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Timber construction as a paragon for regenerative building production in Sweden

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Abstract. The Swedish construction industry is experiencing a resurgence of timber construction, driven by sustainability goals and advances in wood technology. This positional paper argues that such a resurgence can catalyse a new regenerative building production paradigm that not only mitigates environmental harm but actively contributes positive ecological and social value. Informed by the sustainability transitions theory and adopting the phenomena construction methodology, we synthesize literature and industry evidence to conceptualize timber construction as a paragon for regenerative practice. Through this lens, we analyse how timber projects can embody regenerative principles in material choice, carbon footprint, site processes, and community well-being. We then discuss the implications of this paradigm for construction management in Sweden, including the need for new collaborative business models, supply chain integration, and skills development. This paper contributes to the sustainable production discourse by positing that embracing timber-based regenerative production has the potential to bring about a contextually significant paradigm shift towards net-positivity and resource efficiency but will require Swedish construction practitioners to radically rethink production management practices.

1. Introduction and background

Buildings and other construction projects account for 30-40% of global energy consumption and over 30% of annual CO_2 emissions [1]; in response, sustainable construction practices have been promoted to curb such negative impacts. In Sweden, the resurgence of timber construction (e.g., using engineered wood products like cross-laminated timber and glulam) has been hailed as a contributor to such practices [1]. Timber is a renewable, bio-based material that can significantly reduce embodied CO_2 emissions compared to conventional steel and concrete [1]. Today timber construction has yielded flagship projects like the 20-storey Sara Cultural Centre and the (ongoing) 250,000 m^2 development project Stockholm Wood City.

A few flagship projects notwithstanding, short-term cost reduction and profit maximization are still prioritized over long-term resource efficiency and climate neutrality in Swedish praxis [5]. Coupled with urgent national and international climate goals [6], it seems that mainstreaming sustainability, circularity, and resource efficiency would require a radical paradigm shift towards a long-lasting net positive impact [7,8]. In this vein, one can look at the concept of regeneration, which pushes beyond classic approaches of sustainability and circularity by opting for “more good” instead of just “less harm”; regeneration thus points at net positivity instead of just net neutrality through damage repair, improving well-being, reversing environmental degradation, restoring ecosystems, and involving humans as ecosystem contributors [9,10].

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However, regenerative measures, strategies and business models have not been widely adopted in Swedish building production. Recent studies have initiated early conceptualizations of what such an adoption would entail [7,8], but have not yet connected it to contemporary practices. Therefore, in this positional paper representing the initiation of our research, we address the research question how and why the resurgence of timber construction in Sweden can catalyse regenerative building production practices. To address this research question, we adopt the theoretical framework of sustainability transitions [11] and utilize the phenomena construction methodology [12] to synthesize literature and industry insights. Our results show that timber construction can be utilized to not merely address current sustainability demands incrementally but rather push for radical paradigm shift toward regenerative building production. This shift would in require reframing construction management practices, as well as financing, production, organizational and business model innovations; our contributions include, among others, proposals for such reframes and innovations, like collaborative approaches in procurement (e.g., alliance contracting), innovation ecosystems extending beyond single projects to networks of firms across projects, and adopting new KPIs for regenerative performance.

2. Theoretical framework: Sustainability transitions

Sustainability transitions theory (STT) views incremental improvements and technological fixes in sociotechnical systems as ultimately failing to address challenges incurred by unsustainable consumption and production; therefore, it pushes for radical change [10]. STT is primarily grounded in the nexus of the sociotechnical concepts of the multilevel perspective (MLP), technological innovation systems (TIS), and strategic niche management (SNM) [11,13,14].

MLP views transitions as non-linear and unravelling across three nested structuration levels: niches, sociotechnical regimes, and the landscape [11]. Niches are incubators for radical innovations that can be develop while being shielded from competitive market forces (e.g., pilot projects for regenerative timber construction) [11]. Socio-technical regimes refer to the dominant technologies, infrastructures, business models and institutions that are stabilised by incumbent actors and routines, concretizing path-dependence and incremental change [11]. The landscape includes broader exogenous trends (e.g., climate targets, economic relations, cultural values) pressuring the regime [11]. In this structuration, transitions occur when niche innovations mature and align with landscape pressures to sufficiently destabilise existing regimes and take their place [11]. As regimes are typically change-resistant, niche breakthroughs often require both internal momentum and external landscape pressure [11,15].

Following MLP, TIS focuses on developing innovation systems around a specific technology or solution (e.g., using timber for construction), and comprises actor networks (contractors, users, policymakers), institutions (regulations, norms), and technological innovation artifacts [13]. TIS conceives seven systemic functions as key processes that must be fulfilled to successfully develop and diffuse a novel technology: (1) knowledge development and diffusion; (2) entrepreneurial experimentation; (3) directionality of innovation efforts; (4) market formation; (5) sociopolitical acceptance and legitimation; (6) resource mobilisation; and (7) positive externalities (spillovers reinforcing the system) [11]. Systemic barriers hindering innovation can be assessed in terms of their functional strengths and weaknesses – e.g., a stagnation in thinking beyond sustainability and towards regeneration while using timber might reveal a lack of relevant business models or scepticism about building code compliance. Through TIS, early-phase innovation dynamics can be mapped and policy or network interventions to strengthen the

innovation system can be pursued [13]. While MLP focuses on the active destabilisation of incumbent systems, TIS looks at the emergence and diffusion of novel innovations [11].

SNM further examines the deliberate nurturing of niche innovations into regime challengers [14]. Like MLP's incubators, SNM posits that radical innovations typically start in protective niches, such as subsidised demonstration projects [11]. In the niches, dedicated actors (e.g., contractors working with timber or clients practicing social procurement) invest in the innovation's development through three iterative processes of experimentation and feedback: (1) learning about technical issues and broader societal impacts; (2) forming broad stakeholder alliances to support the innovation; and (3) articulating compelling narratives to attract attention and resources [11][14]. SNM can thus guide successful niches into scaling up and entering mainstream markets – e.g., adopting regeneration in building production while using timber.

MLP, TIS, and SNM are complementary; niches can be managed to function as seeds for broader transition dynamics [16]. However, while all three concepts adopt a systems perspective to capture the complexity of sociotechnical change [11], they differ in focal scale and analytical lens. MLP structurally overviews transition dynamics across levels, highlighting how landscape pressures and niche-regime interactions drive systemic change. TIS identifies enablers or inhibitors in the innovation process for a technology. SNM gives a process view for cultivating practical innovations through experiments and learning-by-doing. MLP is thus useful for understanding the macro-context and timing of transitions, TIS for diagnosing innovation system weaknesses and crafting policy support for meso-level system building, and SNM for informing on-the-ground experimentation and micro-level innovation and stakeholder management.

3. Research method: Phenomena construction

This paper situates the insights gained from a targeted literature review within the theoretical framework and then utilizes that to develop its position. We first conducted a systematic literature review (SLR) [17] to: (1) review the historical and technical factors underlying the resurgence of timber construction in Sweden, and (2) explore the general application of regeneration in the built environment. For the latter, we focused on 2016-2025 to capture the recent emergence of, primarily, regenerative design as a distinct paradigm [17], on the basis that the field is relatively nascent and rapidly evolving, with key definitions, frameworks, and examples yet to be solidified. We targeted peer-reviewed academic sources across Scopus and Web of Science, using keywords like "timber construction", "Sweden", "regenerative design", and "built environment". We prioritised literature from the Global North, since much of the relevant discourse originates there, but also included studies from the Global South (when available) to provide broader context. We applied standard systematic screening [17], first by filtering by title/abstract relevance and following with full-text review. Grey literature (e.g., industry reports, guidelines) was also consulted to illustrate two selected recent practical applications, i.e., Sara Kulturhus in Skellefteå and the Stockholm Wood City in Stockholm, as contextual examples where timber construction showcases innovation capabilities in sustainability transitions. The SLR was conducted in iterations, at first broadly netting 2,500 hits; after five systematic screening loops and gradually more specific keywords (e.g., "regenerative construction cases"), we ended up with 56 references.

Following the SLR, we employed the phenomena construction methodology [12] to synthesize our findings on timber construction in Sweden, regeneration in the built environment, and the industry evidence of the two aforementioned cases, into the previously unutilised context of building production. The phenomena construction methodology encourages researchers to actively construct the phenomenon of interest rather than simply accept established definitions

[12]. In our case, “regenerative building production using timber" is not an existing concept, so we built it by synthesizing our literature findings within the STT sociotechnical concepts. We thus addressed our research question by identifying key attributes of regenerative practice and re-conceptualising them for Swedish building production using timber; in this, we combined regenerative principles, sociotechnical transition factors, and timber construction practices.

4. Literature findings

4.1 The evolution and resurgence of timber construction in Sweden

70% of Sweden’s land area is covered by forest, of which ca. 80% is actively managed for timber production [1]. This enabled a dominant historical tradition of timber housing, especially for detached and low-rise dwellings [1]. However, post-WW2 building regulations effectively capped timber buildings at 2-3 storeys due to fire safety concerns; concrete and steel thus became the default materials for most building production in Sweden [1,2]. However, in 1994, the Swedish building code moved to a performance-based regulation and lifted the absolute height restrictions on timber structures [1,2]. This shift, combined with technological advances in engineered wood, led to a rekindled interest in timber construction. New wood bonding technologies led to products like cross-laminated timber (CLT) and advanced glued-laminated timber (glulam), considered to possess improved structural, technical, and even CO_2 sequestration capabilities [1,19,20].

Following these changes, a series of demonstration projects and government-industry initiatives helped accelerate timber construction by demonstrating that timber could meet structural and safety standards for mid- and high-rise buildings, while offering rapid assembly through prefabrication. The Swedish government supported initiatives like Trästad (Wood City) in the 2000s and 2010s, which funded regional projects to develop modern wood construction techniques and supply chains [21]. Several landmark timber buildings were produced, like the Limnologen Project consisting of four 8-storey timber apartment blocks in Växjö in 2009 [22]. In 2021, the 20-storey Sara Kulturhus in Skellefteå became one of the world’s tallest timber buildings [23]. Its structural system is almost entirely timber-based, combining CLT cores, glulam columns and beams, and CLT floor slabs, and prefabricated timber modules assembled on-site were used for the building’s hotel room units [23]. Notably, Sara Kulturhus has been documented as climate positive over its lifecycle, largely due to timber’s low emissions and CO_2 sequestration capabilities; the timber structure stores an estimated 9,000 tons of CO_2, while energy-efficient systems like solar panels are supposed to further reduce operational emissions [24].

In parallel, Swedish developers are scaling up timber in urban development. In June 2023, Atrium Ljungberg announced Stockholm Wood City, a 250,000 m^2 district in Stockholm’s Sickla area composed predominantly of mid-rise wooden structures (including ca. 7,000 office workplaces and 2,000 housing units) [25]. Construction commenced in 2025, with full project completion set to 2027 [25]. Reportedly, Stockholm Wood City aims at showcasing lifecycle climate advantages of timber construction as documented in research [26], but also realizing potential socioeconomic benefits – e.g., better air quality, reducing the occupants’ stress, improving productivity, and construction sites involving fewer heavy truck deliveries [25]. Such ambitions are also coupled with systems promoting on-site renewable energy generation and storage, such as rooftop solar arrays, battery storage, and underground thermal energy storage [25]. However, whether such ambitions will be realized at project completion remains to be seen.

Aside the history of timber construction in Sweden and its culmination in recent flagship projects, it is also important to note its high degree of industrialization [27]. By 2020, 97% of all Swedish timber-framed multi-storey buildings were either completely or partially prefabricated

[28]. CLT panels, modular room units, and glulam trusses are typically manufactured off-site in factory settings and then assembled on-site [20,28]. This advanced degree of industrialization aims at increasing manufacturing quality, reducing transportation time and costs, and shortening on-site production time [29,30]. As those can be factors of socioeconomic improvement in the context around the site, it can be considered that industrialization in production can promote regenerative aspects in tandem with the aforementioned climate and energy benefits of timber.

4.2 Conceptualizing regenerative building production

Regeneration in the built environment has emerged as a paradigm beyond sustainability considerations aiming to simply reduce harm (e.g., lower CO_2 emissions). Instead, regeneration strives for net-positive effects actively restoring and improving socio-ecological systems [31,32]. Regeneration views human development as interconnected with natural and socioecological systems [31,33], co-evolving and mutually thriving through integration and interdependence [34]. In the built environment, regenerative practices seek to renew soils, boost biodiversity, enhance community well-being, and restore the human-nature relationship to counter the ecosystemic degradation brought by existing urban development. Projects are thus placed within broader socioecological contexts via systems thinking, fostering local culture and ecology, co-evolution with natural systems, and net-positive technical ambitions (e.g., renewable energy generation) [31,34]. Ecosystemic services, community well-being, and cultural value thus become measurable success factors in addition to resource efficiency [35,36]. Nonetheless, while recent research highlights the potential for regeneration, ontological and epistemological inconsistencies in defining what that potential means for building production persist [31].

Regenerative principles have mainly targeted the neighbourhood and district levels to foster building and infrastructure integration with nature, as well as improve community and stakeholder engagement [31,34]. District-level projects with relevant ambitions, like Stockholm Wood City, can foster circular systems by synergistically enabling shared energy, water recycling, and community gardens [31]. Building-level examples also exist, such as the net-positive cases of the Bullitt Centre and the Phipps Centre that are accredited through the Living Building Challenge (LBC) [37]. However, by early 2026, fewer than 25 projects worldwide have been fully LBC-certified, revealing a gap between regenerative ideals and mainstream production [31,38]. There is limited guidance on how regeneration can be realised through production, material sourcing, supply chain, on-site management, economic structures, and contractor practices [34].

Relevant barriers include inadequate stakeholder engagement, entrenched industry norms, and lack of incentives, e.g., market valuations rarely consider socioecological benefits, making regenerative investments hard to justify [31,37]. A few pilots have attempted to foster training towards understanding and accounting for such benefits; LENSES (Living Environments in Natural, Social and Economic Systems), a tool developed to help project teams conceptualise and implement regenerative design, was applied in an Australian development [39]. Nonetheless, the sparsity in relevant cases further exemplifies the lack of regeneration integration in mainstream building production even more and highlights the need for capacity-building and education.

5. Timber construction as a paragon for regenerative building production

Informed by the phenomena construction methodology, we will place our literature insights on timber construction, flagship Swedish cases, and regeneration, within the context of building production, while using the previously expounded sociotechnical concepts of MLP, TIS, and SNM. Thus, we will position regenerative building production using timber as a radical transitional

phenomenon and an innovation to be nurtured and scaled. Below, we describe how MLP, TIS, and SNM frame this positioning, and then expound how this is reflected in environmental regeneration, process innovation, community well-being, and potential challenges.

5.1 Framing the phenomenon with MLP, TIS, and SNM

MLP can help identify landscape, regime, and niche factors shaping a regenerative transition in timber building production. At the landscape level, pressures such as climate change, biodiversity loss, international policy shifts, and changing market expectations can create momentum for a regime change. However, the current regime is resistant: contractors prioritise cost minimization, regulations focus on minimum sustainability compliance, supply chains mainly depend on high-carbon materials instead of timber, and a largely risk-averse culture limits experimentation [39].

To drive regenerative building production, TIS points to niche innovations nurtured and connected to regime actors. Timber projects testing regenerative methods (like what Sara Kulturhus and Stockholm Wood City partially did) can act as learning laboratories for new practices. Finally, SNM incentives are essential, offering support through research funding, green procurement, and clients prioritising regenerative goals. As successful experiments accumulate beyond just a handful of flagship projects, networks can form, share knowledge and build momentum, similar to how LEED scaled sustainable practices. A feedback loop can emerge, where landscape pressures (e.g., climate goals) push the regime, enabling niche innovations to influence mainstream practice. As more projects prove viable, larger clients, contractors, suppliers and other actors can begin to adapt, and over time, building codes, standards, and financing tools can evolve to support regeneration, marking a sociotechnical transition from niche to norm.

In this process, intermediaries and coalitions are key – e.g., see below the innovation ecosystems comprising engineered wood producers and suppliers. Ultimately, a radical shift requires bottom-up innovation, top-down pressure, and lateral spread through networks.

5.2 Environmental regeneration: Carbon, energy, and ecology

Timber is a natural carbon store, absorbing CO_2 and locking it in its biomass. When that biomass is used in long-lived building materials (such as mass timber solutions), the carbon remains stored during the building's lifecycle [40]. Thus, substituting timber for more carbon-intensive materials (concrete, steel) can significantly reduce the buildings' embodied emissions [1]. For example, thanks to its timber structure, Sara Kulturhus' embodied carbon footprint is dramatically lower than an equivalent concrete building, and its biogenic carbon storage can lead to a net positive effect over 50 years [24]. Additionally, by integrating 1,200 m^2 of solar panels and efficient energy systems, the building aims at creating a net positive energy outcome [24].

Sweden's focus on prefabrication and industrialized timber further augments these benefits. Offsite production often allows optimized material usage and can be powered by renewable energy [41]. Many Swedish sawmills and CLT factories run on bioenergy (wood residues) or green electricity, meaning the upstream production is relatively low carbon [1]. Shorter construction times mean reduced emissions from on-site machines and transport [41], while timber also avoids the curing time and associated emissions of concrete pours [1,41].

Another aspect is energy performance and renewable integration. Timber's natural insulating properties and the tight integration of CLT panels can contribute to high-performance building envelopes [42]. Many timber buildings also intentionally expose wood in interiors to help with passive humidity regulation and potentially reduce reliance on HVAC [43]. Focusing on passive systems can also be supported by locally produced renewable energy (e.g., through photovoltaic cells, or battery and seasonal geothermal storage) [25]. In Stockholm Wood City,

similar measures can even enable the sharing of energy between buildings [25]. Timber construction does not inherently produce energy, but it can potentially attract clients, designers and contractors willing to implement solutions aiming at net-positivity [44].

Timber can also support the regenerative building production goals of protecting or enhancing ecosystems and biodiversity – though it introduces complexities. On the one hand, a building that uses wood from sustainably managed forests can incentivize forest stewardship and potentially increased reforestation [24]. Sweden's forestry model, which requires replanting after harvest and has growth exceeding harvest in many areas, can support the notion that more timber construction leads to more carbon-sequestering forests being grown [24]. On the other hand, over-extraction is a risk; there is ongoing debate on the optimal rate of timber harvesting [1,24]. A cascading use of wood in a circular bioeconomy maximizing carbon storage time would translate to high-quality timber going to buildings (long-term storage), lower-grade going to other products, and only residual waste biomass burning for energy, but such use is still not fully realized in practice [1,24].

5.3 Process innovation: Industrialization, prefabrication and efficiency

Regenerative building production is not only about what materials or technologies are used, but fundamentally how the building process is conducted. Sweden's timber construction has been intertwined with pushing for process innovation and industrialization [20,29,30]. Increasing efficiency and reducing process waste [8,27] can thus strengthen the conditions for regeneration.

As noted earlier, nearly all Swedish multi-storey timber buildings employ a high degree of off-site prefabrication [28]. This has led to new business models for industrialized construction of multi-storey houses [29]. Firms are developing standardized timber building systems and modular components that can be replicated with modifications across projects [1,29]. Examples include CLT panel systems, volumetric modular systems, and hybrid systems [29]. In terms of quality control and waste management, factory conditions can allow better precision and consistency, reducing errors and rework [20], while standardization and digital design can mean wood panels can be optimally cut, and off cuts can often be reused or recycled in the factory [45]. Moreover, project schedules can be significantly compressed [1]; Swedish prefab timber projects can show substantially shorter on-site durations than traditional ones [29]. Faster construction reduces not only on-site overhead and disturbance but also lessens the cumulative consumption of energy by machinery and utilities [1,29]. Finally, regarding labour safety, working in a controlled factory may be more ergonomic than on temporary site arrangements [46], although this has not yet been thoroughly documented.

Moving to industrialized timber has fostered a Swedish network of specialized suppliers and contractors, encouraging knowledge sharing, continuous improvement and specialization beyond individual projects [20]. Specifically, within Swedish CLT building networks, a series of projects led to niche innovation ecosystems where various actors are collaborating [20]. However, current praxis mostly shoes that there can be redundant actors, role overlaps, or multiple suppliers competing in the same project, underscoring the need for ecosystemic coordination [20].

Lean construction principles are highly relevant as well; emphasizing waste elimination and improving the value flow [27] can complement regenerative goals, especially in and around industrialized contexts [27]. For example, at Sara Kulturhus, just-in-time delivery of large timber panels to site was used to avoid storage and double handling [24]. Moreover, continuous improvement loops are easier when the same system is replicated, as with some modular timber systems; over multiple projects, significant productivity gains can be achieved, thus reducing resource usage per unit of construction [1,20,27]. Nonetheless, a case-based and "picking parts"

implementation of lean in Sweden is still quite prevalent, even among industrialized constructors [27,53]; as such, those perceived benefits are still not thoroughly documented.

5.4 Social and economic dimensions: Well-being and community regeneration

There is growing evidence that wood in interior environments has positive psychological and physiological effects on people [47,48]. Studies in biophilic design suggest that natural materials and patterns can reduce stress and promote comfort [47,48]. In offices, wooden environments have been promoted to increase worker satisfaction and performance [25]. Culturally, it is also claimed that using wood can symbolically and literally bring a piece of nature indoors [25].

Timber buildings can also become symbols of community renewal; Skellefteå used Sara Kulturhus as a catalyst for urban regeneration leveraging the town's forest heritage [24]. The municipality aims at attracting industry and talent around timber construction innovation [24]. Moreover, there is an element of regional regenerative economic development, as CLT factories in northern Sweden can offer local jobs and a value-adding industry beyond just exporting raw logs [24]. Similarly, Stockholm Wood City aims at mixing workplaces, housing, amenities, and a pedestrian-friendly environment, reducing commuting, and spurring local job creation [25].

Considering the industry and its value chain, the growth of timber construction can potentially diversify and rejuvenate the sector's workforce and skillsets [7,8]. Timber prefabrication plants could offer a more high-tech, stable manufacturing setting that might appeal to a new generation of workers with updated digital or engineering skills [49]. Meanwhile, the on-site assembly process for timber modules can be less physically punishing than heavy concrete work, possibly making the occupation more inclusive (e.g., we see better gender equality in off-site fabrication roles) [50]. Nordic initiatives for training in timber construction are underway [50]. This knowledge development is a form of human capital regeneration in the industry [7,8].

In terms of economic scalability and viability, timber buildings can potentially be economically competitive in Sweden when productivity gains from prefabrication are factored in [1]. In the relevant business models, while there are up-front development costs, there are also benefits and value propositions (technical, social, environmental) that can be justified [1,29]. For example, adding wooden storeys on existing buildings can create new revenue while avoiding greenfield development [1]. A project-based business model perspective should capture value across stakeholders, rather than just firm-level profit [1]. In a regenerative economy, this resonates with projects conceived to deliver shared value for all participants [1].

6. Discussion: Implication for construction management practices in Sweden

Leveraging timber construction as a paragon for regenerative production would necessitate shifts in construction management practices. The Swedish experience, as analysed above, points toward a need for adaptation and innovation in how projects are organized, procured, and executed. Below, we discuss key implications for relevant practitioners and firms in Sweden.

Timber projects in Sweden have effectively used collaborative approaches in procurement, such as early contractor involvement or strategic partnerships. Integrated project delivery (IPD) or alliance contracting could thus be conducive for regenerative building production. Stakeholders should align towards a common regenerative goal of being parts of an ecosystem. This integration might involve co-locating the design team with the manufacturer to iterate on designs for manufacturability, or contractors partnering long-term with timber module suppliers.

Additionally, innovation ecosystems imply extending beyond single projects to managing networks of firms across projects [20]. In TIS and SNM, this would involve cultivating

relationships, sharing knowledge, and possibly co-developing standards with other firms to grow the market and capabilities for timber construction. Swedish firms might collaborate via industry organizations to develop standardized connections or design guides for mass timber. Construction managers can thus act as network orchestrators, facilitating the flow of innovation.

However, to avoid conflicts, roles and interfaces need to be clearly defined when multiple companies share tasks that used to be separate. For example, if a timber supplier is doing part of the design (e.g., engineering the connections), the construction manager must ensure that fits into the overall design management process and that liability is clear [20]. A collaborative approach can also mitigate the supplier competition issue by engaging a primary supplier in a partnering role rather than pitting multiple suppliers against each other [20]; by extension, this could mean selecting partners based on quality and innovation potential instead of just the lowest bid.

Furthermore, timber construction introduces different supply chain dynamics compared to conventional construction, such as prefabrication and special transportation needs. For example, large CLT panels or modules often require specific handling (e.g., flatbed trucks with certain size limits); moreover, the on-site logistics of timber elements would ideally reflect going straight from truck to installation. This would require just-in-time deliveries and reliable scheduling. Swedish contractors thus refine logistics for timber, such as trying to use common data environments [51,52] to track components. In regeneration, efficient logistics is key to reducing fuel use and ensuring proper material handling (maintaining quality, avoiding waste). Construction managers may need to further adopt tools like real-time tracking apps, or even blockchain-based supply chain tracing to verify the sustainable sourcing of wood [53].

For material procurement, instead of utilizing commodity markets (as with steel or cement), timber construction often means procuring a system or service from a manufacturer (like buying structural kits). Construction managers must then evaluate and select these prefabricated systems, as it is less about buying in bulk and more about partnering with specialized suppliers who co-create the final product. Selection criteria may include the supplier's potential regenerative practices (e.g., using renewable energy in fabrication).

Moreover, regeneration also means human capital development, i.e., training and reskilling (e.g., on timber assembly techniques, digital modelling, and precision measurements). Swedish institutions do offer such programs (e.g., vocational schools offering CLT assembly training, universities integrating timber engineering into curricula), but re-training on the ground should also be considered; this might involve sending staff to specialized courses. Moreover, even if focusing on building production, a holistic regenerative perspective would consider the successful transition from regeneration-inspired design to the construction process. Therefore, timber design and constructability management skills should also be honed.

At a higher level, each timber project should be treated as an opportunity to capture lessons for organizational learning and feedback. Firms might implement internal knowledge databases, or post-project reviews specifically focusing on what could improve in upcoming regenerative projects. This could involve applying tools like value stream mapping to identify inefficiencies and measuring performance beyond cost and schedule. New KPIs might be adopted on projects: e.g., carbon intensity of construction (CO_2/m^2), percentage of construction waste recycled, etc.

From a lifecycle perspective, construction managers in a regenerative paradigm have to think beyond delivery to the timber building's operational life and eventual end-of-life. Some contractors in Sweden have started to include maintenance services or extended warranties, which could align incentives to ensure the building performs. Additionally, regenerative thinking

implies planning for adaptability and deconstruction, which can also be facilitated by digital material passports [54]. Public clients leading circular economy initiatives could require this.

If regenerative building becomes a policy objective, managers might need to report more metrics (e.g., carbon footprint during production, amount of recycled content, etc.). Already Sweden requires larger projects to submit a climate calculation of the building's embodied carbon at completion (*klimatdeklaration*) [55]. Timber naturally helps reduce that number, but managers need the suppliers' data to compile it; as such, more rigorous data collection and communication with suppliers is needed. Furthermore, certification systems like Miljöbyggnad, LEED, BREEAM, and LBC, create requirement checklists that managers integrate into their workflows; for regeneration, certifications recognizing net-positive achievements should be selected.

Ultimately, the need for regeneration in building production is not just topical. We may focus on Sweden, but other contexts (e.g., Finland) may benefit from utilizing timber construction for regeneration. However, this is contingent to strong contextual factors, including the source-to-site supply chains and the respective demand for and suitability of timber products. Such factors can feed processes of coevolution, environmental transformation and organizational change for the firms in those supply chains, within nationally defined constraints. These processes can in turn create new opportunities and constraints for a regenerative paradigm shift using timber [56].

7. Conclusions

This paper set out to conceptualize how the resurgence of timber construction in Sweden can catalyse a new regenerative building production paradigm. Adopting the sociotechnical framework of sustainability transitions (esp. the multi-level perspective, technology innovation systems, and strategic niche management), and implementing the phenomena construction methodology, we synthesized literature and industry evidence (the Sara Kulturhus in Skellefteå and Stockholm Wood City) to conceive timber construction being a paragon for regenerative practice as a radical, rather than incremental, transition.

Our analysis found that such a catalysis can happen on multiple fronts. Environmentally, it constitutes storing carbon and supporting a circular bioeconomy through renewable materials. Process-wise, it involves driving industrialized, lean production that minimizes waste, improves quality, and elevates operational efficiency and circularity. Socially, it can help create healthier indoor environments, revitalize local communities (especially forest regions), and improving production labour conditions and skills. In terms of innovation, it can foster new collaborative networks and business models that align all production stakeholders towards regeneration. Nonetheless, such a catalysis is challenging when considering current production regimes. Thus, supporting regeneration by shifting towards IPD, supply chain coordination, process innovation, and continuous learning, should include the training of production professionals – esp. regarding new collaboration forms, regeneration metrics, innovation, policy, and digital competence.

Methodologically, applying phenomena construction allowed us to avoid assuming timber construction is automatically regenerative; instead, we investigated why and how this potential can be realized. Our study is limited in that we do not feature an analysis of empirical data; however, our work may spur further research, such as empirical studies measuring the actual regenerative outcomes of timber projects over time, in Sweden and other contexts.

In terms of practice, construction managers and policymakers in Sweden could incubate and mainstream regenerative building production practices using timber, surpassing just flagship projects. This could involve incentives such as public procurement favouring net-positivity and updating relevant building codes (e.g., harmonizing EU standards to open timber export markets).

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