Policy narratives on wooden multi-storey construction and implications for technology innovation system governance

Ritva Toivonen a,b,*, Heini Vihemäki a,b, Anne Toppinen a,b

a Department of Forest Sciences, P.O. Box 27, 00014, University of Helsinki, Finland
b HELSUS, P.O. Box 27, 00014, University of Helsinki, Finland

ARTICLE INFO

Keywords: Bioeconomy Building Market diffusion Finland Low-carbon Policy

ABSTRACT

The development and acceleration of Wooden Multi-storey Construction (WMC) as a set of innovative building technologies has gained political support and attracted public interest in Finland, as in some other forest-rich European countries. The market share of WMC, however, remains low. The technological innovation system (TIS) around WMC in Finland has been assessed as being in its formative stages, but its governance remain poorly understood. This paper analyses policy narratives on WMC in Finland and reflects these against the governance of TIS. Thematic interviews with 17 experts were conducted in 2018–2019 and complemented with a review of secondary materials and observation in wood construction-related events. Four policy narratives were identified, out of which three were “pro-WMC”: (1) the bioeconomy narrative, which sees WMC as a means to advance a more sustainable bioeconomy (2) the climate change narrative, WMC as way to enhance low-carbon cities and building, and (3) the wood industry narrative, seeing WMC as a means to create demand for high-value wood-based products, and/or to reform the construction sector, whereas (4) the counter WMC narrative questioned the public sector’s role in supporting WMC and the environmental benefits of WMC. The policy measures highlighted in these narratives to accelerate WMC varied highly, which demonstrates the contestations regarding goals and means of supporting the WMC niche. The absence of a common vision among the actors in the TIS does not result in an optimal and efficient platform for accelerating WMC market diffusion. Accordingly, the findings indicate the need for more coordinated efforts among the “pro-WMC” key players to empower the WMC niche effectively.

1. Introduction

The megatrends of globalization, urbanization, depletion of natural resources, and climate change are contributing to growing societal pressures to identify and scale up building solutions which are environmentally, economically and socially ‘smarter’ than the prevailing ones. Wooden multi-storey buildings can be conceived as an innovation in the building sector in the European setting (Mahapatra et al. 2012), challenging well-established material and technological choices in industrial construction. The Wooden Multi-storey Construction (WMC) concepts range from ‘traditional’ on-site construction to on-site assembly of elements and components produced off-site, with varying rates of wood usage (Mahapatra et al. 2012; Hurmekoski et al. 2015). It is argued that the mix of material and technological choices labelled as WMC offer more sustainable building solutions compared with the prevailing ones (Wang et al. 2014).

Previous research conducted in Finland and in other parts of Europe has touched on institutional and social factors influencing the diffusion of WMC solutions, often from the perspective of socio-technical systems and ‘multi-level perspective’, or MLP (c.f. Lazarevic et al., 2020). Among the topics studied so far are the innovation drivers in the EU (Tykkä et al. 2010), policy-market linkages (Hurmekoski et al. 2018), and institutional and policy factors shaping the market developments (Toppinen et al. 2019; Vihemäki et al. 2019). Furthermore, studies have addressed the perceptions of construction managers (Hemström et al., 2017), architects and structural engineers (Roos et al. 2010), municipal decision-makers (Franzini et al., 2018), urban planners (Lahtinen et al. 2019a) and consumers (Lahtinen et al. 2019b) regarding WMC or wood as a structural material. To lesser extent, the positions of various stakeholders in decision-making over material choices have been studied. Intermediaries facilitating WMC, and their inter-relations, have also been studied recently (Vihemäki et al. 2020).

Previous research demonstrates that technological and market diffusion of WMC depends on multiple factors. Barriers to WMC growth...
include path-dependencies of the construction sector and the product suppliers (e.g. Hemström et al., 2017; Hurmekoski et al., 2018). Some of the underlying issues are the existing close ties between the industry actors based on long-term collaborations, which tend to foster cooperation solutions involving concrete, as well as the perceptions of the key actors in the construction industry (Mahapatra and Gustavsson 2008; Roos et al. 2010; Ijas 2013; Hemström et al., 2017).

So-called institutional lock-ins - the tendency to stick to the accustomed material and technological options - have been identified as a key barrier for growth in the WMC market in Finland (e.g. Lazarevic et al. 2020). Furthermore, the building costs may not be known at the start of the WMC projects, as the technologies are still developing (Lahtinen et al. 2019a; Toppinen et al. 2019). Hurmekoski et al. (2018) argue that the diffusion of industrial wood construction is slowed down by the risk aversion of both the wood element suppliers and the construction firms.

The innovation system connected with WMC has scarcely been studied (see Tykkä et al. 2010 on policies as drivers for innovation; Lazarevic et al. 2020 on evolution of the technological innovation system (TIS); Viheämäki et al. 2020 on intermediaries). Our aim in this study is to increase knowledge on the WMC-related technological innovation system and its characteristics, as reflected in the discursive practices (narratives/storylines) of the actors related to the WMC market and business sector, and the innovation system. We have used the concepts of storyline and narrative as synonymous.

Drawing from the TIS literature and policy narrative analysis, we analysed the understandings of the actors involved in the WMC innovation system and other relevant stakeholders, on whether, how and why WMC development from niche towards gaining a more main-stream position in construction markets should be enhanced with policy measures. We focused on a single country, Finland, in our empirical research, as there is high variability between countries, and even within them there are extensive variation in the operation and structure of the construction sector (Hurmekoski et al. 2015; Hemström et al., 2017), and the characteristics of the forest sector innovation systems (Weiss et al., 2017). In particular, we addressed the following research questions:

1. What policy narratives on WMC can be identified among the actors?
2. How do these narratives mirror the technological innovation system relevant to WMC?

In this paper, (1) we first introduce the motivation of our study and then (2) provide the context, theoretical background and the policy analysis approaches chosen, and after this (3) describe the methods of analysis and data. Based on (4) the results of the empirical data analysis, we (5) discuss some of the challenges in the WMC innovation system and draw comparisons with earlier research. Finally, (6) we draw our conclusions and identify some potential measures to enhance a smoother operation of the innovation system.

2. WMC context, theoretical background and methodological perspectives on policy analysis

In this Section, we first introduce the context of this study, i.e., wooden multi-storey construction and its current position on building markets, focusing Finland. Then we report on our review of the recent literature on the technological innovation system (TIS) concept and its governance. Then we describe the policy narrative analysis concept, and how we integrate this with the TIS approach as the framework of our study aiming to identify and better understand the WMC-related policy narratives, and their operation in enhancing WMC related technological innovation system.

2.1. Context: WMC development and market diffusion

In Finland, wood is a traditional construction material, and the predominant material in single family and other detached and semi-detached houses (Hurmekoski et al. 2018; Jussila and Lahtinen, 2020). However, in multi-storey buildings (typical in urban areas), precast concrete elements continue to be the dominant way of building, and have been for decades (Huuhka and Lahdenranta, 2016).

Since the 1990s, the enhancement of using wood material in building, and lately particularly WMC technologies, have received attention from the government, and to a varying degree from the private sector. Several WMC pilot projects have been completed (e.g. Lazarevic et al., 2020). For a variety of reasons, wood construction is high on the national political agenda, as reflected in the Finnish bioeconomy strategy of 2025 (MEE, MAF, ME, 2014) and the National Energy & Climate Strategy for 2030 (MEEA 2017). During the governmental period 2015–2019, wood construction was positioned as an important part of the bioeconomy, and was embedded in one of the government’s flagship projects. This policy support materialized in the formulation of the National Wood Building Programme (2016–2022) led by the Ministry of Environment (ME).

So far, the focus of the governmental enhancement policy measures to accelerate WMC market growth has been on the use of soft policy instruments (e.g. support to research, development and innovation (RDI), awareness raising, education), but also more direct measures have been introduced (such as gradual shifts in the building regulations or giving wood as a structural material some leverage in the funding conditions of the social construction projects) (Viheämäki et al. 2019). In the area of low-carbon construction, the Ministry of Environment has produced a roadmap to reduce greenhousegas emissions originating from construction, including the manufacturing of materials and products, in 2017. The measures are expected to be implemented by the mid-2020s. As part of this, there is a policy process to establish how to take the carbon footprint in construction materials into account in the regulations. The plan is to introduce binding legislation and thresholds for construction at various stages via piloting projects, public procurement, reporting obligations (ME, 2018; Lazarevic et al. 2020). The low-carbon policy process is expected to create a more level playing field for low-carbon technologies and materials (c.f. Lazarevic et al. 2020).

Since the mid-2010s, after a long recession, the overall construction business has experienced high growth until the recent slowdown, which has been reflected in the large-scale production and sales of new apartments. The number of flats in WMC buildings has been increasing over the past few years, even though not at the same pace as the general construction sector overall (c.f. Viheämäki et al. 2019). Increased activity in selected cities and municipalities to advance WMC as a climate-smart solution has been observed (e.g. Ruuska and Hakkinen 2016; Franzini et al. 2018). This trend is expected to continue. According to an estimate based on a survey among the municipalities, the number of WMC flats is projected to double between 2018 and 2020 (Rakennustutkimus RTS Oy, 2018).

However, despite of the long-term enhancement policy, WMC still represents a clear niche within the overall construction market, characterized by few companies being involved in the business networks (e.g. Lazarevic et al. 2020; Toppinen et al. 2019). In 2017, the proportion of wood-framed multi-storey buildings was 5% of all new flats (Sipiläinen 2018).

2.1.2. Theoretical background on innovation systems: The TIS approach

The technological innovation system (TIS) framework is one that has been used to track the dynamics and to assess the performance of an innovation system. It has also been used to explore the interactions within the systems and between the systems and their external environments (Markard et al. 2015; Lazarevic et al. 2020). TIS can be
understood as “a set of networks of actors and institutions that jointly interact in a specific technological field and contribute to the formation, diffusion and utilisation of variants of a new technology and/or a new product” (Markard and Truffer 2008, p. 611).

In the operation of the TIS, certain functions (or processes) are considered focal for the success of the system. According to Bergek et al. (2008), the following system functions shape the success of the system: (1) knowledge development and diffusion, (2) entrepreneurial experimentation, (3) influence on the direction of search, (4) market formation, (5) development of positive external economies, (6) legitimation and (7) resource mobilization. Innovation system performance can be conceived as a result of all these key functions, as well as the structural elements, and the feedback loops in between them, creating certain dynamics (Hillman et al. 2011). Some authors have emphasized the need to expand the analysis beyond a certain TIS, as diffusion of the innovations often requires destabilizing the prevailing regime structures (Kivimaa and Kern 2016; Lazarevic et al. 2020).

Because of deeply established behavioural patterns and strong traditions, changing the dynamics of the construction sector is complicated (Rohracher 2001). Few previous studies have addressed the characteristic and dynamics of the TIS linked to WMC. Lazarevic et al. (2020) found out that the WMC-related TIS system is at a formative stage in Finland, suggesting that several of the key functions need further development. Furthermore, reconfiguring the existing regime of the construction sector by influencing the established organizational practices was suggested as a measure that could increase WMC market diffusion.

The governance of TIS has mostly been studied from the perspective of activities and arrangements of governing, e.g. ways in which specific markets or public measures (or both) are used to support innovations, and the actor constellations and institutions involved in a given TIS (Hillman et al. 2011). In addition, the actor constellations (networks) and their role in promoting innovations have been an area of analytical efforts. However, governance can also be understood as something occurring both within the innovation system and outside it, and thus analysis of governance should not be restricted within the system’s boundaries.

Policies and policy making is a part of the interactions (and forms of governing) taking place in a TIS. This occurs for example in the form of specific innovation policies or standard creation, but also in the policy making processes of the external setting, which can then influence the operation of the TIS. Technology and innovation policies influence the generation and diffusion of knowledge, which is important for the emergence of the new socio-technical solutions. Deployment policies contribute to the formation of markets and how the new technologies and solutions might spread (Markad et al., 2016).

To conceptualize more clearly the multi-dimensional concept of governance in relation to TIS, Hillman et al. (2011) have established a framework, drawing from the literature on TIS and governance. It includes the dimensions of (1) policy (which instruments are used?), (2) politics (who participates?) and (3) polity (what are the rules of interaction?). The first dimension pays attention to mechanisms of control (e.g. regulatory, market, cognitive), and whether the focus is on the supply side (“market pull”) or the demand side (“market push”), or both. The second dimension is about the different actors’ roles and responsibilities in the initiation and coordination of the governance arrangements, as well as the level of governance. The third dimension is concerned with the seven key processes or functions of TIS, and the scope of the governance arrangement (e.g. the whole sector or a sub-system within TIS).

2.1.3. Theoretical approach to policy analysis: The Policy narratives approach

The aim of the narrative approach to policy analysis is to understand how the language used in the policy-making processes, and related politics unite and divide the actors, and how these dynamics change. The approach focuses on the continuities and discontinuities in the discursive practices of the policy actors, and their implications. In the approach applied in this study, we drew on Hager’s (1995) approach, in which policy is understood as a struggle for discursive hegemony. Narrative analysis can be understood as a focused form of discourse analysis, restricted to the stories being told about the type(s) of development seen as likely and/or preferable by various actors active in the overarching discourse (see Bauer 2018).

Instead of focusing on policy documents, the focus can be on the narratives told and enacted by different actors engaged in developing or seeking to advance a given innovation, as suggested by Bauer (2018). Storylines, which are also called narratives, play a key role in positioning the subjects and structures (Hajer 1995). In this theorizing, actors are seen as “…selecting and adapting thoughts, mutating and creating them, in the continued struggle for argumentative victory against rival thinkers” (Hajer 1995, p. 65). During the process, certain storylines are formed that summarize complex arguments and mobilize support, thus potentially binding together discourse coalitions. It is important to note that although like policy coalitions, discourse coalitions are based in language and not in values or beliefs (ibid).

In this paper, we used the policy narrative analysis to explore the understandings and argumentation of actors participating in, and stakeholders with an interest in the development of WMC and the related technological innovation system, including governance. The focus is on the actors’ discourse around wooden multi-storey construction as a (new/alternative) building solution, and whether/how to enhance it (measures to influence the WMC-related TIS). In the analysis, the first dimension of the Hillman et al. (2011) framework (“how to govern”) thus receives most attention, e.g. policy instruments and measures as potential ways to “improve” the governance setting.

3. Methods and data

The data and the related methods of analysis for studying policy narratives in this study include both thematic interviews, mostly at the national level, and observation at seminars and workshops related to wood construction in Finland during 2018–19. The interviewees represented policymakers and the public sector (e.g. civil servants from three ministries and three agencies associated with them), the construction business, and third sector actors such as representatives of advocacy, research and other expert organizations.

Most of the interviewees could be described as experts in construction or wood construction. Most also had long-term experience in industrial wood construction, with their organizations explicitly supporting or producing WMC diffusion (Table 1). A few interviewees worked in organizations associated with the innovation system of the broader construction industry, or “in between” these systems. These included two companies, one advocacy organization, and two expert organizations (one of which focused on sustainable building, and one on research and development in general). One of them had some previous experience in WMC but was critical towards it. One of them had experience with WMC and other multi-storey building technologies. The three company representatives were small- and medium sized companies operating at the local and/or regional level, but most of them were also active in the policy processes and debates linked to WMC.

The first informants were identified because of the earlier contacts of the research group and experts in WMC and industrial wood construction, in the spheres of policy, research and business. New interviewees were identified through a snowball method (asking initial interviewees to suggest additional ones), as well as internet searches. Seventeen interviews were conducted by the second author of this paper, of which sixteen were face-to-face and one via Skype. The interviews were conducted in Finnish between March and September 2018 (Table 1). They varied between 45 and 80 min. Interview guides framed the discussions, with some variation in the themes discussed with different categories of actors (see list below). Three of the interviews were framed more around
low-carbon construction, and two around the construction sector generally. They covered similar themes to those covered with the WMC innovation system actors but from the perspective of low-carbon building, or the development of the construction industry more broadly, and the position of wood in these.

Themes covered in the interviews with the experts in the WMC innovation system (those of the broader construction sector / the low-carbon construction), included the following:

- the role(s) of the organization/network in the WMC sector (in the construction sector / low-carbon construction field)
- policy goals, e.g. why, how to support WMC solutions (general construction sector/low-carbon construction solutions)
- instruments and support measures, e.g. existing and ideal
- challenges facing the WMC (broader construction sector/low-carbon construction)
- prospects and visions regarding WMC (broader construction sector/low-carbon construction)

The interview data were complemented by a review of recent news and media stories, as well as observation. The latter took the form of observer as participant (c.f. Baker 2006) and it occurred in wood construction related seminars and events (in Finland, between spring 2018 and spring 2019). This process included listening to the presentations relevant to the research theme, engaging in discussions with other participants, and making notes (paying attention also to the position or background of the informants). It provided a means to supplement the interview data and cross-checking. The observation made in the events, and information gained through listening to and discussing with the other participants, helped in interpreting some of the issues discussed in the interviews, too.

The interviews were transcribed in Finnish by a third-party company, and the contents of the texts were checked (by listening to the recordings) by the second author. In the qualitative content analysis, themes based on the interview guide were built and complemented with themes emerging in the interviews. The method of analysis involved dividing the relevant parts of the data under the themes. Codes were formulated that reflected the questions at stake, e.g. various arguments for or against WMC. The policy narratives based on identification of patterns in how the codes typically emerged in conjunction with others, were then constructed. The narratives varied in relation to their problem definitions, goals, arguments used to support or undermine WMC as a set of building technologies, as well as the ideal policy instruments to enhance WMC market growth.

4. Results

Four narratives were identified in this study, based on the content analysis of the interviews and complementary data. The narratives consisted of the problem definitions and the arguments used to back-up or resist the goal of advancing WMC and the policies and related preferred instruments are described below.

4.1. Bioeconomy narrative

The development of WMC, and more broadly industrial wood construction, is among the central means to advance the growth of bioeconomy in this narrative. For instance, wood construction was presented as the “backbone of bioeconomy” in Finland, especially in the public talks by the representatives of the ministries promoting wood construction, such as the ME (personal observation, 4.4.2018, ME, Helsinki).

According to this storyline, there is potential to increase the utilization of wood in construction in Finland, as the forests are sustainably managed, and the growth exceeds the use of wood. Wood construction is presented as a rational way to use the forest resources. This narrative is typical among some of the ministries (with some variation in the emphasis laid on different sub-goals between the ministries), and at the Forest Centre, associated with the Ministry of Agriculture and Forestry (MAF). As an example, a representative of one of the central ministries expressed the reasons for promoting the use of wood (including in construction) “…forests grow and [when] wood is being used, it has many positive impacts, in Finland and on the national economy, value chains...” (interview 4).

The key ministries in directing the national wood construction programme (ME, Ministry of Economics and Employment and MAF), as well as many agencies associated with them, typically promote wood construction not only based on the need to fuel the growth of national economy, but also from the perspective of regional economy and as source of employment, and also in the hope of new export opportunities (interviews 4 and 6, observation in seminar 14.2.2019, Helsinki, MEEA).

The key policy instruments to push for the WMC development in the bioeconomy narrative include soft instruments, such as information sharing on wood construction technologies, and the associated “benefits” accrued by the different types of actors, e.g. consumers, architects and designers, construction companies. In addition, public investment in RDI and building or strengthening the networks between the companies, as well as between business and RDI actors are suggested as enhancement measures accelerating the innovation system performance. Pilot projects, reforms in public procurement, and (wider) sharing of experiences from them also appear to be promising ways in this line of argumentation. Removing regulatory requirements in the building

<table>
<thead>
<tr>
<th>Nro</th>
<th>Organizational background</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ministry 1</td>
<td>Programme director</td>
</tr>
<tr>
<td>2</td>
<td>Lobby organization (pro wood)</td>
<td>Director</td>
</tr>
<tr>
<td>3</td>
<td>Ministry 1</td>
<td>Advisor (material aspects)</td>
</tr>
<tr>
<td>4</td>
<td>University</td>
<td>Senior researcher</td>
</tr>
<tr>
<td>5</td>
<td>Ministry 2</td>
<td>Ministerial adviser</td>
</tr>
<tr>
<td>6</td>
<td>Ministry 3</td>
<td>Ministerial adviser</td>
</tr>
<tr>
<td>7</td>
<td>Construction company (wood-based &amp; other materials)</td>
<td>CEO</td>
</tr>
<tr>
<td>8</td>
<td>Construction and developer company (wood-based)</td>
<td>Vice-CEO</td>
</tr>
<tr>
<td>9</td>
<td>Expert organization in building sector (non-governmental)</td>
<td>Director</td>
</tr>
<tr>
<td>10</td>
<td>Centre for Economic Development, Transport and the Environment (governmental agency, regional office)</td>
<td>Ex-brand manager (wood products)</td>
</tr>
<tr>
<td>11</td>
<td>Lobby organization (pro-wood)</td>
<td>Director</td>
</tr>
<tr>
<td>12</td>
<td>Lobby organization (other building materials)</td>
<td>Director</td>
</tr>
<tr>
<td>13</td>
<td>Housing Finance and Development Centre (government associated)</td>
<td>Expert on building development</td>
</tr>
<tr>
<td>14</td>
<td>Centre for Economic Development, Transport and the Environment (government associated)</td>
<td>Branch manager (wood products)</td>
</tr>
<tr>
<td>15</td>
<td>Finnish Forest Centre (semi-governmental agency, regional office)</td>
<td>Project manager</td>
</tr>
<tr>
<td>16</td>
<td>Research organization (national)</td>
<td>Senior researcher</td>
</tr>
<tr>
<td>17</td>
<td>Construction company (concrete-based multi-storey construction)</td>
<td>CEO</td>
</tr>
</tbody>
</table>
codes, which have hindered the use of wood in tall buildings, may also need to be addressed by the discourse in this narrative. Yet, this is not so clear cut, as some of the experts associated with the bioeconomy approach also had rather strong reservations, claiming that the current regulations are good enough (for now). Efforts to break down the silos between various actors involved in the promotion of wood construction, or in the broader bioeconomy are called for, as well (like the suggestions by Rotman and Bosman 2016, on the bioeconomy transition).

4.2. Wood industry narrative

In this narrative, using wood in urban building solutions can create more demand for high-value wood products. It is also presented to renew the construction sector towards improved efficiency, increased competitiveness and to a minor degree, as a way to enhance sustainability performance and sustainability goals. This storyline is common among the actors within “pro-wood” construction lobby organizations, and some companies in the WMC industry and business.

The following statement by a representative of one of the key ministries (with background in the wood industry) illustrates the characteristics of the industry narrative: “the importance of the forest industry to Finland, so how to create more value to it. …That is the idea, and the use of [wood] in construction is where it can take place” (interview 1). Furthermore, the same expert states that “the main objective […] is to increase wood construction, and as a sub-objective, it has been brought up that through the increase of wood construction, the carbon storage of the housing stock needs to be increased” (interview 1).

In the storyline, several supporting arguments have been used to back up the need to increase the use of wood in building. WMC is seen as a good solution to respond to the growing urban need for housing (e.g. due to the trends in construction and population) and to other global challenges. It also has health benefits. In addition, in this narrative, sustainability is typically seen to be embedded in wood construction, and as a driving force for the increased use of wood. Sustainability also includes a social dimension, including job creation in the regions, and outside the growth centres. This is illustrated in the story about the Finnish Wood Working Industry by a journalist from YLE, the public broadcasting company: “…sustainable development comes along with wood construction, nearly without any additional cost to the constructor” (YLE, 2019).

The storyline introduces barriers to WMC growth, such as the conservative mindset prevailing in the mainstream construction sector regime, and lobbying by purveyors of other materials, and the broader construction industry. For instance, it was argued that lobbying on behalf of the other materials played a major role during the process when the regulations on the use of wood in buildings were last reformed. Furthermore, a construction industry company with extensive experience in WMC development and pilot testing argued that the anti-wood argumentation by the a lobby organization standing for other materials was very effective, and its attitudes were easily taken on board by the “old-school” civil servants at the ministry and unit responsible for the reform of the building regulations (interview 11).

Further change of the building regulation (especially the fire safety code) towards increased “material neutrality”, to make more space for the use of wood in tall buildings, is seen as an important measure to advance WMC among those commonly adopting this narrative. As one company CEO summarized the efforts to change the fire code during the latest reform process, leading to the new code of 2018 “…we did not manage to get the norms that we wanted. There is still the belt and suspenders—system for wood, and I cannot do anything about it […] and it went the same way as in 2011.” (Interview 11). Some of the expert and advocacy organizations operating in the WMC TIS were yet not calling for such reforms, indicating lack of homogeneity in the views on the optimal policy instruments to empower the WMC niche.

The business actors typically advocated for financial enhancement policy measures to accelerate positive WMC market development (e.g. tax exemptions; better financing conditions for social building projects developing or using new WMC solutions; possibly enhanced access to municipal building sites), and clear growth targets set by the national government for a higher proportion of WMC flats. However, some of those actors representing the wood construction sector were more critical about the idea of using any direct financial instruments, other than public funding for R&D&D projects (e.g. seminar observation, 5.6.2019, Espoo).

This narrative typically calls for pragmatic, rapid policy measures by the government to enhance the growth of WMC and generally industrial wood construction. Within this, both the central government and the local government (regions, municipalities) are perceived as having a role to play. At the regional level, the agreements between the municipalities regarding regional land use plans are sometimes mentioned as a potential way (interview 1). As the municipalities have considerable power in land use planning (through their monopoly to decide about zoning), they can advance the use of wood (or work against it) by allocating land to construction, defining the details of the land use plans and the related instruments (e.g. plot assignment stipulations).

Some of those in the WMC industry and business also rejected the idea of reserving areas only for wooden multi-story buildings. This was because of the risk of creating or strengthening opposition from the side of the regime actors in the construction sector, and the need to adhere to material neutrality principle. Rather, they sometimes called for more material neutrality in the zoning, as the current zoning practices may set limitations to wood, often indirectly (observation in a seminar, Espoo, 5.6.2019).

The regulations and norms on low carbon construction are believed to have a positive effect on increasing demand for WMC solutions in the future (e.g. interview 1 and 2). Yet, it was admitted that there are also uncertainties about this, related to how systems for assessing the carbon balance over the lifetime of the buildings will be set.

4.3. Climate change narrative

In this narrative, the framing of the problems and solutions is focused on transforming the construction sector towards increasingly climate-smart and low-carbon construction, often combined with circularity, and thus climate change appears as the main issue to be tackled. WMC is considered to be one of the means to support this transformation, and therefore worth enhancing. This rhetoric is typically used by experts associated with research organizations (e.g. LUKE, VTT), some representatives of the ministries (especially ME), and from expert organizations such as STIRA, the think-thank supporting circular economy transitions. As one of the interviewees expressed her views: “In my view, it was better […] if wood construction was a preferable choice on the basis of some other thing, in fact, the GHG emission savings, or healthy indoor air quality so that one would set requirements related to those, and wood construction could respond to those, and it would be successful that way” (interview 16).

Narratives of this type also appear in the policy processes linked to sustainable housing and clean indoor spaces, led by the Ministry of Environment. For instance, in a document on future sustainable living environments, diverse use of wood is presented as a means to enhance low-carbon and resource efficient construction (ME, 2018). Furthermore, the head of the STIRA think-thank, argued in favour of wood as a construction material in a debate broadcast on one of the commercial media channels in the following manner: “Wood construction is the best alternative for health and environment” (MTV, 2018), showing how similar arguments (e.g. health benefits) are used as part of several story lines. In terms of the challenges facing the diffusion of WMC, the mainstream construction industry is seen as being resistant to change, and path-dependency is sometimes mentioned. In addition, the wood construction industry is presented as one of the forces causing or contributing to slow progress in WMC diffusion, as the companies are not eager to move towards unified systems “…we have such different systems [of
constructing) and they are being hold on to [by the companies]. (Interview 16).

In this narrative, the national policy and other support measures to advance WMC as a part of low-carbon construction include regulatory reform towards low-carbon or energy efficient construction, awareness-raising among the construction sector actors and consumers. In addition, it calls for procurement tools (e.g. a low-carbon procurement) and the use of voluntary market-based instruments, such as environmental certificates and standards. Both public sector and private sector measures have a role in enhancing the operation of the innovation system.

The policy measures that are commonly called for in this narrative include public strategy programmes and targets related to carbon neutrality in the cities and municipalities. Among those relying on this narrative, the issue of material neutrality was a point of divergence. For instance, a representative of an expert organization on sustainable building argued “The construction industry calls, even more strongly [than us] for material neutrality in the regulatory steering” (interview 9). However, some of the interviewees supported the idea of using criteria that can give an advantage to wood as the structural material in the plot assignment stipulations, due to the associated climate benefits (interviews 4, 16). In this narrative, emphasis is on the potential of the cities and towns as change agents in the transformation of the urban construction sector. As a representative of a research institute stated, “Wood construction and carbon neutral construction, it is a focal theme for the cities” (interview 16).

4.4. Counter WMC narrative

In the fourth narrative, the efforts by the Finnish government to promote wood construction, including WMC, are seen as problematic if not unfair. The narrative is thus named as a “counter narrative” since it critically questions the political promotion and enhancement of WMC. The counter narrative is typical to the lobby organizations of other materials and companies not using wood in multi-storey building (or with past negative experience of trying to build with wood).

One of the ways to counter those pushing for WMC diffusion is to question the science base of the arguments used by the advocates of wood construction. The sustainability and climate benefits of using wood as a construction material are questioned. As one of the interviewees explained, “It is not realistic in any way that one could substitute concrete with wood construction […] as the wood [stock of the globe] will simply not be enough […] Trying to find solutions to climate change by replacing concrete with wood, it is not going to work for sure”. (Interview 9).

Based on the interviews and observation, this narrative suggests that the efforts to promote WMC are lacking legitimacy among the actors in the traditional construction sector, including the companies relying mostly on other materials than wood in their multi-story building business.

The policy instruments highlighted in the other narratives to accelerate WMC, including regulatory reforms, city-level instruments such as zoning and other land use planning instruments, were clearly opposed in this storyline. Any financial enhancement measures (e.g. certain “ex- emptions” for wood or low-carbon materials in the financial criteria used for the funding of social building projects) appeared as unjustified. As one of the interviewees expressed it: “…subcontractors will not assume a role as a bondsman of any material but they will construct only using the material which is the best for each project and the subcontractors see it as taking the system backwards if we start to impose certain materials for each building” (Interview 12).

The issue of “material neutrality” was brought up in the interviews of the actors critical about the promotion of WMC. It was claimed that the building regulations’ reforms making it easier to build WMC would not have been in line of the principle of material neutrality. In some cases, the governmental push for the use of wood in construction in general, or even the on-going process to introduce carbon footprint assessment in the building norms, were perceived to be against this principle, or otherwise questioned (interviews 12 and 17; observation in a seminar, Espoo, 5.6.2019).

It was suggested that for some of those standing for the interests of the non-wood building materials, opportunities to influence the regulatory work in the building sector had diminished during the previous government regime (2015–2019). One of the interviewees suggested that “…our collaboration with the Ministry of Environment has been going down […] partly because in the development of the regulations, there is a strong motivation to promote wood construction and the unwillingness to integrate our comments in the inner circles of the policy making” (interview 12).

In this narrative, it was suggested that the solution to enhance the environmental sustainability of the construction sector should include further development of the production techniques of the prevailing construction materials used to build apartment buildings, rather than shifting to alternatives.

4.5. Summary of the identified WMC policy narratives

In a nutshell, the four identified policy narratives varied according to whether WMC (as a new building technology and the related technological innovation system) was to be enhanced by public policy, or not, and which policy measures should be used to support the technological development and thus trigger more rapid market growth for WMC. Among the identified narratives, three appeared as “pro-WMC”, and one as a (WMC-critical) counter narrative. The “pro-WMC” narratives’ goals included multiple arguments on why WMC should be developed further and its proportion of the construction markets increased. While many of the arguments were widely shared, some only came up in relation to certain policy narratives, which also regards the policy measures suggested to support the goals. The four policy narratives identified in this study are summarized in Fig. 1, and complemented by the authors’ assessment of key challenges (from the point of view of the TIS performance) inherent in these narratives (e.g., Lazarevic et al., 2020; Hurmekoski et al. 2018).

5. Discussion

Our analysis of the thematic expert interviews and other relevant materials revealed four alternative policy narratives around WMC and the related technological innovation system (TIS).

Three out of four identified narratives targeted to enhance WMC growth. However, problem and goal definitions of the narratives varied in terms of whether the growth of WMC was foremost to address: (i) challenges in the wood and construction industry, value creation and effectiveness (wood industry narrative), (ii) construction-related carbon footprint and environmental impacts of the construction sector (the climate change narrative), or (iii) to boost the national economy and employment in a sustainable way (the bioeconomy narrative). In the three pro-WMC narratives, wood was also perceived as an option to reach broader, sustainability related goals. This feature was rejected in the counter narrative, in which any policy measures in support of WMC and the related TIS were strongly questioned. It also rejected the idea of wood as a low carbon or sustainable construction material. In this storyline, the efforts to introduce lifetime carbon assessment in to building regulation were often interpreted as a way to push to use wood in the construction industry.

When mirroring the resulting WMC narratives against the framework by Hillman et al. (2011), it is clear that even the “pro-WMC” narratives prefer varying sets of policy instruments (the policy- and polity- dimensions by Hillman et al. (2011)) to accelerate WMC market diffusion and strengthen the operation of the related TIS. Policy suggestions ranged from ‘soft’ and bottom-up instruments such as network creation, education, RDI, awareness raising and pilot testing to more top-down actions, such as zoning and regulatory reforms and financial means.

Overall, the results suggest that the WMC technological innovation
Fig. 1. Four WMC policy narratives identified in this study, and the assessed key support measures and challenges.

<table>
<thead>
<tr>
<th>Bioeconomy narrative</th>
<th>Wood industry narrative</th>
<th>Climate change narrative</th>
<th>Counter WMC narrative</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Goal: mainstreaming wood in construction, employment and WMC related export</td>
<td>• Goal: Increasing demand for high-value wood products</td>
<td>• Goal: Contribution to sustainability and carbon neutrality goals</td>
<td>• Goal: Questioning of sustainability and climate benefits of WMC</td>
</tr>
<tr>
<td>• Key support measures: Information sharing, investment in RDI</td>
<td>• Key support measures: Building code changes (e.g. fire safety), tax benefits, more active urban land use planning</td>
<td>• Key support measures: Policy reform towards low-carbon or energy efficient construction, awareness-raising campaigns</td>
<td>• Key support measures: Creation of level-playing field among construction materials instead of favoring wood</td>
</tr>
<tr>
<td>• Key challenge: Soft measures have proved to be inefficient, more radical change would require substantial funding for RDI and capacity building</td>
<td>• Key challenge: Attracts strong counter-lobby from traditional construction industry, link to innovation and industry renewal remains weak</td>
<td>• Key challenge: A very wide narrative, losing focus on specific material solution; link to WMC innovation remains weak</td>
<td>• Key challenge: Weak connection to national climate policies and carbon neutrality goals, legitimation challenge</td>
</tr>
</tbody>
</table>

system studied is not yet close to optimal regarding its efficiency and performance on many of the dimensions suggested by Bergek et al. (2008). One issue is the rather fragmented structure of varying goals and policy measures. Other issues were mirrored in the targeted outcomes of the suggested policy measures, such as reducing the lack of (technological) knowledge, and boosting resource mobilization and market development, which are suggested as focal elements for a successful TIS system (Bergek et al. 2008). For example, providing financial ‘carrots’ to incentivize the use of WMC technologies were suggested in some narratives. This seems pertinent in terms of capacity building and getting more technological experience beyond pilot projects (Toppinen et al. 2019). One issue is the rather fragmented structure of varying goals and policy measures. Other issues were mirrored in the targeted outcomes of the suggested policy measures, such as reducing the lack of (technological) knowledge, and boosting resource mobilization and market development, which are suggested as focal elements for a successful TIS system (Bergek et al. 2008). For example, providing financial ‘carrots’ to incentivize the use of WMC technologies were suggested in some narratives. This seems pertinent in terms of capacity building and getting more technological experience beyond pilot projects (Toppinen et al. 2019). These would include reforming the procurement practices and relaxing the loan or financing conditions of social building projects, like done in some other countries or regions favouring WMC-based solutions (see e.g. Weiss et al., 2017, Vihemäki et al. 2019).

Even though a major area of disagreement was on the use of direct regulatory measures such as zoning or revisions of building regulations, there was a common view among the three “pro-WMC” narratives that soft instruments, including increased inputs in education, RDI and knowledge sharing will be needed. The policy measures typically supported in the wood industry narrative fell in between the two other “pro-WMC” narratives. The wood industry narrative underlined the need to move towards greater “material-neutrality” in the regulations and control of construction, while the counter narrative questioned outright the efforts to promote WMC niche using policy measures.

Our analysis suggest that some actors connected with the regime of the construction sector may have strong reservations about the adoption of WMC technologies. However, there are several narratives targeted at enhancing WMC market growth, but even these “pro-wood” narratives differ in terms of the preferred measures to realize the enhancement policy. In earlier research, Hurmekoski et al. (2018, p. 3652) found that strong regulatory push or financial support may cause dissent among the construction sector companies, e.g. “…while top-down norms and fiscal measures might be the only effective enough options in the construction sector to push green building in an acceptable time frame, the bottom-up market-based measures, based on competition and information dissemination might yield more credible solutions in the long-run.”

It appears that to reduce the juxtaposing of wood and concrete as building materials (and solutions based on them), communicating better on wood-based materials and WMC solutions, including their pros and cons, risks and opportunities, would be needed. This can feed into legitimation processes, through influencing public opinion. It can also contribute to regime destabilization function, when directed at (and using arguments understandable to) the incumbent actors in the construction sector. The need to strengthen legitimation and regime destabilization functions in the TIS of the WMC sector have also been raised by Lazarevic et al. (2020). Better alignment of national-level climate change mitigation and innovation policies would be beneficial for improving the integration of the upstream part of the forestry-wood value chain, and to help the WMC niche to growth, as elaborated earlier by Lazarevic et al. (2020).

The public policy measures applied so far to accelerate the WMC innovation system performance and the WMC market diffusion have focused on the use of soft measures to support knowledge development/diffusion functions, e.g. RDI, awareness and network creation (c.f. Vihemäki et al. 2019; Lazarevic et al. 2020). Some more direct measures have also been taken, including the gradual easing of the regulations. Locally, municipal steering through zoning and other land use planning means has occurred. Based on our analysis, actors did not seem to be able to produce genuinely new methods to accelerate WMC innovation system performance and WMC market growth beyond those that have been presented in the existing development programmes, or discussed in the media and in the industry roadmaps.

The policy mix implemented so far in Finland appears closest to the preferences expressed in the bioeconomy narrative. However, measures promoted in the climate change narrative have also emerged (even if they are not aimed at promoting the use of wood as such). These are exemplified in the on-going process to integrate the life cycle assessment of the carbon footprint in directing the building sector and the associated measures, e.g. creation of climate-related environmental standards for buildings. Into the future, we believe that the rise of circular economy aspirations are likely to become increasingly visible in the society, and the concepts of sustainable bioeconomy and circular economy are becoming more intertwined. Consequently, circular and bioeconomy policies should also more explicitly consider by-product-related targets and cascading use of wood (see also Kunttu et al. 2020).

Through the narrative analysis approach, in this study we have highlighted the heterogeneity in the understandings of the actors regarding the ultimate goals of the WMC as innovation in urbanizing...
society and its building sector. Variations on how and who should invest in the smoother and more efficient functioning of the innovation system around WMC could be further investigated. As van Lancker et al. (2016) have suggested, there is also a need to develop innovation processes in the sustainable bioeconomy context towards more intense co-operation, trans-disciplinarity, and inclusion of diverse stakeholders. Based on our findings, and relying on the multi-dimensional conceptualizations of TIF by Bergé et al. (2008), and hillman et al. (2011), we foresee that such an inclusive and co-operative culture would benefit the performance of the WMC related TIF in Finland. There are limitations in the study that need to be acknowledged, such as its country specificity and the difficulty some of the experts, especially on the industry side, to discuss the issues from a sufficiently broad and policy related perspective, rather than narrowly borrowing from their own experiences. The novelty of WMC with a 5% market share is also having an impact on how the actors themselves frame it, and the level of familiarity of the experts with technological innovation base varies. Furthermore, according to many studies, the concept of bioeconomy itself remains fuzzy and bears many potential interpretations (see e.g. Giurca 2018; Hurmekoski et al. 2019), which makes it difficult to put WMC into this particular perspective.

6. Conclusions

In this paper, we identified and analysed the policy narratives on WMC and the technological innovation system around it in Finland among the actors active in the WMC innovation system, and to lesser degree, beyond it. We also explored how these narratives mirror the innovation system around WMC and its governance. Below we draw conclusions and highlight some policy implications.

Our qualitative analysis identified four policy narratives, of which three were “pro-WMC” and partly over-lapping regarding the target of enhancing WMC, and the policy measures highlighted/preferred: (1) the bioeconomy narrative, seeing WMC as a means to advance a more sustainable bioeconomy (2) the climate change narrative, seeing WMC as way to enhance low-carbon cities and building, and (3) wood industry narrative, seeing WMC as a means to create demand for high-value wood-based products and reform the construction sector. The (4) counter narrative questioned the public sector’s role in supporting WMC, and the assumed environmental benefits.

The results highlight a clear lack of consent among the actors about the ultimate goals and policy instruments of supporting WMC niche and advancing market diffusion via the WMC-related TIS. Overall, the governance context of the WMC innovation system appears to be characterized by fragmentation, which is likely to lead to low efficiency and performance of the WMC related TIF. The multitude of pro-WMC narratives indicate a lack of common vision among the parties involved in the TIS. This is in line with the notion that even the three “pro-wood” narratives identified, the related goals and the preferred policy measures are diverse and lack clear coherence.

Regarding the need for further research, the significant autonomy of construction projects and regional variations in housing markets, policies and high level of technical specializations mean that the prospects of new technologies being adopted in the construction sector may also vary extensively even within a country, as noted by Hemstrøm et al. (2017). Therefore, it would be useful to compare the narratives on how to accelerate WMC detected in this study, with a focus on the national level, with those of the actors in local and regional innovation systems. This could include studying the conceptualizations of the developer and contractor companies and their roles on the TIS, as well as the role of the public sector, such as urban planners as gatekeepers (c.f. Laitinen et al. 2019a). In addition, comparisons between Finland and other countries where WMC solutions appear to be on the rise, including the other Nordic countries and some parts of Central Europe (e.g. Toppinen et al. 2018; Lilja 2019), would help in expanding our understanding of the innovation system and its governance in various socio-technological settings, and possibly in identifying alternative ways to support it.

Our research indicates a few areas for the policy development. Firstly, to improve the efficiency of the innovation governance, and the performance of the WMC-related TIS, building up a common and widely shared vision of measures, actors and the interactions among these WMC innovation system actors would be useful. This could be facilitated by better communication and more coordinated efforts among the “pro-WMC” key players, when seeking to empower the WMC niche. There is also a need to collaborate beyond the sectoral boundaries and break through the silos between various actors related to the WMC market development and TIS, and considering actors that are not directly involved in the construction business sector. For instance, Laitinen et al. (2019a) highlight the role of urban planners in promoting WMC in Finland. This is also underlined as one factor for more efficient performance of the WMC-related TIS and the growth of WMC solutions on the construction markets by previous studies on regional forest sector innovation systems (Weiss et al., 2017) and the governance of the Finnish bioeconomy transition (Bosman and Rotmans 2016).

Declaration of Competing Interest

We have no competing or any other conflict of interests to declare.

Acknowledgements

This paper was produced under the WoodVision 2025 (2017-2019) research project implemented at the Department of Forest Sciences, University of Helsinki. The authors are grateful for the funding provided by Metsämiesten Säätiö Foundation, Ministry of Agriculture and Forestry (Finland), and Central Union of Agricultural Producers and Forest Owners (MTK). We would also like to thank all the informants for their valuable contributions, and Editor and the two anonymous reviewers of the journal for their valuable and constructive comments for the development of this paper.

References


MTV, 2018. An e-article on a public debate “How to build in a more environmental friendly way – It is not a rocket science”. (in Finnish: Kuinka rakentaa ympäristöstavallisemmin “Ei se ole rakettitiedetta”). Available at: https://www.mtv.fi/lifestyle/koti/artikkeli/kuinka-rakentaa-ymparistostavalliville-mmr-eisse-ole-rakettitiedettja/7006206/#xK2BU1yF.


