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Unlocking success: key elements of sustainable business models in the wooden multistory building sector

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Few studies have investigated the processes and strategic interactions among the Wooden Multistory Construction (WMC) industry actors, its customers, and local policymakers. Further insights into this field are needed for a sustainability transition in the construction sector. This study aims to explain WMC's corporate sustainability strategies for co-creation with customers and municipalities. This was based on interviews with key informants in the sector and WMC actors using three case studies in Sweden. Our interviews focused on business processes, interactions with users and municipalities, sustainability, and innovation in the WMC market. The findings reflect the notion of a slow transition in the Swedish WMC market toward using more wood as a bearing structure, which is supported by the competitive advantages and climate performance of wood. The three case studies indicated that the corporate focus is currently placed on incremental improvements in operations, price competitiveness, and successful project management. However, in contexts where wood construction is seen as a unique advantage, collaborations between the construction industry and end users have developed and served as novel platforms for WMC market development. The study concludes that WMCl growth hinges on the industry's housing offerings prioritizing quality, affordability, and swift construction.

KEYWORDS

business strategy, co-creation of value, sustainability transition, sustainable business model, timber construction

1 Introduction

Amidst the challenges posed by global climate change and the rapid growth of urban populations, there is a growing need for sustainable building materials and solutions (Ogunmakinde et al., 2022). A significant contributor to greenhouse gas (GHG) emissions is the construction sector, with building-related emissions accounting for approximately 21% of the world's total CO_2 equivalent in 2019 (IPCC, 2022). This includes 57% from indirect emissions related to heating and electricity, 24% from direct site emissions, and 18% from embodied emissions associated with materials like cement and steel (IPCC, 2022).

In contrast to the most used construction materials like concrete, the utilization of wood emerges as a promising avenue for mitigating climate impact (Sathre and Gustavsson, 2009). Advanced wood-building techniques, such as mass timber, provide a unique opportunity

TABLE 1 Driving forces and barriers to wooden multistory construction development.

Driving forces	Description	Reference
Political goals	Directives and national legislation incentivize industrial adaptations, including the choice of building material. Local enactment of policies and goals for climate neutrality may support wood construction.	Östman and Källsner (2011) Brege et al. (2017) Franzini et al. (2018)
Research and development	Technical material innovation and understanding, involving pre-fabricated techniques or engineered wood products can create advantages for wood.	Gosselin et al. (2017)

Barriers	Description	Reference
Path dependence	Industrial past investment in non-wood technologies, patterns, and habits. Developers and building companies are not familiar with wood.	Mahapatra et al. (2012)
Skills and practices	Architects' and structural engineers' roles in construction. Education and experiences are biased toward concrete.	Roos et al. (2010) and Markström et al. (2019)
Awareness of material choices	Consumers limited awareness of bearing material in apartment buildings.	Mark-Herbert et al. (2023)

for substantial, long-term carbon storage, avoiding the carbon-intensive production processes associated with concrete (Churkina et al., 2020). Consequently, wood stands out as a renewable construction material with a comparatively low embodied carbon footprint, further enhanced by the active sequestration of CO_2 by newly planted trees post-harvest. This aligns seamlessly with the objectives of Sustainable Development Goal 13, 'Climate Action.'

Beyond its environmental benefits, timber in construction offers structural advantages, including strength and reduced weight (Ramage et al., 2017; Chen et al., 2020). Moreover, wooden materials are valued for their aesthetically pleasing and natural qualities (Jonsson et al., 2008), with some evidence suggesting a positive impact on well-being, though additional research is needed (Burnard and Kutnar, 2015). Consequently, wood construction has the potential to contribute significantly to the realization of Sustainable Development Goal (SDG) 9, 'Industry, Infrastructure, and Innovation,' as well as SDG 11, 'Sustainable Cities and Communities' (United Nations, 2022). Under favorable conditions, the adoption of Wooden Multistory Construction (WMC) can play a pivotal role in fostering sustainability within the infrastructure sector.

1.1 Challenges for a transition - wood construction diffusion

Wood construction has a rich heritage in Nordic countries, rooted in longstanding building traditions and the abundance of productive forests. While wood has consistently held a substantial share in single-family houses, reaching approximately 85–90% (TMF, 2023), urban and multistory houses have historically leaned towards alternative materials, primarily concrete and steel, for over a century. Building regulations have historically played a role in this divergence. In 1874, the Swedish government, aiming to prevent city fires, implemented a building code that stipulated a sufficient street width alongside restrictions on the use of wood in multistory constructions and as cladding material. It was not until 1994, upon Sweden's entry into the European Union, that this legislation was repealed. The contemporary Building Regulations, which are regularly updated, focus on functional requirements, e.g., in terms of fire resistance, rather than specific building materials (The Swedish National Board of Housing, Building and Planning, 2023).

Despite political efforts to diversify the construction sector in terms of materials and techniques, the WMC has increased but at a moderate pace (Mark-Herbert et al., 2023). Wood construction is still perceived as an alternative building technique, with only approximately 18–20% of new multifamily constructions being made of wood (SCB, 2021).

The diffusion of WMC is influenced by both driving forces and barriers, as illustrated in Table 1. These factors, closely connected to key stakeholder roles shape the trajectory of WMC development, its diffusion, and institutional framework. Legislation has in modern times played a role in promoting wood construction by creating equal conditions between different building techniques and materials (The Swedish National Board of Housing, Building and Planning, 2023). Recent and anticipated requirements for climate declarations of building materials further support the differentiation and promotion of WMC based on climate impact. This legislation not only influences financing conditions but also provides a foundation for research and development, enabling wood construction firms to catch up with established construction segments. Despite these advancements, the predominant norm remains the use of steel and concrete in multistory constructions, where WMC construction, often based on modular techniques and cross-laminated timber (CLT), constitutes a niche segment (Nord and Brege 2013; Brege et al., 2017).

Barriers to faster dissemination of WMC include path dependence, manifested in sunk investments and subcontractors' expertise, favoring conventional techniques like concrete and steel (Toppinen et al., 2022). The accumulated pool of skills and knowledge also leans towards non-wood alternatives, facilitated by technical education curricula (Roos et al., 2010). Additionally, key stakeholders, including customers and municipalities, may lack awareness of the opportunities to choose construction materials, influencing their risk perceptions.

The primary actors in this transition, facing both driving forces and barriers, are the WMC construction companies. These companies bear the weight of skepticism and 'questions' about WMC but also have the opportunity to fully leverage the associated benefits and driving forces. WMC builders are continually communicating with local policymakers and end-users for collaborative construction, concurrently developing business models that may foster a sustainability transition (De Keyser and Mathijs, 2023). A *business*

model combines the value creation, delivery, and capture mechanisms an enterprise employs, whereas a *business strategy* is a more comprehensive concept that also involves different market segments and measures to maintain a competitive position in the market (Teece, 2010). However, the specific role of WMC builders in aligning sustainable wood construction insights with business expertise has received less attention (Jussila, 2022; Jussila et al., 2022).

While existing studies have explored sustainability in building, system development, business collaboration, and other operational aspects of the WMC sector, the dynamics of how the wood construction sector collaborates with customers and municipalities for value creation, and how their business strategies evolve during an ongoing sustainability transition, remain under-investigated. The current literature often discusses the possibilities, potentials, and impact of wood construction (Churkina et al., 2020; Gallego-Schmid et al., 2020). Fewer examine the potential transition from the business perspective. A deeper understanding of these areas could illuminate priority actions to support sustainable construction and enhance value creation through interactions between business actors in WMC, local authorities/municipalities, and customers.

1.2 Aim

This study aims to explain the conditions fostering value co-creation between construction companies and municipalities, specifically focusing on WMC and associated building projects from a corporate perspective. The primary inquiry revolves around comprehending wood as a construction material, identifying business opportunities within WMC, and exploring the organizational contexts conducive to business activities. The study formulates three key research questions related to stakeholder, business, and organizational perspectives:

What is, in the view of WMC, the understanding of different stakeholders regarding wood as a load-bearing material in multistory constructions?

How are business opportunities generated for WMC business development?

What organizational conditions contribute to the enterprises' promotion of WMC?

The empirical spotlight is on corporate and operational construction perspectives, given their pivotal role in shaping negotiations that ultimately determine construction practices (Toppinen et al., 2019). Corporate representatives, at different levels, were selected for interviews, assuming their insights would reflect a strategic understanding of the development of WMC business opportunities. The project establishes theoretical boundaries related to national and international political policies, such as taxes and legislation.

The subsequent sections of this study unfold as follows: In section 2, we present a conceptual framework, providing a theoretical backdrop. Section 3 offers insights into the methods employed in the research, outlining the approach taken. The empirical findings are then detailed in section 4, shedding light on the results of the study. Section 5 presents an analytical discussion, revisiting corporate perspectives on wooden multistory constructions while delving into ongoing transformations. Finally, section 6 contains concluding contributions, summarizing the key conclusion from this exploration into the co-creation dynamics between construction companies and municipalities in the realm of WMC.

2 A conceptual framework

The theoretical framework is outlined within the context of corporate involvement in sustainability transitions, wherein, in this study field, less sustainable materials and practices are systematically replaced by their more sustainable counterparts. Furthermore, this presentation applies to the analysis of structural perspectives on business models and the requisite conditions for effective collaboration (Osterwalder and Pigneur, 2005; Lüdeke-Freund et al., 2018). Hence, the integrative conceptual framework prioritizes key features of business model development and emphasizes relational aspects within the WMC industry in the sustainability transition process.

2.1 Sustainability transitions

As outlined by Geels (2004, 2018), sustainability transitions involve gradual changes from a multi-level perspective, as depicted in Figure 1. The ongoing processes within this multilevel model exhibit mutual interdependence. However, in the scope of this project, the investigation into conditions facilitating the co-creation of value for WMC was conducted at the niche level, with the socio-technical regime and socio-technical landscape levels serving as contextual frameworks (Payne et al., 2008).

Figure 1 presents a visual representation of a sustainability transition, with distinct phases characterized by internal changes, and external processes influencing development across multiple levels. Each company examined in this study represents a niche innovation within WMC, contributing to a potential ongoing sustainability transition. The insights gained from expert interviews not only enhance the understanding of the socio-technological regime but also provide insights into potential pathways for transitions at the socio-technical landscape level.

2.2 Sustainable business models

In the business development process, actors formulate business models and implement value-driving processes, incorporating various sustainable business model components to varying extents. Bocken et al. (2014) introduced a model delineating business components or 'archetypes' based on strategies for value-driving processes (see Table 2).

These business model archetypes, as depicted in Table 2, are categorized into three groups: technological, social, and organizational value propositions. They play a crucial role in shaping the key components (value proposition, value creation and delivery, and value capture) of fundamental sustainable businesses (see Figure 2).

In Figure 2, the value propositions are specifically interpreted in the context of WMC for all three cases examined in this analysis. The elements of value creation and delivery, as well as value capture, encompass diverse strategies for generating value. Some of these processes involve in-house activities, while others are integrated into a broader supply or value chain or even an industrial system. This

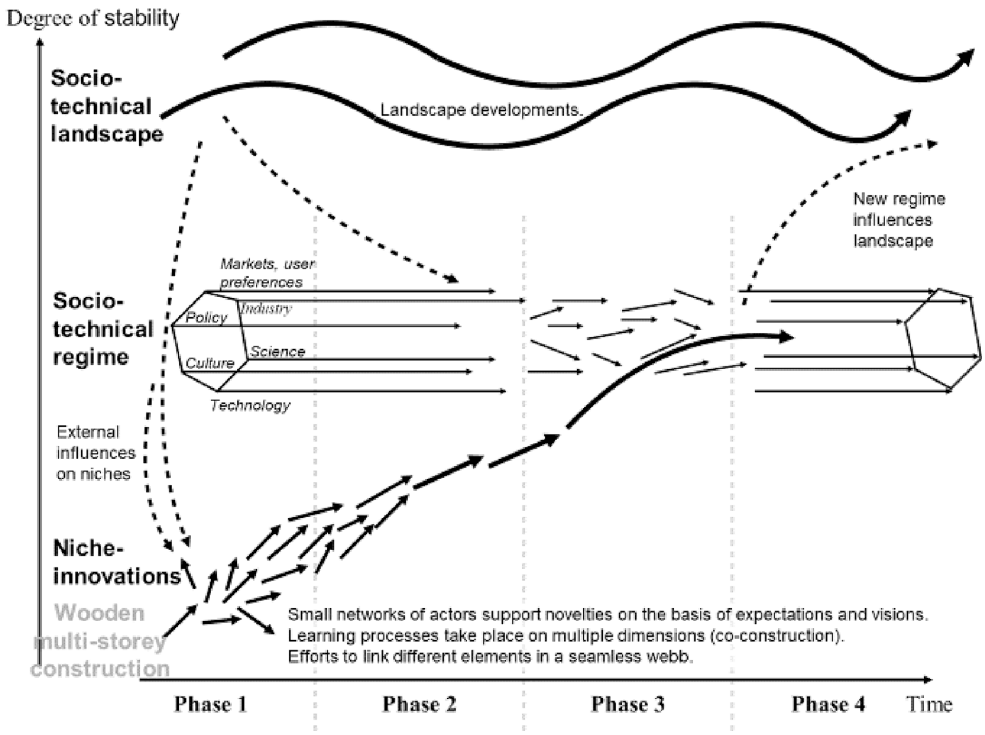

FIGURE 1
A theoretical perspective for sustainability transition processes [inspired by Geels (2018, p. 226)].

TABLE 2 The sustainable business model archetypes [inspired by Bocken et al. (2014, p. 48)].

Grouping	Archetypes
Technological	Maximize material and energy efficiency Create value from waste Substitute with renewables and natural processes
Social	Deliver functionality rather than ownership Adopt a stewardship role Encourage sufficiency
Organizational	Repurpose for society/environment Develop scale-up solutions

aligns with the distinction McElhaney (2008) drew between instrumental and political corporate responsibility.

2.3 Co-creation of value

The co-creation of value is a collaborative process involving a for-profit organization and its partners, which can include NGOs, state organizations, or consumers. This collaboration aims to develop innovative products or services and foster new ideas, emphasizing relationship marketing. Sometimes, this collaborative effort is termed a public-private partnership (PPP), seen as a potential avenue for addressing sustainability challenges (Waddock, 1991; Glasbergen, 2011; Hallström et al., 2014). Glasbergen (2011) defines PPPs as collaborative processes evolving through steps like establishing a shared agenda and forms for joint work (Figure 3).

The conditions for a gradual sustainability transformation process, as articulated by Glasbergen (2011, p. 4), align well with the concepts of value creation (Bocken et al., 2014) and the significance of institutional conditions (Geels, 2018). Value creation, especially in terms of value proposition and capture (Bocken et al., 2014, Figure 2), occurs both internally and in collaborative organizational settings. Geels (2018) refers to this as niche innovation within the broader context presented in Figure 1.

In the construction industry, this process involves addressing resource efficiency challenges through internal corporate adaptations of materials and processes, as well as at a systemic level. Collaborative efforts and a systems perspective become pivotal conditions driving the transformation of market development. Employing Geels (2018) conceptual model, this process unfolds at a socio-technical regime level, with the potential to influence a gradual change at the landscape level. In the construction context, this landscape-level change could manifest as alterations in legislation.

3 Method – a qualitative approach

3.1 Research procedure

The study's methodology is grounded in a practical understanding of real-world situations, as emphasized by Robson and McCartan (2016). The focus of the research is on multistory construction projects, with a particular emphasis on the corporate perspective,

FIGURE 2
Key components of the business model framework [Based on Osterwalder and Pigneur (2005) and Bocken et al. (2014, p. 48)].

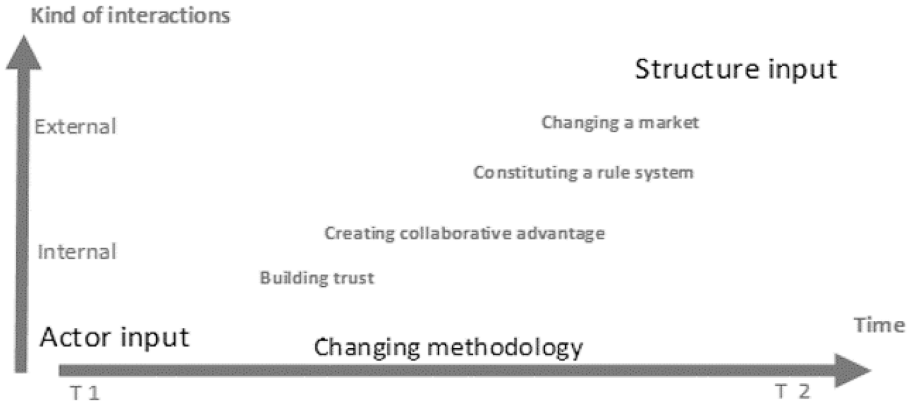

FIGURE 3
A model for an idealized process for the development of public-private partnerships (Glasbergen, 2011, p. 4; with modifications).

recognizing its significant influence in the overall construction development landscape, as highlighted by Toppinen et al. (2019). For comprehensiveness, the study incorporates details about specific construction projects.

The research also pays attention to institutional conditions, which form the contextual backdrop for the study. These conditions are explored through interviews with key informants, adding depth and insight to the understanding of the construction projects and their broader implications within the institutional framework. This inquiry's research process unfolded in two distinct steps:

3.1.1 Step 1

Key informant interviews were the first step, aiming to capture the prevailing scenario of wood construction in Sweden and its connections to sustainability transitions, and the current status. These interviews offered expert insights into the present socioeconomic, economic, and technical facets of wood construction, essentially providing a snapshot of the socio-technical regime.

3.1.2 Step 2

The second step involved interviews based on qualitative semi-structured questionnaires with open questions with Swedish professionals engaged in building projects. The interviews involved both managers at the corporate level and operational leaders who managed individual projects. These interviews delved into aspects such as business models, co-creation of value, and industry perspectives on the role of wood construction in a sustainability transition.

These methodological steps align with an empirically driven approach, detailed further in the following sections (3.1–3.3). In steps one and two, we conducted interviews with key informants and representatives from selected construction corporations, which are detailed in sections 3.1.1 and 3.1.2.

3.2 Key informant interviews

Key informant interviews aimed to gather insights and perspectives, covering policy development, municipal planning, the developer/housing sector, and end-user involvement. The selection criteria aimed at capturing features of the sustainability transition within the WMC sector, such as urban sustainability trends from a research angle, perspectives of a developer and public housing company actor, policymaker, architect/designer, and municipal administrator. These interviewees were identified through an advisory board associated with the Knock on Wood (KNOW) project and had leading positions in organizations or building companies that are active across the whole of Sweden. The interviews, as outlined in Table 3, were tailored to capture specific information within each respondent's area of expertise.

TABLE 3 Key informant interviews providing a contextual understanding.

Key informant	Date	Justification for selection	Topics
Researcher, Urban sustainability	27/32021	Overview of sustainability in urban areas	Key stakeholders in wood construction Regulations and wood construction
Representative of developer and public benefit housing company	27/32021	Provides views from a large developer and housing company on sustainability and material choice	The market structure for wood construction Selection of construction companies Number of potential suppliers of WMC View on wood versus more climate-intensive projects Environmental certification The role of municipalities View on sustainability and circularity
Project leader at the National Board of Housing, Building, and Planning	7/52021	Current development of environmental declaration on building materials	Planned policies for climate declarations Climate impact of construction Sustainability indicators in construction Zero emission targets The role of wood construction in lower emissions EU policies for reduced climate impact EPD – Environmental Product Declaration Policy means
Wood Architect, Experience in wood construction in co-building	12/42021	Collect insights of 'alternative', especially co-creation on housing types involving wood	WMC market structure Wood construction technologies Community housing and wood construction The role of municipal policy for wood building Outlook for wood Construction and sustainability Know-how and WMC The role of the architect
Responsible for wood construction program in municipality active in wood	23/92021	Understand the role of a municipality's perspective on sustainability and wood construction	Description of wood construction projects End customer requirements on wood construction Wood hour maintenance Sustainability and circularity in building

Interviews, lasting from 30 min to 2 hours, were conducted by two or three researchers. Comprehensive notes were taken and interview manuscripts of about 20 pages per interview were prepared. These summaries underwent validation by the interviewees. The preliminary findings from these interviews, combined with a literature review (Jussila et al., 2022), guided the design of the study's second step: case studies. Moreover, the study's findings are discussed and contrasted with relevant results in the extensive literature review (Jussila et al., 2022).

3.3 Qualitative interviews and case studies

The further case interviews explored detailed analyses of six wood construction projects. The activity began by selecting three cities with substantial wood construction activity and targeted municipal policies for WMC (Table 4). These cities, featuring diverse WMC types at locations with growing populations, formed the backdrop for the case studies. In each locality recently finished wood construction projects (< 3 years old) were selected, because the activities and encountered challenges would be in fresh memory.

To capture both strategic and operational perspectives, we adopted a two-level case study approach. In each project, local project leaders provided insights into local processes and co-creation aspects of the WMC markets. Interviews were also conducted with representatives at strategic headquarters levels, such as CEOs, marketing officers, or sustainability officers. In smaller companies, a single person might handle multiple roles, as shown in Table 5. The material contained 160 pages and 58,831 words.

3.4 Case interview approach

We conducted qualitative interviews to collect data, as they are recommended for capturing individual attitudes and values (Byrne, 2004). Qualitative interviews offer a unique opportunity to gain insight into people's fundamental life experiences (Kvale and Brinkmann, 2015). To ensure a systematic approach, we developed the interview questions using an analytical framework, enhancing the ease of coding and subsequent analysis. The interview guide adhered to the business model change and co-creation aspects. It included the following corporate-level aspects: Company business model, characterization of customers, customer sustainability requirements, the role of sustainability in business strategy, business operations, and sustainable innovations. Project-level questions concerned: time plan, business partners, collaborations, customer relations, end-user contacts, and sustainability requirements.

TABLE 4 Selection of cities in the empirical study.

City	Population 2021	Criteria for selection of city	Wood construction project
Gothenburg	587,549	The second largest city in Sweden, known for environmental city planning concerns but no WMC strategy	Housing types Start-Finish Number of apartments
Uppsala	237,596	A medium size city, with no WMC strategy, but a climate mitigation policy	Housing types Start-Finish Number of apartments
Växjö	95,995	A relatively small, well-known 'wood city' with strategies for WMC	Housing types Start-Finish Number of apartments

TABLE 5 Case interviews.

Interviewee	Project City	Date interview (year-month-date)
Project manager	Göteborg	2021-11-23
Project manager	Göteborg/Växjö	2021-11-09
Technical manager/ Head of sust. (HQ)	Göteborg/Växjö	2021-11-01
Project manager	Göteborg/Uppsala	2022-02-18
Project manager	Göteborg/Uppsala	2022-02-18
CEO	Göteborg/Uppsala	2022-01-20
Project manager	Uppsala	2021-11-08
Project manager	Uppsala	2021-11-08
Project manager	Växjö	2021-11-08

The interviews were semi-structured, following a predefined set of questions and theme sequences (Kvale and Brinkmann, 2015). Researchers diligently followed up on interviewee responses and narratives (Kvale and Brinkmann, 2015).

Due to the COVID-19 pandemic, the interviews were conducted online, leveraging technology to facilitate the research process. The sessions were recorded and subsequently transcribed into text, with the transcripts shared with interviewees for validation. This approach not only adhered to safety measures during the pandemic but also allowed for a thorough examination and validation of the collected data.

3.5 Analysis

After completing empirical data collection, the analytical process followed, which encompassed transcription, validation, and thematic coding. To streamline this process, NVIVO, a computer-assisted qualitative data analysis software, was employed (Saldaña, 2021). NVIVO facilitated the coding, storage, and analysis of the interviews, enhancing the efficiency of the analytical approach.

Throughout the analysis, individual annotations were incorporated into the text using analytical memos, following Saldaña's (2021) recommendations. The authors engaged in discussions to develop a coding framework. Subsequently, the analytical procedure involved initial descriptive coding and aggregation where several codes were joined in clusters, followed by pattern coding to generate more concise and focused categories. This stepwise approach ensured a systematic and comprehensive analysis of the gathered data.

4 Results

4.1 Insights from key informant interviews

The empirical findings unfold in two sequential steps, commencing with insights from key informant interviews that set the empirical context. Subsequently, we delve into case-specific empirical data and interviews. A comprehensive analysis of key informant interviews revealed pivotal findings about the current status and trajectory of residential wood construction in Sweden (Table 6). This comprehension serves as the contextual backdrop, akin to Geels (2018) socio-technical regime. This section is followed by the findings in the subsequent case studies.

The interviews reflected that there are several institutional, economic, and behavioral drivers behind a transition towards wood construction, at local, national, and EU levels. Expected developments play an important role and the interviewees also mentioned obstacles and factors that are slowing the development, such as professionals' knowledge and sunk investments.

These results informed the subsequent case studies and interviews with more precise data about business models, stakeholder interaction, wood construction development, and sustainability performance.

TABLE 6 Findings from key informants.

Key informant	Key finding
Researcher, Urban sustainability	County Administrative Boards and municipalities can, in some cases, influence material selection through requirements on climate impact and circularity. The WMC is often interconnected with land allocation agreements with the municipalities. Presentation of a range of local regulations affecting construction projects: noise legislation, shore land protection, and zoning. Expected tighter climate regulations can favor WMC against other materials.
Representative of a private developer and housing company	The official requirements and strategies within developers and housing companies are toward climate neutrality. The environmental advantages of WMC can and probably will be more publicly promoted. Turnkey contractors are important so that the contractor is aligned with the goals (e.g., climate declarations). Fossil materials are becoming more tightly connected to risk. The municipality plays an important role in the development of wood construction, both as specifiers and sellers of land in city planning projects. Circularity is being developed within the housing sector.
Project leader at the National Board of Housing, Building, and Planning	The building sector must become climate-neutral by 2045. LCA and EPDs are important policy tools to reach this goal. Successively stricter climate emission limits are expected. WMC has a lower impact compared with other materials. Four policy areas influence WMC: annulated carbon credits, means of control, zoning, and WMC strategies. Financial and insurance institutes can be future partners in giving green loans and more advantageous insurance for more climate-friendly housing.
Wood Architect, Experience in wood construction in co-building	Wood is good as a product with a long life and for storing CO_2. It is a sustainable material. Co-building groups are often genuinely interested in wooden, environmentally sound building practices. They offer opportunities for co-creation between the construction enterprise and the dwellers. Astonished that architects are not more interested in wood; focus on aesthetics/fashion often results in concrete houses. The developer has a very central role when house materials are chosen. Land access is key for co-building groups. The political process and municipal land allocation strategy are very important for wood construction.
Responsible for wood construction program in municipality active in wood	There is an increasing housing deficit in many municipalities. Closeness to the forest and culture to support the forest industry has promoted wood construction in this municipality. Wood construction would be helped by municipal support and coordinated maintenance plans for WMC housing.

TABLE 7 Themes for codes from the interviews.

Themes of codes	Explanation
Business model	Codes that describe how business models are described
Development work	Codes that described developments and improvements within the WMC
Costs	Codes that described costs related to aspects of WMC
Marketing	Codes that described the marketing aspects of WMC
Sustainability	Codes describing sustainability in the WMC sector

4.2 Case study findings

Emergent themes and critical topics derived from our two-tiered coding process and case interviews were elucidated in Table 7, with detailed results expounded in subsequent sub-sections. The inductively obtained themes reflect key concerns during the WMC transition process.

4.2.1 Business model

Respondents underscored the 'open' nature of their business models, emphasizing collaboration with partners and local authorities in the evolving WMC landscape. Collaborative efforts centered on mitigating climate impact and addressing technical challenges. Despite acknowledging the time-intensive nature of such collaborations, project leaders conceded the necessity of collaborations and dialogues for the advancements. However, two strategic groups could be identified regarding end-consumer engagement in the construction process: those focusing on limited contacts and prospective dwellers, employing a 'product-dominant logic,' and those building companies tailoring solutions throughout the construction process, epitomized by the Co-building group's 'service-dominant logic.'

In most interviews, the product focus prevailed, with customer contact primarily concentrated on the customer/developer relationship. These limited interactions with end consumers prompted some respondents to express a desire for more customer feedback and even participation, recognizing its importance in refining the construction process. Differences in business models between

building companies were particularly clear in their sustainability communication, ranging from a limited emphasis in the communication about the wooden building material to strategies highlighting wood as a unique selling point.

Municipalities played a pivotal role in shaping business models and fostering networks involving local authorities, research institutes, and collaborating businesses. Quality management emerged as a crucial component, with a nuanced view of material competition, where each material has its pros and cons, and an emphasis on collaborative value creation involving local authorities, architects, and key professionals involved in the construction. The business model's *value capture* depended on its ability to achieve high production efficiency and customer satisfaction, which both were products of good planning and process flexibility.

4.2.2 Development work and innovations

All interviewees observed the ongoing transitional phase in the wood construction sector, emphasizing the continuous need for the development and refinement of building components and processes. The imperative to combine materials efficiently, coordinate product flow, and address sustainability concerns underlined the dynamic nature of the industry. Energy performance improvements in newer buildings resulted from collaborations between wood-component factories, contractors, and structural engineers, contributing to cost-and energy-efficient solutions. Discussions also indicated a burgeoning shift towards embracing broader sustainability goals in construction planning and realization – not only climate impact – including biodiversity and well-being, e.g., through community attractiveness.

Respondents acknowledged the advantages and challenges of wood in construction, while also highlighting the need for optimal material combinations allocations. Continued technical development, often in collaboration with research institutes, was identified at the companies' strategic, management level as key to enhancing customer satisfaction. Project leaders described, on the other hand, incremental innovations that continuously reduced costs and lead times in production.

4.2.3 Costs

Cost-related goals focused on reaching the desired target market without compromising quality and reducing costs and waste during construction. Concerns about volatile wood prices and the intricate connection between production efficiency and logistics were highlighted in the interviews. Logistics, especially in urban environments, posed challenges requiring meticulous planning for wood elements and modules. These operations required good lead time management with a well-planned approach considered advantageous for cost savings and opportunities to streamline the processes. Dialogues between entrepreneurs, building material suppliers, and local policymakers were deemed essential for addressing the limited experience with wood as a construction material.

In comparison to other projects, those that involve collaboration between developers and future residents, known as co-managed projects, have a unique feature. In these projects, individuals who will eventually occupy the space had the opportunity to actively influence and provide input on various construction stages throughout the entire process. This approach could increase customer satisfaction and foster a greater sense of engagement among the end consumers, although at higher costs in certain instances.

4.2.4 Marketing

Construction companies played a partial role in marketing built apartments to developers and future residents, emphasizing technical aspects like energy performance. Marketing communication occasionally touched on the environmental benefits of wooden houses, although challenges were acknowledged in communicating carbon-binding properties to end-users. The structural material, wood, itself was not frequently leveraged as a unique selling proposition.

Hence, the value proposition as per Bocken et al.'s (2014) framework, is predominantly aligned with the technological dimension (efficiency in resource use) and partly with the social dimension (delivery of functionality). Proactive strategies to drive sustainability transitions to a landscape level were yet to manifest.

4.2.5 Sustainability

Legal requirements in construction influenced both developers and builders to reduce climate impacts and acquire the necessary skills to comply with current and expected standards and requirements. Respondents referred to the advantages of the wooden material in relation to, e.g., concrete but they also indicated challenges connected to the climate performance in the construction phase and wood procurement. The respondents' views on sustainability management reflected both current requirements from municipalities and customers and expected future climate policies affecting material choice.

Broader sustainability aspects were also extensively discussed, in the interviews spanning social, environmental, and financial dimensions (Table 8).

In these instances, interviews delved into topics such as work safety, climate declarations, investment principles, and communication, highlighting the multifaceted nature of sustainability in construction.

5 Discussion

This study reflects a situation where wood construction in Sweden has increased, positioning itself closer to becoming a member of socio-technical regimes (Geels, 2018) (Figure 1), although a full mainstream position awaits. According to Figure 1, this would imply that the WMC sector has reached phase 2 or phase 3. The individual business projects displayed similarities, primarily by focusing on value capture through cost efficiency and quality maintenance. Co-creation of value is crucial for WMC market development, albeit with limited direct contact with prospective dwellers – except in co-managed construction projects.

Institutional factors, particularly climate impact regulations, are anticipated by business actors to propel climate-friendly construction. Logistics, costs, sustainability communication, and marketing emerge as vital considerations among WMC companies. These findings support the importance of the development of an institutional context for market development, similar to what has been identified needs in Finland (Toppinen et al., 2022). While wood construction contributes to sustainability transitions, this study suggests that this evolution is gradual, contingent on factors like public procurement, incremental learning, client preferences, sustainable business models, and legislative changes.

TABLE 8 Sustainability aspects in WMC business models reflected in the interviews.

Sustainability aspect	Viewpoints from the case interviews
Social	Contemporary policymakers and societal attention are directed towards addressing climate impact, comparatively less emphasis is on social sustainability. Assessing social sustainability performance in the construction sector is challenging. Elements such as light, noise reduction, and air quality are indicators of the "quality of life," which are components of social sustainability.
Environmental	The WMC is dedicated to contributing to climate neutrality in construction. Opting for wood in construction holds the potential for dual advantages, contributing to both climate preservation and financial gains. Wise planning and investments can favor sustainability, e.g., centralized waste management systems, where initial investments translate into sustainable and cost-effective outcomes over the long term.
Financial	Investors perceive wooden construction as a strategic environmental investment. With the upcoming generation, aged 18–24, becoming the primary apartment buyers, there is a potential surge in demand for climate-efficient construction.

The findings do in several aspects support findings in previous studies [and referred to in Jussila et al. (2022)]. As suggested by De Keyser and Mathijs (2023), this study also points to the importance of appropriate business models in the bioeconomy sector. Our findings distinguished the degree of customer involvement as an important business model feature. Closer contact with the users was recommended by Toppinen et al. (2018) as a key success factor for the WMC industry.

Future growth depends, according to the respondents, on sectoral adaptation to legislative demands, environmental values, and innovative financing. The industry's focus on technical and logistical aspects, alongside product quality, indicates a focus on a stable but measured pace of progress. The open position towards other stakeholders supports the findings by Gosselin et al. (2018). Both this study and Gosselin refer to value-added stakeholder relationships that may handle obstacles. Obstacles that collaborations can bridge may refer to challenges related to standards and misconceptions regarding multi-story wood construction, which conform with findings by Nordin et al. (2010), Riala and Ilola (2014), and Vihemäki et al. (2019). Further, our findings also align with Ramage et al. (2017) and Chen et al. (2020), regarding the perceived importance of development work and quality advantages of wood. They also support Sandberg et al. (2008), highlighting the need for streamlined production abreast with the implementation of sustainability enhancements.

The role of wood construction for sustainability transitions, previously considered by Toppinen et al. (2019) as well as Pelli and Lähtinen (2020), was also mentioned in our inquiry, in particular in the key-informant interviews. They highlight that a strategy must embody both incremental efficiency enhancements with sustainability improvements, much in line with what is described as win-wins by Piercy and Rich (2015).

However, cost efficiency and rapid installation (short lead times) were prime considerations in our interviews; answers that were also noted by Roos et al. (2010) and Jussila et al. (2022). The views on cost competitiveness for WMC varied, but it was consistently a priority competitive consideration by leaders and managers, which was also recently concluded by Markström et al. (2019).

Marketing can, according to our findings and previous studies, in several instances be linked to influencing *stakeholder awareness;* a need that is prompted by a low familiarity and also low confidence among stakeholders for wood construction (Markström et al., 2018; Stern et al., 2018). Maybe this is why, in our findings, the wood building industry was considerably more focused on emphasizing the system's performance advantages rather than the environmental aspects. Overcoming misconceptions may be the most important path towards improved competitiveness (Lähtinen et al., 2021).

The role of the sustainability potential of wood in construction was noticed and discussed by the respondents. References to general improvement possibilities in line with Sathre and Gustavsson (2009), and on a wider geographical scale (Churkina et al., 2020; Ogunmakinde et al., 2022) were in some cases indicated by our respondents. Still, the interviewees were not so much helped by the global expectations that WMC could become a competitive type of carbon sink compared to other carbon-storing alternatives. The respondents' first concern was to satisfy customers and avoid reclamations. Large-scale sustainability transition visions are therefore not dominant in the answers – but product quality and customer needs are. Sustainability considerations were mentioned in terms of assessment criteria, as a by-product of wood construction that also presents other quality advantages such as speed in construction and light weight. However, our answers reflected expectations that climate policies gradually would imply further climate regulations in the construction sector, which probably can promote wood construction.

The findings cannot be generalized beyond the cases, or the specific position in the business cycle and evolution stage for MWC. Based on experiences and positions among key actors of the WMC industry, it investigates their priorities and concerns about business practices and processes. The findings are bound to the economic development, context, location, and other time-dependent factors (e.g., the public discussions) and they reflect what Geels (2002, 2004, 2018) refers to as a development on a niche level. Answers and key concerns may vary depending on the business cycle. However, the study's relevance and applicability in different conditions can also be evaluated by assessing the methods and procedures utilized in this study.

Future research should analyze the strategic adaptations among all key stakeholders in the WMC sector as emission standards and climate performance standards increase. More knowledge about the change process would enhance the effectiveness of successive learning

mechanisms, which aid in identifying appropriate policy instruments, facilitating a smoother transition towards sustainability.

6 Managerial implications

This project highlights three key areas where business models for WMC can impact market development, particularly in sustainable development: urban land use, societal sustainability, and architectural innovation.

WMC can influence urban land use by promoting efficient land utilization through higher-density construction methods. This efficient use of resources, often termed "smart," is based on reduced energy consumption and the reuse of materials. Innovative architectural and construction practices facilitate these efficiencies.

In summary, while multistory construction strategies provide solutions to urban density, sustainability, and housing needs, they also necessitate careful consideration of their broader implications on society, the environment, and the economy. Striking a balance among these factors is crucial for successful business model development in urban planning and development.

Based on our findings regarding the industry's perspective on its role in sustainability transition, we recommend promoting incremental development of processes and products through frequent exchange of lessons and ideas within the industry and ongoing R&D efforts focusing on solutions to operational and sustainability challenges.

7 Conclusion

This study has yielded insights into the WMC sector. While wood is widely recognized as a sustainable building material, building companies continue to prioritize cost efficiency and value creation. The industry's decision-making is shaped by developers' priorities and regulatory frameworks, delineating the parameters within which wood construction companies operate. While acknowledging the potential competitive advantage of addressing climate impact, the industry predominantly concentrates on strategic and operational aspects that are within its control for continuous improvement.

The sector is actively pursuing incremental enhancements in both quality and efficiency. Rather than emphasizing the environmental benefits of wood, industry stakeholders are strategically focusing on refining their processes and operations to ensure sustainable growth. This approach underscores a commitment to balancing ecological considerations with pragmatic business objectives.

Representatives in the WMC sector pragmatically recognize both the merits and challenges of wood construction. Views are grounded in a preference for gradual growth, emphasizing reliable raw material supply, continuous learning, and adaptive legal frameworks.

Sectoral growth hinges on exemplary housing offerings prioritizing quality, affordability, and swift construction. While climate impact remains a competition driver and the business actors expect increased climate regulations, this study suggests that it is not a paramount consideration for most residents.

Rather than endorsing a polarized competition between building materials, the industry accepts hybrid construction forms. Business models primarily align with technological archetypes, emphasizing efficiency in resource use. The sector's evolution was marked by incremental improvements, focusing on legislative compliance and process standardization, underscoring a measured approach to achieving competitiveness in WMC.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

EN: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing, Data curation. JJ: Investigation, Methodology, Writing – review & editing, Validation. LH: Writing – review & editing, Conceptualization, Validation. KL: Writing – review & editing, Conceptualization, Methodology. CM-H: Writing – original draft, Writing – review & editing, Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Data curation, Funding acquisition, Supervision, Validation, Visualization. RT: Writing – review & editing, Conceptualization. AT: Writing – original draft, Writing – review & editing, Investigation, Validation. AR: Writing – original draft, Writing – review & editing, Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Data curation, Software, Validation, Visualization.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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