Policy Review

Encouraging Councils and Governments Around the World to Adopt Timber-First Policies: A Systematic Literature Review

Scott N. Milestone[1] & Paul D. Kremer

The undeniable rise in Mass Timber Construction (MTC) on a global scale heralds the dawn of a new era for truly sustainable construction. The adoption of renewable materials in products such as Cross Laminated Timber (CLT) and Glue Laminated Timber (GLT) coupled with new construction processes optimises modern methods of sustainable construction. Councils and governments are beginning to initiate Wood Encouragement Policies (WEPs), setting guidelines that foster timber use in construction. Employing a Systematic Literature Review (SLR), the present paper sought to answer the question 'how do we encourage/influence more councils and governments to adopt timber-first policies?' – focusing in particular on the adoption of WEPs by councils and/or governments not attached to a forestry community from which social, environmental and economic benefits are derived. Ninety research items were identified as a result of the searches in known databases. Exclusionary and inclusionary criteria were applied resulting in sixty-two items qualifying for review. Results suggest councils and governments with no direct reliance on the forestry industry sector for economic benefit can adopt, or at least associate with, WEPs. Results are discussed and suggestions are presented to attempt to increase the adoption of WEPs by councils and governments across the world.

Keywords: *Mass Timber Construction; MTC; Cross Laminated Timber; CLT; Glue Laminated Timber; GLT; Wood Encouragement Policies; WEPs; Sustainability; Construction; Timber; Timber-First*

The construction industry is seeking to adopt modern methods of construction thereby revolutionising the way we build (NHBC, 2016). Included in the suite of technologies that fall under this umbrella is an undeniable rise in Mass Timber Construction (MTC). As the primary component in MTC is timber, or wood, the use of MTC as an alternative material and process has inherently motivated various councils and governments to initiate the adoption of Wood Encouragement Policies (WEPs). WEPs are a set of guidelines that foster the stimulation of wood use in construction. Generally, WEPs do not specifically mandate for timber to be used as a primary material in building, however, acknowledge and respect that wood is a renewable construction product with significant advantages, including holistic environmental, economic and social benefits (Rotorua Lakes Council, 2015; Tasmanian Government, 2017).

MTC provides benefits such as new and upcoming prefabricated methods of construction; while WEPs offer an element of pragmatism by yielding the ability to meet international climate change goals in tandem with the increase of MTC in the industry (Rotorua Lakes Council, 2015). WEPs also encourage the sourcing of responsibly managed timber by aiding forest management and contributing to the renewability of a resource for future generations (Food and Agriculture of the United Nations, 2016). Naturally, WEPs are more prolific in areas that have an established affinity with the forestry industry and councils and governments such as Rotorua (NZ), Latrobe (VIC, Australia), Fraser Coast (QLD, Australia), Tasmania (Australia) and British Columbia (Canada), each maintain a degree of economic dependence upon the forestry sector and thus advantageously sustain encouragement policies (Stewart et al, 2012: 8; Schirmer et al, 2018: 20; Rotorua Lakes Council, 2015; Tasmanian Government, 2017: 2). Ultimately, a trend exists whereby governments that hold an affinity with the forestry industry associate more with wood encouragement strategies than governments that do not affiliate with the forestry industry sector (Stewart et al, 2012: 57). The Town of East Fremantle (WA, Australia), however, has recently adopted a strategy to encourage wood use in construction while maintaining little-to-no direct association with the forestry industry (East Fremantle, 2017).

Drivers of WEPs over the last decade have worked in tandem with one another and in turn, the rise of WEPs has increased with the establishment of MTC. Such factors for wood construction solutions include; the Christchurch rebuild, affordable housing, seismic-proofing buildings, research and development, international desire for renewable materials and rapid increase in building and housing activity throughout Western nations (United Nations, 2015; Rotorua Lakes Council, 2015; Smith, 2015: 12; Eyre et al, 2009: 27; Tasmanian Government, 2017: 2). Ultimately, then, a considerable opportunity to stimulate the adoption of WEPs across more councils and governments around the world presents itself, especially in locations outside of those with a specific forestry industry related economy.

Following an extensive literature review, a gap was identified concerning the synergy of the up-take of MTC and the adoption of WEPs by councils/governments with and without a forestry community. The evidence suggests that alternative solutions concerning how councils and governments with no direct reliance on the forestry industry sector can adopt, or at least associate with, WEPs.

Contact
[1]Scott Milestone
University of York
Heslington, York, YO10 5DD, UK
Email: sm1859@york.ac.uk

Mass Timber Construction Journal
Received 17th Jan 2019, Accepted 10th March 2019
DOI: Not Assigned

Method

A Systematic Literature Review (SLR) was employed in order to answer the question 'how do we influence more councils and governments across the world to adopt timber-first policies?' The first section of the SLR examines current action in the industry, understanding the core premise of the driving force behind WEPs. The rest of the SLR is then structured as follows: (1) contemporary WEPs and motivations for wood utilisation; (2) barriers to wood solutions; (3) opportunities for WEPs and (4) established initiatives that can actively stimulate more councils and governments to implement wood utilisation strategies. The items within the review were rigorously screened and filtered to determine inclusionary and exclusionary criteria. Research items were collected to further our understanding of contemporary WEPs in tandem with the impacts of MTC and forestry communities/industries.

The research compromised contemporary work dating back no further than 1995 to the present day. This meant that each study and report maintained its relevance to the wider scope of the project. All of the scholarly and governmental papers were identified on Google Scholar, ResearchGate and/or Google Search, and were only extracted for employment once identified as crucial to the research agenda. As the present research paper attempts to examine government policy and research in synthesis with academic research, it was deemed necessary to exclusively utilise these search engines rather than academic-orientated ones due to the potential of omitting government papers, which were ultimately vital to the research question.

Search Criteria

Boolean Operators were used to construct chain-based searches in the quest for pertinent research items. Search terms included; "wood" AND "first" AND "policy" AND "timber" AND "forest" AND "community" AND "encouragement" AND "environment" AND "new zealand" AND "australia" AND "employment" AND "forestry" AND "industry" AND "construction" AND "importation" AND "benefits" AND "canada" AND "europe" AND "north america" AND "barriers" AND "opportunities" AND "council" AND "government."

Ninety research items were identified as a result of the searches. Nineteen reports, twenty-eight academic pieces, six policy documents, five conference and meeting papers and four web pages were placed into the inclusionary criteria and thus reviewed, equating to a total of sixty-two inclusionary items. A further eleven reports, fifteen academic articles and two policy documents were excluded from the review, equating to a total of twenty-eight exclusionary items. Exclusionary data included pieces that were overly broad in focus or too distant from the research agenda – fundamentally failing to address the research question. Ultimately, the use of a systematic literature review ensured that the correct papers were identified in each chain search, filtered to suit the needs of the research agenda and synthesised accordingly.

Results & Discussion

In the following section, the paper sets out to synthesise government attitudes and academic research around timber procurement strategies. Following an analysis of the results, the paper then opens a short discussion how to best stimulate policies and thus encourage MTC adoption across various nations and localities. A critical aspect to the SLR was the identification of what is termed 'policy ecology' (Perley, 2001: 15). Policy ecology addresses the environmental, social and economic aspects of policy matter, and is a common theme for any business/government to consider when adopting WEPs.

Table 1. Inclusionary and Exclusionary Criteria for the Systematic Literature Review

Criteria	Inclusionary	Exclusionary
Language	Accessible in English	Not accessible in English
Relates to	Construction industry; Forestry industry; Environmental sustainability; Economic sustainability	Fails to provide insight into any of these selected industries/sectors
Aims of literature	Shares insight into potential barriers of wood use in construction and/or offers opportunities to better utilise wood resources and provide wood-orientated solutions	Does not prioritise/focus specifically on wood utilisation, barriers and/or solutions
Source	Books, articles, reports, working papers and any other form of scholarly, academic or governmental research/statistics	News articles and other non-scholarly evidence/statistics that can easily be disputed and subject to bias
Content of literature	Engages with domestic and international policies surrounding the use of wood and other construction materials	Fails to address relevant information in relation to research agenda

Thus, throughout this review, subtle attention is paid to the 'policy ecology' in the surrounding discourses. In the following sections the literature is reviewed in a systematic manner, starting first with contemporary WEPs and motivations for using wood/timber in construction; secondly, examining barriers to wood utilisation; thirdly, looking at alternative ways to harness wood utilisation before fourthly, exploring practical initiatives and/or laws to carry out specific ways to utilise wood solutions. In Tasmania, the most southern state of Australia, WEPs stimulate sustainable econ-

-omic development and growth, which in turn, supports its forestry industry sector (Tasmanian Government, 2017). The Tasmanian example illustrates that actions by government to implement and adopt WEPs subsequently has a two-fold impact; firstly to mitigate climate change through the adoption of a renewable resource, and secondly, to encourage/stimulate the use of wood – an economic staple (Tasmanian Government, 2017: 1). Similarly, Wattle Range (SA, Australia), Rotorua Lake Council, (North Island, New Zealand) and British Columbia (Canada) have established WEPs to garner the positive impacts they have on their respective local economies (Wattle Range Council, 2015; Rotorua Lakes Council, 2015; British Columbian Government, 2018). Latrobe City Council in Victoria, Australia, not only maintains an encouragement policy, but has recently produced a paper that examines patterns in the industry, seeking to better utilise wood in construction (Latrobe City Council, 2015).

Common motivations for adopting WEPs identified in the review were: taking inspiration from other councils to uphold similar measures; promoting the renewability of the forestry and building industries (such as adoption of MTC); growing demands for rapid affordable housing; harmonising with international environment/sustainability goals and encouraging contractors/ suppliers to use wood more normatively for local economic gain (Latrobe City Council, 2015: 11; Rotorua Lakes Council, 2015: 5; Kyogle Council, 2015; Wattle Range Council, 2015; Wellington Shire Council, 2018: 124). In part, the adoption of WEPs subsist due to increasing demands from governments, communities and industries that share a mutual motivation regarding an awareness of the holistic benefits that come from using wood. Kremer and Symmons (2016: 11) found that wood is significantly higher in its social acceptance when compared to alternative materials; while the greater environmental sustainability of wooden structures is also widely recognised and thus further accepted (Kremer & Symmons, 2015).

Of critical note, the councils and governments within the present paper insofar share a strong affinity with WEPs and derive significant economic benefits from a strong forestry industry sector. For example, 2.6-3% of the employed workforce in Gippsland (in which Latrobe City Council is located) depend on the forestry industry for employment. In fact, the level of employment in the timber industry grew 12% in the region from 1996-2006 (Stewart et al, 2012: 49). The socio-economic impact of the forestry industry holds a large amount influence in Gippsland explaining, at least in part, why councils such as Latrobe (VIC, Australia) and others, aim to uphold the utilisation of timber in all possible fields.

Aside from the aforementioned motivations that influence councils to adopt WEPs, Gosselin et al (2017) highlight several other factors that holistically contribute towards the motivation for wood use – see figure 1. The chart includes; aesthetic benefits, increased on-site productivity gains in construction, costs reductions, technical aspects of timber (the benefits of the engineering/architectural properties of wood in comparison to alternatives such as concrete and steel) and sustainability benefits (Gosselin et al, 2017: 555). Indeed, the literature confirmed that the most important motivation (31% of the industry) for wood utilisation is the sustainable and positive environmental performances that the product brings to the fore. (Gosselin et al, 2017; Roos et al, 2010; Kozak, 1995). Mutually, councils and governments, architects, structural engineers and other industry players all express the desire for renewable building solutions (Rotorua Lakes Council, 2015).

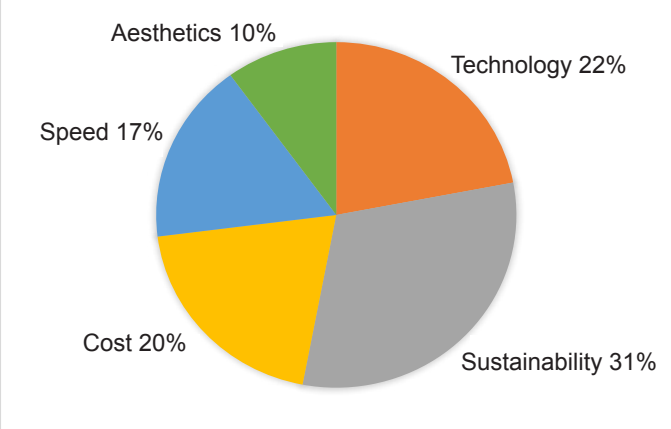

Figure 1. Motivations for wood utilisation in construction. Adapted from Gosselin et al, (2017).

The other motivations (including aesthetics, erection speed, technical aspects and cost) are more industry-orientated than government-specific (Gosselin et al, 2017: 555). Roos et al (2008) and Shmeully-Kagami (2008) explored the limited demand for energy used in the manufacturing and construction processes of timber structures, which presents new evidence for manufacturers and governments to perhaps meet environmental or even economic quotas. Thus, while demand for wood solutions in councils that maintain a forestry industry is prevalent, there is also much potential for further change outside of forestry-orientated bodies (Perrett, 2011).

The utilisation of wood products in construction has many benefits and thus motivations, however barriers were identified within the literature. These barriers explain why the use of timber in buildings has been hindered in its progression heading into the 21st Century – as seen in figure 2.

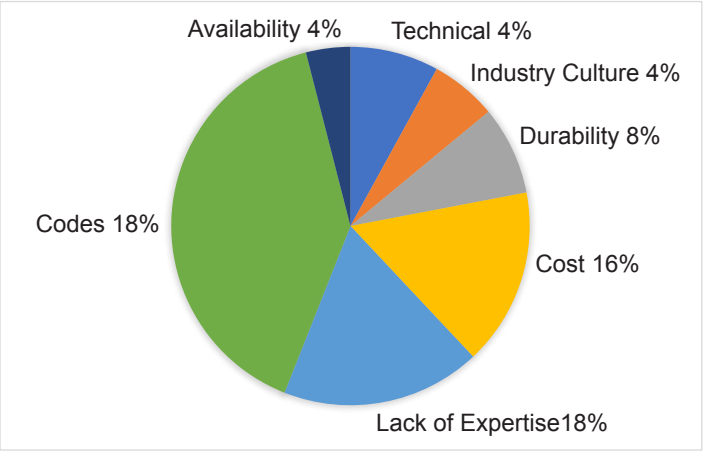

Figure 2. Wood utilisation barriers in construction. Adapted from Gosselin et al, (2017).

The most prolific obstacle contributing to the lack of wood utilisation in construction stems from rigid building codes (Gosselin et al, 2017). Gosselin et al (2017) found that national building

codes include a variety of rules and limitations constraining the use of wood - these incorporated: (1) Fire safety rules; (2) incorrect perception of wood fire resistance and (3) lack of knowledge related to codes and to the calculation of wooden beam sizes and ties (Gosselin et al, 2017: 557; Kozak, 1995: 21; Goetzl and McKeever, 1999: 20; Kozak and Cohen, 1999: 44; Östman, 2004; Marsh, 2016; Schmidt and Griffin, 2013; Hildebrandt et al, 2017: 415). For example, in most countries, the maximum height for any structure – utilising wood as a prime fabrication – is six floors (Gosselin et al, 2017: 557). Turner et al (2005) also found that China's building codes subsequently discriminate against New Zealand's radiata pine. Indeed, due to the rigidity of codes across the globe, MTC is clearly unable to flourish to its full extent.

The second main barrier to wood utilisation concerns the relatively low level of expertise in the industry. Much of the literature identifies a lack of knowledge in the field, inherently affecting wood use by architects and structural engineers, establishing that a thorough understanding of wood technologies is still yet to develop (Gosselin et al, 2017; Roos et al, 2010; Xia et al, 2014). A lack of interaction with MTC in general is also prevalent in the surrounding literature. Apathetic and naïve attitudes towards wood use encompasses several elements: (1) The conservative attitude of the construction industry; (2) high preferences for established practices; (3) the lack of standardisation and organisation of the industry; (4) the lack of stigmatisation of wood as a key component of 'social housing' and (5) the important need for further research in the industry (Gosselin et al, 2017: 559; Hurmekoski et al, 2015; Buckett, 2014: 64; Rotorua Lakes Council, 2014: 16). Research into innovative and renewable solutions, then, will be a key driving force behind establishing wood utility as a mainstream method of construction. Cost also appears to be a persistent barrier in the harnessing of wood as a building material. Indeed, the stigma surrounding the affordability of timber affects the demand for the product, rather than the supply of it (Perrett, 2011: 7; Kozak, 1995; Gosselin, 2017: 556).

Typically, motivations for timber use are principally idealistic and, to an extent, utopian. However, opportunities for the adoption of wood use is often more pragmatic. The literature includes the potential for the industry to benefit from the uses of off-site panelised construction (Jaillon and Poon, 2008: 959). Due to its quality and speed attributes, as well as its applicability to the range of residential 'typologies,' off-site (pre-)fabrication offers huge potential to become a normative conception in construction (Buckett, 2014: 7; Wood Products Victoria, 2015: 10) and thus stimulate timber utility on a larger scale. The adoption of a renewable alternative to more traditional construction methods affords a new opportunity for councils and governments, that are not attached to a forestry industry, to view WEPs as a primary driver to meet sustainability objectives, or social housing deadlines.

Indeed, wood trading offers an opportunity to increase the demand for wood products in regions such as South East Asia and the Middle East (Ministry of Agriculture and Forestry, 2009: 30). New markets in these areas - that do not have an affinity with domestic forestry industries due to geographical circumstances – concurrently seek to establish trade relations with governments that have access to forests within their domain. New Zealand's top export markets for wood are: China 38%, Australia 15% and South Korea 10%. More recently in 2016, China imported 68% of New Zealand's logs (Ministry for Primary Industries, 2016: 3-4; Turner, 2005: 33). China is thus afforded an opportunity to ensure that WEPs are established for its local market, a market that is devoid of a domestic forestry industry, yet one which has the ability to consume copious amounts of timber for economic and even social benefit.

The implementation of WEPs have shown to stimulate wood utility in construction (Tasmanian Government, 2017: 1). WEPs may also contribute to the phasing-out of subsidies that support fossil resource use, for example, the utilisation of concrete or steel building materials inherently contributes heavily towards carbon emissions, however, by favouring wood solutions over other materials, the release of carbon into the atmosphere can be significantly cutback (Eurostat, 2014; Hildebrandt et al, 2017: 415). Generally, tax incentives are the most favourable method to reduce carbon emissions and thus increase timber use in the construction sector. Tax designs can be implemented to burden companies that continuously emit high greenhouse gas emissions, or reward those that consistently reduce their carbon footprint (Hildebrandt et al, 2017: 415). Indirect cost incentives have been proven to be more effective in increasing the efficiency of the manufacturing sector, as opposed to direct policies. For example, in Europe, the cement sector will not have to buy carbon credits until 2043 due to the technicalities of the legislation (Hildebrandt et al, 2017: 415; Morris, 2014). WEPs can of course be much more colourful. As Hildebrandt et al (2017) discusses, institutions and authorities have undeviating potential to encourage the utilisation of wood-based solutions throughout the industry. Such initiatives might include research development in education institutions, which can, in turn, create positive spill-over effects in terms of 'passing on' information relating to wood use in construction – something which is especially important when 'overcoming path dependencies' – a rigid link in a conservative building industry (Aschhoff and Sofka, 2009; Hildebrandt, 2017: 416; Gosselin et al, 2017).

One unique study managed to draw firm links between WEPs and forestry sector affiliation with WEPs and non-forestry sector affiliation. Kuzman et al (2017) compared three countries – Finland, Sweden and Slovenia – finding that each nation had their own respective policies to enhance the use of wood in construction. Finland, for example, had a 'National Wood Construction Programme 2011-2015;' and, since 2016, has appointed an official advocate for the use of wood in construction (Kuzman et al, 2017). Another strategy to initiate wood utilisation was the facilitation of a 'wood culture'. Kuzman et al (2017) found that promotional campaigns and technology platforms were also developed in the 1990s in Finland. As a legacy of this, two main approaches are thus concurrently used throughout Finland, including the promotion of the concept of 'modern wood cities' and the construction of wooden multi-storey apartments and office buildings (Kuzman et al, 2017; Riala and Ilola, 2014). The concept of wooden cities positively stigmatises timber construction solutions, easing the process of other initiatives, such as tax incentives, procurement policies and trade initiation. Positively stigmatising wood construction is another method to 'overcome path dependencies' (Aschhoff and Sofka, 2009; Hildebrandt, 2017: 446) in a rigid and conservative building industry (Gosselin et al, 2017). Such an approach therefore indicates a connection between economic and social policy approaches surrounding wood utility and can contribute to the adoption of WEPs across councils and governments all over the world, regardless of forestry affiliation.

Conclusion

The present paper sought to address timber-first policies in relation to MTC and how councils and governments can stimulate this growth through procurement policies. The evidence from the review suggests that councils and governments with a close relationship/dependency on forestry communities for economic and social benefits are naturally more motivated to adopt WEPs (Latrobe City Council, 2015; Rotorua Lakes Council, 2015; British Columbian Government, 2018). The bigger challenge is engaging the remaining portion of communities to consider the benefits of wood use, in turn driving the implementation of WEPs. It is clear from the analysis presented that WEPs can promote and sustain both economic and social benefits for communities through the adoption and use of wood by-products, trading agreements, wood use in construction and the adoption of renewable resources as a method of attaining environmental objectives. Councils and governments who have not adopted WEPs should conduct a cost benefit analysis and may find that timber use in their region/locality is more beneficial than first thought. Wood encouragement strategies stand for much more than simply the adoption and use of wood, they also represent a morally just and focused commitment to the global sustainability movement.

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