather information and data on the reuse of construction materials, and the supplier's role in making it a part of the mainstream. This included examining the current extent of material reuse, commonly reused materials, processing and quality control methods, and relevant laws, standards, and regulations. Additionally, the review explored planned actions by regulatory bodies, NGOs, and industry leaders that either promote or hinder material reuse in construction. Lastly, the key functions of a construction materials supplier were mapped out.

The literature review was conducted in two parts:

1. Scientific Literature – Books, academic articles, and reports were sourced from web-based databases, including Chalmers Library, Google Scholar, and Scopus.
2. Strategic and Regulatory Documents – Policy papers, industry guidelines, and regulatory documents were obtained through a combination of web-based searches and direct communication with organizations, including stakeholders within Derome’s client network.

The review did not follow a strict systematic methodology. Instead, the aim was to summarize and synthesize as much relevant literature as possible to provide a comprehensive overview of construction material reuse and the potential of suppliers as a facilitator for its wider adoption as a material alternative. Key words that were used in the search for literature included *construction material reuse*, *construction material supply chain*, *supply chain theory*, *construction material supplier functions*, *construction material regulation*, *construction material standards*, *CSRD*, *reuse Sweden* and *construction reuse challenges*.

3.2. Empirical data collection

Existing academic literature on the relevant topics and industry documents provides valuable insights into the reuse of construction materials and the construction materials suppliers’ role in the industry. However, there is currently a significant gap in knowledge regarding why traditional suppliers are yet to enter the market, how they would do so, and what capabilities they would need to satisfy the demands of their key clients, contractors. To address this gap, a qualitative empirical interview study was conducted to gather knowledge and perspectives from professionals on both the supplier and construction contractor sides.

The interviews were conducted both in person and via online video call, lasting approximately 60 minutes in total. To ensure effective and ethical data collection, the interviews followed a semi-structured format, as defined by Gubrium and Holstein (2001). This approach involved open-ended main questions, allowing interviewees to provide detailed responses, while follow-up questions enabled deeper exploration of relevant topics.

The target sample consisted of 12 interviews with 17 interviewees: 5 of which were conducted with contracting firms, and 7 with Derome representing materials suppliers. Some interviews were conducted as group interviews, while others with a single interviewee. The aim of this set up was to gather information from a variety of experts, while creating nuanced results that differ dependent on the individual interviewee, organisation and position in the construction industry value chain.

The interviews were conducted in Swedish, in the Greater Gothenburg metropolitan area, and transcribed through Chalmers' AI Portal tool, which is trained to not store any potential confidential information. The transcriptions were manually reviewed in order to ensure accuracy and confidentiality. The interviews were only translated when entering the results into the thesis in order to maintain accuracy.

The information gathered from interviews with construction contractors provided knowledge regarding what they require in terms of reused construction materials, i.e., what a supplier will need to deliver in terms of product variety, product volume, quality assurance, and logistics services. For interviews with contracting firms, two groups were identified as suitable interviewees:

1. Environmental Strategists – individuals responsible for long-term sustainability objectives and corporate policies.
2. Construction Project Managers – professionals with hands-on experience in project execution and material procurement.

Simultaneously, interviews conducted with suppliers provided information on their current capabilities, what services they intend to provide in the future, and how they aim to achieve their goals. Here, four suitable profiles were identified:

1. Environmental Strategists – the same as for construction contractors, but on the supplier's side. Individuals responsible for long-term sustainability objectives and corporate policies.

2. Logistics Professionals – individuals with experience in logistics strategy and operations.
3. Supply Chain Strategists– individuals responsible for designing and operating supply chains of construction materials suppliers.
4. Strategic Sourcing Specialists – individuals responsible for materials purchasing and sourcing.

The breadth of knowledge and opinions of the interviewees provided a nuanced insight into the market for construction material reuse and what gaps will need to be filled for reused materials to become commonplace in construction projects. All interviews conducted were recorded for the purpose of more accurate transcriptions, with the explicit consent of the interviewee. Interviewees' identities are confidential; however, their role and the organisation they work for is not. This is to give the reader context to the results produced by the interviews while protecting the interviewees' right to confidentiality. All interviewees accepted these terms.

The company, roles, what interview questions were asked and how they are referenced is presented in

Table 2 and

Table 3. Note that when referencing the company, the brand is named, not the full legal name of the company. When referencing Derome's contracting business, it is referred to as Derome Hus to separate it from its materials supplier business. The interviews that were conducted as group interviews are highlighted in each table.

Table 2. List of interviews at contracting firms.

List of interviewees at contracting firms			
Company	Interviewee reference (single or group interview)	Roles	Questions in Appendix
Skanska	S1 (single interview)	Sustainability specialist	A.1. Environmental Strategists
NCC	N1 (single interview)	Sustainability specialist	A.1. Environmental Strategists and A.2. Project Managers
Peab	P1 (Peab group interview)	Quality- and environmental engineer	A.1. Environmental Strategists and A.2. Project Managers
Peab	P2 (Peab group interview)	Contracting engineer	A.1. Environmental Strategists and A.2. Project Managers
Peab	P3 (Peab group interview)	Sustainability specialist	A.1. Environmental Strategists
Brixly	B1 (Brixly group interview)	Sustainability specialist	A.1. Environmental Strategists
Brixly	B2 (Brixly group interview)	Materials specialist	A.1. Environmental Strategists
Brixly	B3 (single interview)	Senior site manager	A.2. Project Managers
Derome Hus	D1 (single interview)	Sustainability specialist	A.1. Environmental Strategists
Derome Hus	D2 (single interview)	Project supervisor for factory house production	A.2. Project Managers

Table 3. List of interviewees at materials suppliers

List of interviewees at materials supplier firms			
Company	Reference	Roles	Questions in Appendix
Derome	D3 (single interview)	Procurement category manager	B.3. Supply Chain strategists
Derome	D4 (Derome procurement group interview)	Strategic procurement specialist	B.4. Strategic Sourcing Specialists
Derome	D5 (Derome procurement group interview)	Strategic procurement specialist	B.4. Strategic Sourcing Specialists
Derome	D6 (Derome logistics group interview)	Logistics specialists	B.2. Logistics Professionals
Derome	D7 (Derome logistics group interview)	Logistics specialist	B.2. Logistics Professionals
Derome	D8 (single interview)	Circularity specialist	B.1. Environmental Strategists
Derome	D9 (single interview)	Senior sustainability manager	B.1. Environmental Strategists

3.3. Derome

This study focuses on the supply chain for reused construction materials, in collaboration with Derome. The research is conducted not as a case study, but in co-operation with the company, aiming to provide insights that contribute to strategic development which can be applied to the construction material value chain in general.

Derome supplies a wide range of construction materials through its building materials trading business, serving its contracting business, developers and professional clients (Derome, n.d.b). The company acts both as a wholesaler and distributor, sourcing products from multiple manufacturers while also producing certain materials within its own facilities. Due to this, its dual role presents both challenges and opportunities in implementing reuse on a larger scale, as they must balance their supplier relationships,

logistics, storage solutions and contractor expectation. Derome's industry network will serve as a basis for gathering broader insights from perspectives such as contractors, manufactures and other stakeholders. However, while Derome is used as a source of information and support, the findings will remain applicable to the industry at large.

4. Results

In this section, the results of the empirical interview study are presented. Questions were asked to each interviewee dependent on their area of expertise. The semi-structured nature of the interviews resulted in questions often branching out. Consequently, the results of the interviews varied in scope and depth with overarching common themes and specific insights into pilot projects.

The interview process, as a result of the pre-established lines of questioning as well as through revelation and added context by the interviewees, produced four key themes. These, presented in sections 4.1 - 4.4, detail the motivations behind sustainability and reuse, existing legal problems and gaps in knowledge, issues related to sourcing, and market possibilities and digitalisation.

4.1. Motivations for sustainability and reuse

To provide a comprehensive conclusion regarding the possibilities for construction materials suppliers in the reuse space, it is important to know the underlying reasons for its increase in popularity. Therefore, questions were asked about the motivations working with reuse. Questions were also asked regarding general sustainability strategies. These questions were asked of the contracting companies, as well as the material suppliers. A common theme that also appeared was the question of profitability; given that reused products can be more expensive, in what projects are they viable? And who shall pay for the additional cost?

4.1.1. Motivations of the construction contractor

The construction contractors, in our case represented by Brixly, Skanska, NCC, Peab and Derome Hus, operate on a project-by-project basis and are bound by the contractual agreements made with the client. As such, it is the client who ultimately determines the sustainability targets for each project. These targets typically reflect the client company's broader strategic sustainability goals and are enforced through contractual clauses, including those related to reuse. At the same time, both clients and contractors must

comply with overarching legislation such as the EU taxonomy, the Corporate Sustainability Reporting Directive (CSRD), energy efficiency regulations, and carbon taxation. This means that a baseline level of environmental effort is required by both parties to meet legal obligations.

When it comes to who is pushing for reuse, B1 identified the public sector as the primary driver, particularly through public procurement requirements. In contrast, S1 pointed to private real estate developers as being at the forefront of the push for circularity. According to S1, both these developers and Skanska themselves are seeking to stay ahead of future regulations while also meeting internal climate goals. N1 expressed a more moderate view, noting that both public and private actors are actively driving reuse and often influence each other, stating “*Ambition from the public sector often influences private sector behavior.*” In all five interviews with the contractors’ sustainability strategists, it was agreed that marketability is a relevant factor when taking on projects where sustainability, and reuse in particular, is a focus.

Derome Hus, whose projects were “[...] produced in a housing factory to 90%” according to D2, were positive but sees challenges to the introduction of reuse in their projects. This they explained was due to the precision and repeatability needed in factory production, stating “*in a factory production setting, it becomes very difficult. Then the supplier chain really has to work, and there needs to be a steady flow of identical products.*” D1 and D2 were positive to the introduction of reuse wherever it could be, however only if there is a client demand, with D2 adding that price is still the far-and-ahead most important factor in winning bids.

Although Brixly has set a strategic goal of reaching carbon neutrality by 2030, both B1 and B3 stated that they typically follow the minimum requirements set by clients, along with any applicable standards and regulations. They noted that this is due to the current conditions of the Swedish construction sector, stating they can’t pay more to lower carbon footprint unless explicitly stated in their contracts. Brixly reported some experience with reuse, though B3 stated “*it can introduce challenges such as the need to revise design documentation.*” While B1 expressed optimism about reuse, they also questioned whether it could deliver on all the expectations currently placed on it. B1 instead emphasized the

importance of improving material production processes, particularly through electrification and energy efficiency, as a more realistic route to reducing carbon emissions in the construction sector. B2 explained that they only initiate their own environmental measures when these do not result in substantial additional costs that clients are unwilling to cover. While Brixly is relatively large within its region, it faces difficulty competing with larger contracting firms for environmentally demanding projects as B2 explained, *“Take the big players, Skanska and Peab. They’ve been working with reuse for a long time, and since they also build for themselves, it’s natural that they include reuse in some of those projects and use them as practice. That way, they get better at it. They have routines and staff with expertise in reuse, which gives them greater business opportunities.”*

The largest firms like Skanska, NCC and Peab often have greater influence over the sustainability ambitions set by clients, particularly because they can afford to turn down projects that do not align with their own environmental targets, according to S1. They are also frequently engaged earlier in the process through design-build contracts, allowing them to shape sustainability outcomes from the design phase. These firms have committed to achieving carbon neutrality and are exploring various strategies to reach that goal, with reuse included as part of their broader efforts. They actively seek out projects with high sustainability ambitions, according to interviewees at these three companies. S1 and N1 noted that they are willing to accept lower profit margins in specific cases. These are strategically chosen projects such as pilots, or projects in collaboration with ambitious clients, viewing these as long-term investments in competence and brand value. Interviewees at the firms however noted that even for these projects, pricing is still an issue, only willing to pay more for reused products to a certain extent.

In all of the interviews with Skanska, NCC and Peab, positive views on the role of reuse and circularity in the construction industry were expressed. However, they offered differing perspectives on how significant reuse will be in the long term. S1 was the most optimistic, suggesting *“there is no theoretical limit to the share of a building that could be constructed from reused materials.”* However, S1 specified that there are current practical limitations that make a 100% reused building impossible. Interviewees from NCC and Peab were more cautious, with both N1 and P2 acknowledging the technical possibility of

reusing structural elements but noting the difficulty of sourcing such components in the right specifications. Instead, they favoured the reuse of structural finishing components, with P1 suggesting that ventilation ducts, ceiling systems, electrical parts, and plumbing porcelain are currently the most appropriate. While these may not significantly reduce the total carbon footprint of a project as stated by P3, they are easier to source than structural components.

4.1.2. Motivations of the material supplier

The construction materials supplier unlike the contractor, does not operate on a project-to-project basis. Instead, their business model is like any other retailer or wholesaler, not decided by any one client or project contract, instead by the collective demand of all clients. As such, sustainability policy can in theory be more independently formulated. However, as the contractors are the clients of the materials supplier, any materials-related sustainability goals are perforce down the value chain. Derome, which was the only company of the interviewees at materials suppliers, had no specific sustainability target they work towards. Subsequently their construction materials supplier business has the freedom to evaluate their own sustainability initiatives.

For Derome, they see several reasons for working sustainably. Firstly, D8 and D9 note that their clients, the construction contractors, always have requirements regarding the environmental impacts of materials. Also related to client demands, they name the importance of having environmentally certified products – if a construction project wants to get a specific certification, so too must the materials that are used in it. These two client related reasons are highly connected to competitive strategy, as the larger construction companies will not procure materials from a non-sustainable source. D8 explained that for Derome, *“there currently are no specific targets set for reused materials.”* Both the logistics specialists and environmental strategists at Derome were enthusiastic in exploring the market potential of offering such products, due to its apparent trendiness and the increase in requests from their clients. D3, D4 and D5 who work with procurement did not feel that reused materials had such high demand. They added specific demands from clients are often handled by the sales department, and that they rarely are directly involved with clients.

According to the environmental specialists interviewed, D8 and D9, even though Derome sees potential in reused products, they would be cautious to make significant investments before knowing that there is real market potential. They, together with D3 highlighted the importance of being able to find profitability in reused products before entering the market – any increased costs of procurement must be covered in some way and cannot be a net loss. When asked about reused materials to win contracts, D8 and D9 were positive to the idea. However, they were careful to point out that there is no current plan on introducing reused products at scale, even if some pilot projects will be conducted. This was due to current demand and supply uncertainty as well as the lack of clear industry and legal frameworks.

4.2. Regulation and gaps in knowledge

The regulation, quality assurance and standardisation of reused materials was a recurring theme during the interviews. Some interviewees expressed concerns over the current lack of clear regulatory frameworks, industry standards and consistent quality control practices. These gaps create significant uncertainty as well as barriers when scaling up reuse in the construction industry.

4.2.1. Lack of clear definitions and regulatory guidance

An issue raised by several interviewees was the absence of unified definition of what qualifies as reused material. B3 stated that it is quite unclear what reuse is, and D9 pointed to how different actors interpret reuse differently. These issues stand as a point of disagreement that surfaced in the interviews, as there were contradicting opinions on what qualifies as reused materials. While some interviewees such as D8 and D9 believe that reuse should strictly refer to materials that have been previously installed and then removed, others accept leftover or new unused materials as reuse. In addition, views on circularity definitions can even be split within a company.

In the interviews it was revealed that most of the existing regulations are designed according to new materials in mind, which leaves a significant grey area when it comes to assessing and approving reused materials. D3 questioned whether old stamps and

certifications remain valid. This uncertainty complicates the integration of reused materials into projects and raises questions about legal compliance and safety standards.

4.2.2. Challenges in quality assurance and certification

Ensuring the safety and quality of the reused materials was another major concern identified in the interviews. B2 raised questions about how to guarantee and quality assured products that come back, especially in the absence of established processes. They also expressed hesitation about liability, preferring to distance themselves from it because they cannot maintain full control over third party certified reused materials.

D3 discussed specific challenges related to reused gypsum boards, highlighting that *“the producers often focus on increasing recycled content rather than supporting reuse.”* This leaves a vacuum in market for actors willing and able take on quality assurance for reused materials. The need for new actors and systems dedicated to reuse certification was also discussed. D3 also suggested that “pure reuse suppliers” could take on the role of inspecting and re-certifying reused products. Finally, D3 noted that verifying, for example timber quality, requires specific competencies and formal approvals that are not yet widely established or standardised across the construction industry.

Many contractors stated that they have quite high requirements when it comes to quality and reliability when selecting their suppliers, ensuring the safety and quality of the reused materials was a major concern. D2 expressed the need for certifications and standards, saying that clearer certifications for reused materials would facilitate their use. To make reuse easier, they would need to know the minimum quality standard of what they are buying, similar to how you do with new materials. Further they stated that products from virgin material have many established standards which makes it clearer what you are buying, something that reuse does not have today. This was also questioned by D3 and D4, who couldn't see how to guarantee, and quality assure products that come back, especially in the absence of established processes.

4.2.3. Compatibility with existing building codes & certifications

A question raised in the interviews was the compatibility for reused materials with current building codes and safety requirements. B3 asked whether reused doors from the 1990s could meet today's fire safety regulations. Other concerns mentioned in the interviews included compliance with energy efficiency and acoustic performance standards, which has evolved since the original manufacturing of the materials.

Several times the interviewees also highlighted the role of environmental certification systems, for example Svanen and Miljöbyggnad, when encouraging or facilitating reused materials. These certifications often reward projects for circularity and reuse, but the specific requirements for these certifications can vary which then can further complicate their application. During the interviews it was noted that the demand for certified buildings is driven by the developer in most cases, and when the environmental ambitions are high, reuse becomes more feasible. However, in many cases it is the economic constraints which leads the projects to deprioritise the environmental certifications.

4.2.4. Legal and regulatory developments

Going forward, several interviewees anticipated more regulatory developments when it comes to circular materials. D8 expected that *"there will come new demands and potential legislation"*, and D3 also noted that environmental assessments are becoming more important for new products, stating *"We are to evaluate suppliers both financially and from a sustainability perspective. Price and volume are still important, but they are more of a hygiene factor."* However, N1 pointed to a lag between the policy discussions and the actual implementation, saying that right now there is a lot of talk regarding stricter environmental requirements, but it is not much happening.

In addition to the regulatory developments, liability was a major concern. Without clear regulatory support or an industry standard, many companies remain wary of accepting the responsibility for reused materials. D4 discussed that they try to distance themselves from this when materials are sourced from suppliers who claim to have inspected them. D9 also mentioned the uncertainty regarding reclamation, as when the reclamation occurs, who will carry the responsibility then?

4.3. Supply and sourcing

This chapter examines the potential future approaches, as well as the current approaches to acquiring reused building materials, highlighting the challenges and opportunities found during the interviews.

4.3.1. Existing informal sourcing methods of reused materials

Currently, reused building materials is characterised by informality, decentralised and case-by-case sourcing strategies. In several interviews it was described that the current sourcing practices are fragmented and reliant on personal relationships or individual initiative. During the interview with B3, they stated that the sourcing is very ad hoc, as there might be someone who knows a person who happens to have a certain number of materials laying somewhere. In the interview with S1, they described a project where three individuals were dedicated to manually search for reused materials in the early stages. However, this approach was described as not sustainable in the long-run and that there is a need for more systematic sourcing. In Peab's case, their approach was a bit more systematic, as in their project they brought in reuse consultants for extra competencies and experience. The consultants help with tasks such as finding material networks and understanding how materials need to be treated. In addition to this, the consultants utilise their contact network to help find materials, which is a similar process as to what B3 stated.

In many cases, sourcing of reused materials is similar to second hand trading. D3 likened the reuse market to individual sellers where they store materials such as insulation or tiles in barns and sell them when the opportunity arises. These sorts of transactions are often unregulated and varies in terms of material quality and availability. Building materials may also re-enter the market informally from construction sites as left over goods. D3 also noted that returns of unused materials have been a practise for year, but to an exceptionally low extent. This return process is typically not formalised as reuse as an objective, and the handling often falls outside structured procurement frameworks. Finally, D3 pointed out that sellers inside building supply companies might arrange returns or reused material sales independently, lacking a structured company-wide policy.

When sourcing for more specific and high-demand materials such as reclaimed brick, specialists such as Brukspecialisten has emerged. Their business model shifted from supplying new bricks to offering 90% reused bricks. However, even in these cases supply is often limited, as S1 said that the problem with these suppliers do not always have enough materials, which leads to having to order new materials.

4.3.2. Difficulties in establishing a reliable supply

One of the most pressing and complex barriers to scale up reuse in the construction sector is the establishing of a reliable supply. On several occasions during the different interviews, the unpredictability of material availability, both in quantity and consistency, was described as a core challenge. In the interview with B3, it was described that without access to sufficiently large volumes of materials such as plasterboards, any efforts to process or use them becomes irrelevant. The difficulty does not only lie in sourcing materials, but also in sourcing them in a way that is dependable enough to support long-term planning and integration into construction projects. According to D6, new products can be produced and delivered according to demand forecast and have lead times as short as next day delivery. In comparison, the availability of reused materials is mostly dependant on unpredictable events like demolition schedules or leftover from different sites. These are factors which are inconsistent by nature and difficult to coordinate on large scale.

In the interview with N1, they explained that *“in Sweden today around 400 apartments are demolished every year and around 40 000 are being built, which accounts for 1% of what is being built. So even if the material is being used to 100%, this is not enough to satisfy the demand.”* This they said, means that if the demand for reuse continues to grow, the current supply can never meet the volume requirements of larger construction projects. As a result, the actors who are motivated to include more reuse in their processes are constrained by a lack of dependable access. S1 illustrated this tension with using the example of reused bricks. Due to the limited availability, customers often must place their orders well in advance, sometimes before the bricks have been sourced. B3 also touched on this, explaining that the current reuse planning the accumulation of materials

sometimes a year in advanced. Planning this far in advanced for material gathering is quite different compared to the typical construction workflows and demands an initiative-taking, not reactive, supply approach.

During the interviews, there were split opinions regarding the scalability and volume. On one hand, interviewees from both sides believe in a potential for scaling up reuse, particularly through new systems and better coordination. Some shared the idea of dedicated actors or hubs which include standardised processes as a solution. On the other hand, the lack of sufficient volume and consistency in supply was seen as a fundamental barrier to scaling reuse for larger construction projects, something mentioned during the interview with N1, where they questioned the scalability, stating that there is not enough material to meet future demand.

4.3.3. Logistical and storage implications for sourcing

B3 explained that in order to successfully use reused materials, the procurement must begin a year or more in advance compared to the actual construction phase. Introducing reused materials into the tightly timed framework presents several logistical challenges, as it is not only the planning that becomes more complex, but storage also becomes another major concern. As B2 highlighted, accumulating reused materials months or years in advance requires physical space, as well as infrastructure and investments to support it. Warehousing for reused goods is significantly more demanding than for new, standardised materials, not least due to the variations in sizes, conditions and quantities that was to be managed. This mismatch in timing between when the reused materials become available, which is typically after or during the demolition, and when they are needed for new construction creates storage burden that adds both to the logistical and financial complexity. This unpredictability is not limited to volume and timing, but it also extends to a more fundamental lack of clarity around what counts as reuse in the first place. B3 questioned whether using leftover new materials from construction sites can qualify as reuse or if true reuse should only apply to materials that have been previously installed and then removed from another building. D1 referred to this issue as a point of contention for many different stakeholders, as they have differing interpretation of what reuse entails. This lack of definition hinders the implementation as it makes it more

difficult to establish targets, track performance, or develop shared procurement procedures.

This ambiguity can be seen in practical questions about which materials are suitable for reuse and under what circumstances. B3 brought attention to this issue of “saved material”, waste or overstock from construction sites being used as reused material. While some see this as a viable reuse pathway, other may argue that producers often prefer to manage these types of surpluses internally through recycling rather than reintroducing it into the market for reuse. There are also physical concerns regarding material degradation. D2 discussed the quality of timber, as wood can lose its structural integrity if stored improperly over time. Unlike new products which comes with factory guarantees and clear technical data, reused materials often lack consistent documentation. Assessing their safety and remaining lifespan requires specific expertise, which several interviewees have stated that this competence is not yet widely available across the sector. D8 also pointed out the related issue about the risk of taking back materials that cannot be sold. Once these materials are returned to suppliers such as Derome, they occupy warehouse spaces and tie up resources. If it turns out they are not fit for resale or reuse, the result is wasted capacity and potential economic loss.

4.3.4 Practical logistics capabilities and constraints

Following the previous discussion regarding general logistical and storage challenges in sourcing for reused materials, the perspective provided by D6 & D7 offers further insights into how logistics functions within a traditional supplier organisation. Many sourcing practices remains informal and ad-hoc, D6 highlighted that the logistical infrastructure for managing building materials, reused or new, is mostly already in place.

D6 described that Derome’s logistics systems includes regionally based warehouses, a substantial fleet of trucks, as well as the ability to manage site specific deliveries under tight schedule. The system already supports various forms of transports, including direct site-to-site transfers and return flows from construction sites. According to D6 & D7, this setup could accommodate reused materials with relative ease. Provided that incoming materials meet the basic requirements for specification, labelling and packaging. However, the main limitation here does not lie in transportation or storage capacity, but

in the lack of upstream standardisation and clarity. D6 emphasised that logistics processes depend on knowing what is being transported; its dimensions, conditions and handling needs. This level of information is standard for new materials, but it is rarely available for reused products. Not including these specifications, reused materials cannot be entered into the inventory systems or planned efficiently in deliveries, leading to uncertainty and inefficiencies for drivers, warehouse staff and planners.

In addition to this, D6 also noted that while pickups of return or excess materials already occur in their current operations, expanding this to include reused materials, such as via return logistics, would only be possible if volumes and quality are predictable. The opportunity for this exists, but without standardisation, returned reused goods risks becoming inefficient and costly. To combat this, B2 stated that instead of taking in a large variety of materials, which can lead to a “hoarding” effect where the items gather dust, the suppliers *“ought to focus on fewer products, for example 3 products that we have that we know we get a turnover on”*.

4.4. Collaboration and digitalisation as key enablers

While there are several hinderances to creating a dependable market for reused materials, there is an overall optimistic view on the practice of reuse itself. This optimism extends to co-operation between contractors and materials suppliers, as well as other actors such as demolition businesses and industry NGOs. The question is whether contractors and their clients, suppliers and lawmakers can compromise in decisions of quality and cost to allow reuse to become a viable option for all parties. And how can the key actors effectively communicate to enable large scale reuse?

4.4.1. Collaboration

To address these systemic challenges, collaboration can be an important factor for future reuse strategies. Interviewees consistently emphasised the need for stronger partnership across the value chain, from demolition companies to architects and end clients. D9 advocated for structured partnerships with demolition actors, stating that these collaborations could enable early materials identification, plan disassembly and streamlined reuse. D9 also notes that reuse supply chains could become a source of

competitive advantage of companies developed partnered reuse capabilities. Collaborations could also support specialised roles in inventory control and documentation, helping reuse actors build operational capacity.

B3 explained that early integration is key, as without coordinated reuse goals from the start, reuse is unlikely to be viable at later stages. This connects directly to the value of collaborative planning during early project phases, where roles and responsibilities for reuse can be more clearly defined. Interviewees also highlighted the need for digital tools and shared inventory systems that display the availability and specifications of reused materials, enabling better supply-demand matching and improved market transparency.

4.4.2. Economic ownership

Beyond collaboration, a notable point of discussion that arose in the interviews was that of economic ownership of materials and processes. One such was the question of responsibility of quality assurance and liability as discussed in 4.2.2. This arose partly as a question of competence, i.e. who should or can carry out the quality assurance, and partly as a question of who should pay for it. D8 highlighted the lack of a standardised or common quality assurance for reused material. P1 added that this means that the materials often need to be controlled on site after delivery by the contractor, with varying qualities being delivered, rendering some material useless. B3 and D2 underlined that contractors want to avoid both quality variance and to perform quality assurance themselves, due to the added costs and required competence, leaving a gap in the market for other established actors or new ones.

From the material supplier point of view, supply chain and procurement professionals stated that the materials suppliers would prefer to avoid the liability of quality assurance or certification, especially materials sourced from third parties. This they explained is due to the difficulty in controlling or verifying the full lifecycle of reused goods. S1 suggested that the Research Institute of Sweden (RISE), who is an authoritative governmental organisation in materials sciences, could play a part in quality assurance certification. The idea would be for RISE themselves to do it, or for them to hand out reuse certificates to material suppliers.

D9 suggested that the quality assurance issue necessitates a new type of partnership or role to be established, stating *“I think that if we’re going to turn this into a truly long-term and sustainable customer offering, then I believe we need to collaborate with other actors. And that might mean having some kind of cooperation agreement with demolition contractors.”* Here the supplier of the demolished materials partners with the construction materials wholesaler like Derome to provide the facilities and materials know how. B1 added that perhaps the material producers could be part of such a new partnership, as they already possess the competence and certifications needed. However, D5 raised a concern that such involvement may conflict with the commercial interests of products, as reuse competes directly with virgin material markets, potentially limiting their motivation.

The summary point of economic ownership comes down to that the reused materials themselves are seen as a potential liability. D5 alluded to that certain easement of quality requirements from the contractor side could encourage suppliers to invest more in becoming reuse suppliers. As neither the suppliers nor contractors want to assume liability for potential defects, either third parties may be required or some sort of liability sharing through partnerships.

4.4.3. Strategic partnerships

All interviewees from the contractor side emphasized the importance of establishing formal partnerships or framework agreements to support the scaling of reuse. These agreements would ideally involve traditional material suppliers, contractors, and specialized reuse suppliers, and mirror existing agreements used for virgin materials. Across most interviews, contractors expressed a strong preference to continue working within the existing procurement frameworks, sourcing materials through familiar suppliers under established conditions.

Contractors pointed out that current procurement practices for reused materials are a major barrier to scaling reuse. S1 highlighted the labour intensity of sourcing reused products as a significant challenge. Both B3 and S1 discussed the need for early

involvement of reuse suppliers during the project planning phase, with B3 specifically warning about the high cost and complexity of redesigning projects when reused materials are introduced too late. Another key issue mentioned is the lack of logistical support, such as transportation and warehousing, which contractors often have to manage themselves by subcontracting.

From the supplier perspective, D9 stressed that strategic partnerships are essential to make reuse scalable. They argued that the current ad hoc procurement of reused materials is unsustainable and proposed developing formal agreements with demolition or deconstruction firms to secure a reliable first-hand supply of reusable material. Building on this, D3 noted that material suppliers like Derome would likely need agreements with numerous large regional and small local firms, due to the fragmented nature of the demolition sector. Both D9 and D3 suggested that larger suppliers might eventually need to establish their own deconstruction businesses or acquire existing ones to secure supply. Additionally, D3 proposed forming partnerships directly with property owners or real estate investment firms, ensuring that when properties are renovated or demolished, material suppliers are contacted early to assess reuse opportunities.

The issue of supply scale is particularly pressing for contractors. Each of the interviewees at contractors stated that a reliable and predictable supply of reusable materials is necessary for reuse to be a viable option in projects. N1 highlighted the low ratio of deconstruction to new construction, resulting in limited and inconsistent availability of reusable materials. As a potential solution, D6 suggested implementing a hub-and-spoke distribution model, where materials are collected locally before being transported to central or regional hubs. *“This would enable better inventory management and allow larger orders to be fulfilled efficiently through consolidated shipments rather than numerous small deliveries”*, according to D7.

In summary, both contractors and suppliers see partnerships as crucial to increasing the viability of reused materials in construction becoming mainstream. The need for services like sourcing and logistics create market opportunities for the suppliers. However, this requires suppliers to take initiatives and look over their own supply chains.

4.4.4. Collaboration through digital mediums

Several interviewees at contractors pointed out that sourcing reused materials today is highly manual and inefficient and would preferably be done by suppliers instead. B2 and S1 both highlighted that sourcing is done ad hoc and takes a lot of time. In one project, S1 said three people were assigned just to look for reused materials, which they described as unsustainable without better tools.

Both contractors and suppliers agreed that a digital sales platform would be needed to scale reuse. B3 suggested it should work like a more professional version of sites like eBay where users can browse pictures, see material specifications, and access certificates. D6 had a similar idea, to have three material classifications through the digital sales platform in order to provide transparency for prospective buyers. Class A would be “as new,” Class B would be “with defects,” and Class C would be “with significant defects”. The classes would vary in price dependent on material quality, with Class C marketed to private customers for DIY projects. D3 and D9 also pointed out that reused materials need to have quality documentation and certificates available digitally if they are going to compete with new materials during procurement. There were also concerns raised, with D8 explaining that reuse materials are harder to list digitally because stock changes all the time. D9 added that it would be a big administrative task to keep a platform updated and questioned who would be responsible for running it.

Even though there are challenges, interviewees believed that reuse will eventually move toward more digital solutions. Platforms like Sistabild and pilot projects by companies like Vasakronan and Castellum were mentioned, although interviewees agreed that these initiatives are still early in their development. Overall, digital collaboration tools were seen as crucial to making reuse easier, more structured, and more scalable across suppliers, contractors, and demolition firms.

5. Discussion and suggested measures

This chapter analyses the empirical findings in relation to the literature as well as the interviews, with the aim of deepening the understanding of suppliers' role and challenges in the reused construction materials market. The discussion is divided into two parts; First, exploration on how the supplier role currently operates in practice, including how suppliers interact with the reuse market today, the constraints they face and how these processes differ from traditional supply models. The second part focuses on the shift developers should go through in order to enable reuse at a larger scale. This includes capabilities, structural changes and strategic positioning that may be necessary for suppliers in order for them to have a more active role in establishing reuse in the industry. The section also expands on the results found in the theoretical framework and empirical findings by discussing and expanding on strategies found in literature and suggested by interviewees through deductive reasoning.

5.1. Characteristics and expectations of suppliers in reused construction materials

Suppliers in the reused materials market operate within a context that is still undefined and lacking regulatory support as well as standardised procedures, which characterises the traditional material supply chains. While the conventional suppliers manage predictable flows of certified new materials, suppliers working with reuse are expected to function in a fragmented landscape shaped by irregular availability, inconsistent definitions and lack of a formal quality assurance system. As a result, the role of reuse supplier remains fluid and often experimental, where their scope varies from logistics and warehousing to certification and documentation.

Traditionally, suppliers who have historically geared towards standardised product flows, are facing market conditions that demand a shift in strategy. Driven by stricter sustainability expectations, regulatory frameworks and client's environmental targets, the ability to offer reused material is no longer just a value-added service, but also a potential differentiator in competitive bidding (Debacker & Manshoven , 2016). As mentioned in the interview with D6, suppliers who can provide verified reused materials, aligned with the environmental certifications and measurable sustainability outcomes,

position themselves more favourably to win contracts. However, successfully integrating reused materials into a traditional supply portfolio requires more than just access to reused products. Contractors expect high standards in terms of quality volume and delivery reliability, and reused materials often present challenges in meeting these criteria. While client demand for reuse is growing, suppliers will only be able to capitalise on this opportunity if they transform their business models and internal capabilities to meet the professional construction standards. The ability to consistently deliver reused materials which fulfils requirements within quality and timing will not only improve their competitive position but also establish them as credible actors in the transition to circular practices in construction (Knoth, et al., 2022).

A clear shortcoming identified in the interviews was that reused materials are still treated as if they were new within the design phase. In the interviews with B2 & D7 they acknowledged that reused materials are only considered late in the project timeline, often after the material specifications have already been finalised. This creates a process where reused products must “fit into” designs that were never meant for them, making sourcing difficult or unfeasible. In many cases reused materials are proposed as a last-minute substitution rather than being planned for from the beginning. Several interviewees expressed frustration with this dynamic and described that currently the systems assumes that reused materials should conform to the same procurement logic as new products, an assumption which makes the reuse processes much harder to succeed. The mismatch between reuse potential and design aligned with the literature by Inanloo (2024), as it was described that the reuse of materials is significantly constrained by the linearity in design and procurement processes. In order to scale up reuse, it must be considered not as a material substitution but rather as a design parameter that involves early-stage decisions (Knoth, et al., 2022).

A critical expectation is that suppliers evolve to offer services, not just in distribution or warehousing, but also in the early design phase of construction projects. D7 discussed that rather than positioning reuse as an afterthought or as a substitute, suppliers could participate in the design development, helping to identify viable reused materials from the outset and advising on logistics, volumes and certification needs. This would create a fundamental shift from transactional roles to consultative ones. The new service could

also include that suppliers take on responsibilities for managing availability assessments, documenting reused material flows and guiding clients on how reuse choices affect the logistics and timelines. The model would represent that reuse is not “fitted into” a traditional process but rather planned as part of a parallel tailored system. Such an approach could influence what is possible, instead of simply rejecting the idea later in the process.

However, the expanded role requires a corresponding shift in competence and trust. Suppliers need to be recognised as partners with knowledge and capacity to advise on availability, performance, logistics and documentation. This does not only include technical knowledge of materials, but also the ability to navigate inconsistent definitions and regulatory ambiguity. Suppliers must have the tools and frameworks to justify their decisions and communicate clearly with contractors and designers. If not, the promise of early involvement risks becoming a burden rather than a benefit.

Certification and liability were another persistent challenge. While suppliers are expected to provide materials that meet the technical and safety requirements, the infrastructure to support quality assurance remains weak. Today there is currently no industry-wide protocol for verifying the performance of reclaimed materials such as timber, steel or insulation, and even when third-party certification is used, legal liability often falls back on the supplier. D3 explained that even if the material is tested, who’s responsible if it fails? That is what no one wants to answer. D4 elaborated saying that this risk, alongside the lack of clear documentation or continuity of certification across reuse cycles pushes many suppliers to avoid high-liability products altogether. Structural components will then especially be avoided unless accompanied by robust third-party involvement. The vacuum in certification creates space for the emergence of “pure reuse suppliers”, yet these roles are still underdeveloped and unevenly distributed.

During the interviews it was also noted that the lack of a unified definition of reuse further complicates operations for suppliers. Different perspectives regarding “saved material”; leftovers or unused products, and if it should really qualify as reuse. On one side, seen in the interview with D6 the argument that saved materials are easier to manage and offers lower risks, the other side, stated by D7, highlighted that only materials that have been

installed and then dismantled should qualify. These misaligning views affects how suppliers should categorise inventory, how reuse is reported in sustainability metrics and how the materials should be priced and presented for the clients. If there is no clear agreement of what reuse is, how can targets be set for it? While the challenge lays on an industry-wide level, suppliers can already take steps forward to mitigate the confusion by adopting a more transparent internal classification system that categorises reuse into two levels: “saved materials” & “pure reuse”. This distinction was brought frequently in the interviews, where the leftover materials were often disregarded due to unclear procedures or lack of return systems. If reuse was separated into these categories, suppliers can clarify their offerings, better match materials to the clients’ expectations and make sourcing and logistics more predictable. In interview D5 & P1 it was described that it would also allow contractors to make informed decisions based on their project needs, risk profiles and potentially increase the returns rather than waste, something that would align with sustainability targets for most companies. While the dual categorisation would not solve the definition ambiguity on its own, it would lay as a groundwork for greater standardisation in the future.

While the product range for ‘saved’ materials could vary depending on the supplier, the ‘pure’ reused materials should have a limited offering. A recurring theme in the interviews was the suggestion that suppliers should consider specialising in a limited selection of products rather than attempting to manage a broad and diverse material portfolio. It was pointed out several times that the logistical, technical and administrative challenges of reuse increases significantly when suppliers try to handle too many different material types. Instead, if they focus on one of few materials, it could offer advantages. It would allow suppliers to build a deeper expertise in specific product categories, creating a streamlined sourcing and storage process, as well as improving the operational efficiency (Knoth, et al., 2022). In regard to the certifications, this limitation could also reduce complexity. As noted in the literature review, different materials often require distinct testing and documentation procedures (Debacker & Manshoven , 2016). Concentrating on a smaller range would limit the need for suppliers to develop broad resource intensive testing capabilities. A more focused strategy would also contribute to market clarity. If suppliers become known for specialising in certain materials, contractors and clients would know where to turn for reliable access, quality assurance and guidance within

those segments. While the selection of which materials to prioritise is beyond the scope of this report, the potential benefits of target specialisation is an important tool for suppliers to navigate in the reuse market.

5.2. Development of internal capabilities

Becoming an “good” or competitive supplier of reused construction products will require planning and investment from the traditional materials suppliers. In theory, the market for reused materials has the same fundamental characteristics as construction materials made of virgin materials. This means that suppliers should be able to offer reused materials without major investment in reshaping their supply chains and capabilities. The added challenges for reused material in comparison to traditional products are threefold: sourcing, quality assurance, and logistics.

5.2.1. Sourcing

As was found in section 3.3.2, reused construction material currently has very high supply uncertainty (Al-Werikat, 2017; Adamides & Mouzakitis, 2024; Chopra & Meindel, 2019). This is due to two main factors: limitations in available supply volume and the unstructured, informal way in which it is procured. Current sourcing practices are fragmented and heavily reliant on ad-hoc searching or informal networks. These resemble second-hand trading more than structured supply chains, making sourcing both unpredictable and unsustainable.

According to supply chain theory, a more reliable supply reduces uncertainty, which in turn leads to fewer stockouts and improved profitability (Chopra & Meindel, 2019). Materials are sourced from the demolition of buildings (Inanloo, 2024), which is inherently dependent on the existing building stock and when building owners decide to renovate or demolish, making it difficult to influence the overall volume of supply. However, what could be improved is how much of that supply is captured and how consistently it can be accessed. Therefore, a reasonable way to enhance sourcing capability would be to change or improve the procurement method. This can be achieved

by establishing formal procurement channels through strategic partnerships with demolition and deconstruction businesses, as suggested by D3 in the interviews.

For construction materials suppliers, expanding operations to include deconstruction services as suggested by D9 and D3, or forming partnerships with external demolition or deconstruction firms appears to be a necessary step toward more systematic identification and consistent sourcing of reused materials. Interviewees at contractors frequently emphasised the need for a shift from reactive distribution to proactive facilitation of reuse, i.e. taking it out of the hands of the contractor and into the hands of the suppliers. A suggestion is that early engagement by suppliers, ideally at the pre-demolition planning stage, would allow them to prepare for careful dismantling and ensure better extraction of valuable materials. This type of upstream integration would improve control over material flows and enable better logistical and inventory planning. However, even with proactive involvement, the underlying constraint of limited supply volumes remains, as N1 stated in the interviews. To overcome this, suppliers will need to enter into multiple partnerships or establish framework agreements with various actors, as suggested by D3.

One approach, suggested by D3, is to develop framework agreements with both large and local demolition and deconstruction businesses. These agreements could include pre-defined pricing and quality standards based on a classification system. Such a procurement model could enable these businesses to generate additional revenue streams, while providing suppliers with a more reliable and traceable flow of materials. However, implementing this model would involve challenges. The collection process would require considerable effort, given the wide distribution of sources and the need for transportation and processing. However, logistics professionals at Derome D6, still thought this would be feasible given the large logistics infrastructure already existent at most large construction materials suppliers. In addition to logistical complexity, a portion of the collected materials may fail quality control, resulting in lost value. This emphasizes the importance of partnering with firms that can deconstruct buildings carefully without damaging materials, or as previously suggested, integrating this function into the business of the supplier for better control of the supply. To minimise the risk of unusable

material, it would stand to reason that suppliers may need to limit the range of accepted materials based on recoverability and refurbishment potential.

An option to improve material availability is to expand the sourcing scope to an international level. This could help mitigate the limitations in domestic supply by increasing the total pool of accessible reused materials. However, this would reasonably reduce the environmental benefits of reuse due to the longer transport distances involved. Additionally, establishing stable partnerships across borders may be complex and costly, especially outside of trading unions such as the EU or EES. Regulatory differences, certification requirements, and logistical coordination are all potential hurdles. Differences in building codes and gaps in knowledge regarding the building stock of other countries provides an additional layer of complexity. Material passports could be a part in solving some of the issues posed by an international reuse market (Wilson, et al., 2023), however practical implementation still seems a far-away prospect. Therefore, international expansion might be more realistic as a long-term strategy, once the domestic reuse market has scaled up further and international standards are more harmonised.

5.2.2. Quality assurance and processing

Material quality control was a common subject in the interviews. The second-hand nature and deconstruction methods increase the risk of defects markedly, meaning that due diligence and quality control are extra important. This was a frequent concern of interviewees at contractors in particular, as stated by B3 and D2. In order to assure the utility of materials collected from deconstruction and demolition and be an attractive supplier of reused materials, the material suppliers must have the capability to ensure material quality. Procurement specialists D4 and D5 at Derome stated that material suppliers are liable for the materials they sell for a period after sale, meaning that any issues caused by faulty products can result in damages being owed. From a supplier standpoint, ensuring material quality with rigorous and costly testing and taking on liability was not preferred according to D4. This means that, unless some level of liability relief is provided by the contractors or real-estate developers, prices of reused materials

are likely to remain high due to the manual labour and processes associated with quality control and certification.

In order to minimise the amount of wasted material and increase transparency, suppliers could look to introduce material quality classification. One idea presented in 4.4.4 by D6 and D7 at Derome would be to have material classifications at different price points, marketed to both contracting businesses and private individuals. While such a system would in theory minimise waste, price may remain an issue. Therefore, focusing primarily on higher quality materials to sell to larger contractors at a higher price seems more reasonable, as the interview findings showed that large contractors are willing to pay more to lower their carbon footprint. An option could be to also have an aftermarket for private individuals with discounted prices could allow for some cost recouperation for leftover products.

Material classification would necessitate the capability to quality control the material, a function which was required by the contractors either way. For reused products that already carry valid and up-to-date quality certificates, and that have not been classified as waste before being selected for reuse, minimal testing is needed in theory. However, as deconstruction and demolition usually occur at or near the end of a building's lifespan, this means that quality documentation and certificates may be absent or out of date. For such materials, new quality control and certification will therefore be required. This means that material suppliers must either carry out quality control and processing in-house or outsource it to subcontractors, as suggested by S1 in the interview findings. If the supplier decides to handle this in-house, it stands to reason initial investment in acquiring the proper licenses, facilities, equipment and staff training will be required. In contrast, outsourcing may prove expensive, create bottlenecks and reduce control over scalability.

When it comes to refurbishment of materials and products, it was found that some materials were more prone to need heavy refurbishment (Inanloo, 2024). This means that some materials and products, depending on their make, model, material and wear, may be more expensive in comparison to virgin products. Therefore, it is vital for suppliers to ensure proper economic due diligence before deciding on what reused materials to

market. While large contractors are willing to pay more to lower their carbon footprint, the interviewees at these companies indicated that this is only to a certain extent. Depending on the material type and volume, there could also be a possibility to automate or streamline refurbishment to some extent, provided that supply and demand volumes justify the investment.

5.2.3. Logistical capabilities

Evident from both the empirical findings and literature, effective logistical drivers are key to ensuring a functioning supply chain. The capability to manage facilities, inventory and transportation is fundamental to running a competitive construction materials business (Al-Werikat, 2017; Chopra & Meindel, 2019). These combine to keep lead times short and prices reasonable, which are competitive priorities for materials suppliers (Seth, et al., 2018).

Although reused construction materials are often sourced as whole products, the process is rarely as simple as collecting the material and delivering it straight to the site of a new construction. As highlighted in the literature, many materials require some degree of inspection, cleaning and testing before reuse, depending on the material category and regulatory context (Deweerd & Mertens, 2020; Inanloo, 2024). In addition, quality certification is a must according to several interviewees at contractors. That being said, for certain elements like doors or fixtures, the needed refurbishment may be minimal. In these cases, supply chain processes will reasonably be less complex than for virgin material products, as they would require fewer steps. For an established, large construction materials supplier, the logistical infrastructure capabilities are already in place according to D6, which could form a solid foundation for reuse integration if a supplier wanted to enter the market.

If the sourcing methodology based on a hub and spoke logistics model is used, as suggested in 4.4.3, several investments may be required depending on the supplier's current capabilities. Centralised warehousing becomes a key enabler to ensure efficient outgoing material delivery if this strategy is adopted. Depending on company size, geographic spread and current supply chain design, these facilities may already exist. If

so, additional warehousing space might be required at existing locations, along with facilities for light refurbishment or inspection.

While warehouse centralisation generally results in a less responsive supply chain and increased lead times (Chopra & Meindel, 2019), the limiting factor in reuse logistics is not responsiveness but rather the availability of supply. If reusable materials are to be sourced in small volumes from a wide geographic area, centralising inventory allows suppliers to pool these inputs. This increases the likelihood of fulfilling contractor orders through single shipments rather than partial deliveries, which interviewee D7 suggested would reduce coordination costs and improve client satisfaction. However, it must be acknowledged that some suppliers may require hybrid models to maintain responsiveness for projects that require short lead times.

Inventory management processes would reasonably, on the surface, resemble those used for new materials. However, the characteristics of reused materials as found in both such as inconsistent inflow, varying conditions and the concerns for material degradation introduce additional complexity according to D2, Jia (2025) and Parmigiani et al. (2011). Contractors, according to B3, require sufficient volume for reuse to be attractive, which means that materials may need to be stored longer to accumulate enough volume for resale. This means that their condition must therefore be monitored to avoid spoilage or loss of structural integrity. Moisture, dust and improper handling are real risks that must be accounted for in warehouse design and operations.

To ensure sufficient supply, suppliers must also have the capability to collect materials efficiently from demolition and deconstruction projects, as highlighted in the interviews. As explained D6 and D7 at Derome, most suppliers already possess some level of transportation capability, either in-house or via third parties, meaning this should not pose a fundamental obstacle. However, the efficiency of collection runs of reused materials will reasonably vary depending on source location and load volume. If a single site cannot provide a full truckload, delivering smaller batches to regional depots for eventual shipment consolidation may improve overall efficiency. A strategy that could be possible is backhauling, i.e. to pick up reusable materials from demolition sites when returning from delivery trip to construction sites. This approach reduces empty mileage

and enhances logistical sustainability, aligning well with circular economy principles. However, this is highly dependent on what demolition and construction is occurring within set geographic areas, and if there are existing agreements regarding the procurement of the materials from the demolition sites.

In summary, while many construction materials suppliers already possess core logistical infrastructure such as transport fleets, warehouse systems and delivery planning tools, integrating reuse still requires targeted investment. Not necessarily in hardware, but in strategic planning, process adaptation and possibly in expanded or retrofitted facilities. Additionally, regulatory ambiguity regarding material classification, traceability and quality assurance, pose further operational risks that must be addressed early. Still, considering the growing demand for circular solutions and potential long-term advantages, such investments may represent a worthwhile short-term cost for strategic positioning in a shifting market.

6. Limitations and future studies

While this thesis offers an initial overview of the role of suppliers in the reuse market, several areas were identified during the study that should be included in future research. A fundamental issue that remains is the definition ambiguity surrounding what reuse actually entails. Interpretation varies across actors, and this lack of clarity complicates both practical implementation and sustainability accounting. However, the problem lies at an industry level. As it affects the whole construction industry, it needs to have one established meaning. With unity regarding the definition, future research within the field of reuse should be able to clear up a lot of the ambiguity that negatively impacts it in its current state.

As this study's findings are based on a combination of literature review and interviews, this dual approach provided a broad perspective, however, some limitations should be acknowledged. First, the number of interviews with suppliers was limited. While Derome provided valuable insights into the perspective of a large traditional suppliers, interviews with other suppliers were not obtained. Three additional supplier companies were contacted but either declined or did not respond to the interview requests. Subsequently it restricted the diversity of supplier's perspectives that were included in the analysis. Future studies should prioritise engagement from a broader group of suppliers, as well as "pure" reuse actors where their core business is built around reused materials. Comparing these perspectives would provide a more complete picture of the reuse ecosystem.

Second, while group interviews were used in four interviews, potential biases could have been introduced if participants influenced one another's responses. However, during the analysis, no systematic differences were found in how participants answered in group settings compared to the individual interviews. Instead, the group format often allowed for richer conversations and the development of more nuanced ideas, as participants were able to build on each other's thoughts. In some cases, this collaborative dynamic

even stimulated even greater creativity, leading to more detailed perspectives on potential challenges and future business opportunities.

It would have been valuable to conduct group interviews that include participants with different professional backgrounds to further explore how their perspectives might converge or diverge. A cross functional discussion could reveal new insights into how reuse practices can be integrated at both strategic and operational levels.

Economic viability of reuse remains as a critical knowledge gap, as the report touched on the issue of cost and liability but never explored in detail the financial models that might support suppliers in adopting reuse at scale. Due to the fact that most companies prioritise economy, including more financial aspects in the analysis would benefit the sector, as they would never invest in something that is not profitable for them. Delving deeper into business cases, cost structures and profitability scenarios would help to clarify under what conditions reuse can become a stable and self-sustaining component of the construction supply chain. Having a case-study based research could also be useful, where it would allow for more detailed examination of parameters such as pricing strategies, procurement models and project specific reuse outcomes. In addition to this, it could also be important to understand which materials people are most interested in. Conducting market research to find components, materials or products that are attractive as reused materials would help suppliers to avoid excess inventory from unsold stock and a more reliable market demand.

Equally as important is the perspective of property developers, those setting the sustainability targets that often determine whether reuse is even considered. The results of the empirical study showed that contractors are both drivers of reuse and reluctant adopters of it due to client pressure, a clear contradiction. Engaging more directly with clients and developers in order to understand their motivation for sustainability and reuse would help in gaining knowledge of where the true market pull lies, clarifying the market potential.

In operational terms, there is a need to investigate the logistical dimensions of reuse. Issues with warehousing, storage duration and materials handling protocols create

serious challenges for suppliers, especially when material flows are unpredictable and product dimensions non-standard. Studying how suppliers can develop effective logistical systems, or how existing infrastructure can be adapted to support reuse can be essential for making these practices doable.

Finally, questions regarding how to enable durable collaborations across the reuse value chain requires further investigation. Governance models that support long-term partnerships between demolition actors, suppliers, contractors and municipalities are still underdeveloped. Research into incentives, shared risk models and policy instruments that promote collective ownership and responsibility could help build the institutional support needed to move reuse from pilot projects into standard practices.

7. Conclusion

In essence, the answer to the question, “*What are the characteristics of a ‘good’ reuse supplier?*”, is not fundamentally different to the answer to the question “*What are the characteristics of a ‘good’ supplier?*”. The metrics are the same: effective sourcing and logistics, proper market analysis and ultimately, client satisfaction. However, what differs are the characteristics of reuse and the added capabilities needed to enter a new market of products.

Suppliers of reused construction materials are characterized by the expectations set on them by their clients – the construction contractors, and by extension, their own clients. Contractors reused materials to be reliably delivered, quality assured, environmentally certified, limited liability, and with sufficient volume to have an environmental impact. In order to meet these demands and become a first-choice supplier of reused products, the construction materials supplier must invest to ensure scalability and profitability. This means that they must develop systems to identify, track and collect reused materials, ensure their quality, and adapt storage, transportation, and inventory systems to handle non-standardized materials. The supplier must also match their supply chain responsiveness to the high demand uncertainty of reused construction materials. By investing in these areas and adapting to circular economy principles, suppliers can bridge existing market gaps and make reuse a more accessible and viable option for the construction industry.

The market for reused products in construction can still be considered to be in its infancy even if interest for reused products is ramping up. Demand in Sweden at the moment is surging, but the actual volume of reused material as a share of all construction material remains low. Additionally, regulations, standards and practices are yet to be determined, leaving room for the industry itself to set the tone for future development. Being first comes with risk, as it involves some degree of trial and error, and regulation can change requirements for products and services. That being said, market demand for high quality reused products seems likely to increase over time based on the evidence found. For construction materials suppliers, this presents an opportunity to be ahead of the curve ultimately gain a controlling share of the market.

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9. Appendix

A. Interview questions for construction contractors

A.1. Environmental Strategists

- What sustainability goals does your company have related to building materials and reuse?
- Are there specific quantitative targets for reuse, or are they more general sustainability strategies?
- What drives your sustainability strategies? Legislation/market?
- How do you view the reuse of building materials as part of your strategy to reduce climate impact?
- Is reuse a prioritized strategy compared to other methods such as material recycling or energy efficiency?
- Are there specific projects where you have tried to use reused materials and can share experiences from?
- What obstacles do you see in using reused materials in your projects?
- Do you see differences in obstacles depending on the type of construction project (e.g., housing, commercial properties, infrastructure)?
- What kind of support or services from suppliers would facilitate increased use of reused materials?
- Would a digital platform for finding and purchasing reused materials be a solution?
- Are there any internal requirements or policies that affect decisions to use reused materials?
- What factors are crucial for reuse to become a competitive solution for you?
- What would be required for reused materials to compete with newly produced materials on the market?
- How do customer requirements and preferences affect your ability to use reused materials?
- Do you see a change in customer attitudes toward reuse, and how does that affect your strategic decisions

A.2. Project Managers

- How is material procurement handled in your projects today? How are suppliers selected, and what makes a good supplier in your opinion?
- How often are reused materials considered?
- What factors determine the choice of supplier – price, quality, delivery reliability, or something else?
- What do your contracts with suppliers look like? Are they project-based or do you have framework agreements?
- What is decisive when you choose suppliers?
- What do you think are the biggest challenges when using reused building materials at the project level?
- Are there internal policies or external requirements that complicate the use of reused materials?
- How important are factors such as quality assurance, certification, and standardization when selecting materials?
- Would clearer certifications or standards make it easier to use reused materials?
- What requirements do you place on suppliers regarding product variety, volume, and delivery reliability?
- If a supplier of reused materials couldn't guarantee the same delivery reliability, would you still consider using their products?
- How important are stable deliveries compared to price and quality?
- Would a framework agreement for reused materials be more attractive than purchasing materials on a project-by-project basis?
- How do you think the logistics of reused materials would differ compared to new materials?
- How does logistics affect your willingness to use reused materials?
- How do cost and scheduling affect the ability to use reused materials in a project?
- Would longer delivery times be a barrier to using reused materials?
- What share of your projects do you think could use reused materials if suppliers had better solutions to these challenges?

- What role do digital tools and traceability play in facilitating reuse?
- Could better traceability systems make it easier to choose reused materials?
- How would you like a supplier of reused materials to adapt their services to better meet your needs?
- Would you prefer having a dedicated point of contact at the supplier, or are you more interested in having clear digital tools for ordering and traceability?
- If you could design the ideal supplier for reused materials, what would their offering look like?

B. Interview questions for materials suppliers

B.1. Environmental Strategists

- How do you view your role in enabling reuse within the construction sector?
- What do you consider to be the main responsibility of suppliers when it comes to reuse?
- What drives sustainability efforts within your organization?
- What strategic sustainability goals do you have related to the reuse of construction materials?
- Are there specific strategies in place to increase reuse within the company?
- How do you view future demands from customers and legislation regarding circular construction materials?
- Do you think reuse will become a legal requirement in the future?
- What initiatives have you taken to develop your services related to reuse?
- What business opportunities and risks do you see in scaling up reuse?
- Is there a business model where reuse can become profitable?

B.2. Logistics Professionals

- How do you currently manage logistics and storage of construction materials?
- What services do your customers require from you?
- Who is responsible for intermediate storage of materials?
- What challenges do you see in ensuring the delivery of reused materials?
- Will intermediate storage be necessary?
- Are there solutions that can avoid intermediate storage and enable direct transport from site to site?
- Are customers willing to wait longer for reused materials?
- How can Just-in-Time deliveries versus warehousing affect the ability to integrate reused materials?
- What is the limit for how long materials can be stored before it becomes economically unviable?
- What setup do you believe works best for reuse?
- What improvements in logistics flows would make reuse easier and more efficient?
- Are there technical solutions that could facilitate transport and handling?
- How do you think you can collaborate with material subcontractors and end customers to achieve efficient logistics for reused materials?
- How does the transport and handling of reused materials affect your costs compared to new materials?
- Are there solutions to optimize logistics and reduce costs?

B.3. Supply Chain strategists

- Do you have plans to adapt your purchasing and delivery strategies to include reused materials?
- Have you identified sources of reused materials, or are such purchases made more irregularly?
- How "responsive" does your supply chain need to be to integrate reused materials? Do changes need to be made, or can you continue more or less as usual?
- What capabilities or qualities does a supplier need to develop to handle reused construction materials effectively?
- Are new processes or systems required to manage reuse?
- How do you view collaborations with other actors (reuse hubs, digital platforms, construction contractors) to create a functioning value chain?
- What type of collaboration do you believe would be most effective?
- What standards or quality requirements need to be established for reuse to become a more integrated part of the supply chain?
- How can the industry work to standardize reuse?
- How do you view the need for digitalization and traceability in managing reused materials?
- Are there any digital solutions you consider particularly important?

B.4. Strategic Sourcing Specialists

- If you were to start purchasing reused materials, how do you think the procurement process would differ compared to new materials?
- Is it possible to have agreements with contractors for "first dibs" on materials?
- What factors would be decisive when choosing a supplier of reused construction materials?
- Availability?
- Communication?
- How do you think the availability of reused materials would affect your purchasing decisions?
- What order volume would be necessary for it to be profitable to use reused materials?
- How would you assess the quality and performance of reused products compared to newly manufactured ones?
- How would you handle a lack of standardization or variation in material properties?
- Which economic factors do you believe would be most important when evaluating reused materials (price, life cycle cost, risks)?
- What types of financial incentives could increase the willingness to purchase reused materials?
- What would be required for you to start using reused materials on a larger scale?



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