

CONSUMER'S EXPECTATIONS AND SUSTAINABLE THINKING TOWARDS TIMBER CONSTRUCTION IN AUSTRIA

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Abstract:

Wood as a construction material is not only very versatile, with its renewability and capability of acting as long-term carbon storage, it is able to play a key role in solving one of the most critical and talked-about problems in this day and age: climate change and environmental pollution. To maximize this effect, timber construction needs to become ready for the mass market and establish itself as the standard building method, something heavily dependent on the attitude of the consumers looking to buy or build real estate. This study, conducted as an online survey with a diverse group of participants, primarily aimed to explore what consumers are looking for when buying or building a house and how they think about wood as a construction material. Consumers tended to mainly care about aspects influencing their living experiences and their real estate's value stability – higher-earning consumers more than lower-earning ones – and while ecological factors are seen as important, they are not a decisive factor in making a buying decision. The participants thought favorably of wood as a construction material, however, aspects like its price and durability were seen more negatively, while other aspects, especially its healthiness and high quality, were seen more positively. While the vast majority agreed with wood being eco-friendly, it was not its key selling point. Subsequently, possible explanations, solutions and outlooks were given.

Key words: timber construction; wood products; sustainable building; bioeconomy; eco-awareness.

INTRODUCTION

Climate change and environmental stewardship are as never before state-of-the art subjects. One of the main goals of the World Climate Conference 2022 is that more than 190 participating countries should formulate long-term strategies to reduce their climate-damaging emissions to zero by the middle of the 21st century and to bring them to the so-called "Net Zero" (United Nations Climate Change 2022).

Clever wood use could mitigate climate change, resulting in significantly lower emission of greenhouse gases compared to other materials (Valsta et al. 2017). From all construction materials, wood stores large quantities of carbon, with sustainable use of biomass resources for long term (Kazulis et al. 2017). Wood substitutes environmentally damaging sources of material and energy such as fossil fuels (Myllyviita et al. 2021). Timber was revitalized as a sustainable construction material for being highly renewable and nontoxic with low embodied energy feature (Aboulnaga and Elsharkawy 2022). Modern timber constructions use wood and engineered wood products like glue laminated timber (GLT) or cross laminated timber (CLT), as well as different combinations of wood-based composites aiming to achieve solid structures with better structural, physical and sustainable characteristics (Milner and Woodard 2016). Development of glue lamination technology led to structural products with arbitrarily large sizes. GLT and CLT are competitors of steel and concrete for pre-defined (medium-to high-rise) multi-storey buildings (D'Amico et al. 2021).

The service life of timber structures is from 50 to more than 200 years. The product lifespan of wood houses and bridges is from 50 to 200 years, of wood trusses from 60 to 400 years (Reinprecht 2016), (Zubizarreta et al. 2019).

While the market share and market presence of timber construction has been constantly rising for the last decade (Stingl et al. 2011), the timber industry should strive how to gain more consumers and what their demands are, to increase its market share, ultimately making the construction sector more sustainable.

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Timber construction determine reduced energy consumption and building costs. Studies concerning sustainable development (Generalova et al. 2016) (Bajno et al. 2021) and monitoring (Marsili et al. 2017) of wooden buildings emphasised that for these low-energy constructions can be applied innovative design, with the advantage of scalable and modular production, considering also damage detection (Hijikata and Mita 2006). Previous studies as (Gold and Rubik 2009) and (Petruch and Walcher 2021) provided a body of information related to consumer preferences towards timber construction. On the other hand, there is a lack of data concerning consumers' priorities, consumer values and the role of ecology, sustainability and eco-friendliness in this sector.

The aim of this research is to identify consumer's priorities, their customisation in timber construction, in which way can be better implemented in timber industry and to what extent the purchase decision is influenced by consumers' sustainable thinking. Observing consumer preferences for wood construction sector is an interesting exercise especially considering different age categories. In their research, (Petruch and Walcher 2021) analysed millennials attitude vis-à-vis timber construction. The present study analyses, besides millennials, other age groups, to ensure a balanced scatter of survey participants.

MATERIAL AND METHODS

To reach a diverse group of Austrian customers amongst all demographic, psychographic and sociographic groups an online survey was conducted between February and March 2022 and distributed via personal and institutional social media as well as amongst students and departments at the Salzburg University of Applied Sciences and the University of Salzburg. The survey consisted of five main parts: Demo- and sociographics, an eco-consciousness self-assessment, the perception of timber as a construction material and ecology as an influence on real estate buying decisions. The majority of survey takers did not have any previous knowledge of timber or timber construction and no background information was provided at the time of the online survey. For "Agree" or "Disagree" questions an average percentage of agreement was then calculated from the results of the online questionnaire with "Fully Agree" being considered 100% agreement, "Agree" 66%, "Disagree" 33% and "Fully Disagree" being considered 0% agreement. The same system was used for "Important" or "Not Important" questions. Due to the relatively small sample size of 128 a weighted or cluster analysis, similar to (Petruch and Walcher 2021), or other statistical analyses were not applied as they were not expected to yield more representative results.

RESULTS AND DISCUSSION

Due to the disproportionately high efficiency when distributing the survey amongst young adults, primarily students, only 10% of the participants were over 35 years old, with the vast majority, 60%, being between 19 and 25-year-old. The participants gender was an almost exact split with 50,0% identifying as male, 49,2% identifying as female and 0,8% of the 128 participants preferring to describe as nonbinary, an accurate representation of the 49,2% male and 50,8% female whole Austrian population (Bundeskanzleramt 2020) and the 51,4% male and 48,6% female 19 to 35-year-old Austrian population (Statista.at 2022). The participants are located primarily in rural areas (60%), followed by suburban (23%) and urban (17%) areas, a more rural-leaning audience than the Austrian national average, where 59% live in urban areas (statista.at, 2022b). Note that in official statistics suburban or rural areas are considered urban if the municipality has over 10.000 permanent residents. In total 98% completed secondary education of some form with 48% having post-secondary education. Overall the audience was educated above average (Statistik Austria 2021a) with 16% having postsecondary education without a degree, 21% holding a Bachelor's degree, 9% holding a Master's degree and 2% having completed a doctorate or PhD of some form. Over two thirds, 70%, are employed or self-employed with 36% of all participants being students with a side job, 12% working full- or part-time and earning less than 30.000 € annually, the Austrian average annual salary (Statistik Austria 2021b), and 22% of all participants working full- or part-time and earning over 30.000 € annually. The questionnaire participants were also asked for a self-assessment of their eco-awareness on a scale of 0 (none at all) to 5 (very eco-conscious) with the questions explanation specifically asking them to take the influence of sustainability on their day to day buying decisions into consideration. The average participant rated their own eco-awareness with a 3 (median) / 3,22 (arithmetic) out of 5. While these results are too abstract to directly compare or validate, they prove that all survey takers let factors like sustainability and eco-friendliness influence their buying decisions, especially as none of the 128 participants answered with 0 and only 5 (4%) of them answered with 1 out of 5 (Table 1).

Table 1

Age, gender structure, living environment, profession and eco-awareness of survey's participants

Age Group		Total (n)	Total (%)	≤ 18 (%)	19 – 25 (%)	26 – 35 (%)	36 – 45 (%)	≥ 45 (%)
		128	100	00,8	60,2	29,7	06,3	03,1
Gender	Male	64	50,0	00,8	28,1	16,4	03,1	01,6
	Female	63	49,2	00,0	31,3	13,3	03,1	01,6
	Nonbinary	1	00,8	00,0	00,8	00,0	00,0	00,0
Living Environment	Urban	22	17,2	00,0	08,6	05,5	01,6	01,6
	Suburban	29	22,7	00,0	12,5	09,4	00,8	00,0
	Rural	77	60,2	00,8	39,1	14,8	03,9	01,6
Education	Secondary w/o Matura ¹	3	02,3	00,0	01,6	00,8	00,0	00,0
	Sec. w/ Matura AHS ²	30	23,4	00,0	17,2	06,3	00,0	00,0
	Sec. w/ Matura BHS ³	33	25,8	00,8	20,3	03,1	01,6	00,0
	Postsec. w/o Degree	20	15,6	00,0	10,2	05,5	00,0	00,0
	Postsec. w/ Bachelor's	27	21,1	00,0	09,4	07,0	04,7	00,0
	Postsec. w/ Master's	12	09,4	00,0	01,6	07,0	00,0	00,8
	Doctorate or PhD	3	02,3	00,0	00,0	00,0	00,0	02,3
Profession	Student w/ Side Job	46	35,9	00,8	28,1	05,5	01,6	00,0
	Student w/o Side Job	39	30,5	00,0	20,3	07,8	00,8	01,6
	Full Time < 30.000€ p.a.	15	11,7	00,0	07,8	02,3	01,6	00,0
	Full Time > 30.000€ p.a.	28	21,9	00,0	03,9	14,1	02,3	01,6
Eco-Awareness ⁴	0 (0%)	0	00,0	00,0	00,0	00,0	00,0	00,0
	1 (20%)	5	03,9	00,0	02,3	01,6	00,0	00,0
	2 (40%)	16	12,5	00,0	07,8	03,1	01,6	00,0
	3 (60%)	62	48,4	00,8	29,7	15,6	00,0	02,3
	4 (80%)	36	28,1	00,0	17,2	07,0	03,9	00,0
	5 (100)	9	07,0	00,0	03,1	02,3	00,8	00,8

Ann.: ¹ Austrian High School matriculation exam; ² Austrian High School; ³ Austrian Vocational High School for Technology or Business; ⁴ Self-Assessment on a scale from 0 to 5.

The consumers' priorities when building, planning to build or renting a house is a vital piece of information to better understand consumer demand, both from a marketing and a technological standpoint. The aspects considered most important were "Durability" and "Healthiness" with 97% and 94% of participants either answering "Very Important" or "Important", while the aspects "Eco-friendliness", "Naturality and Recyclability" are not considered as important, with 86%, 85% and 81% answering "Very Important" or "Important", respectively. When only looking at the percentage of participants answering "Very Important", the difference between the first two and last three categories is much higher (Fig. 1). Similar to Rubik & Gold (2009), this studies results show that while ecological aspects are important to the consumer, aspects which directly influence their living experience are more important when making a buying decision, however the difference is not significant.

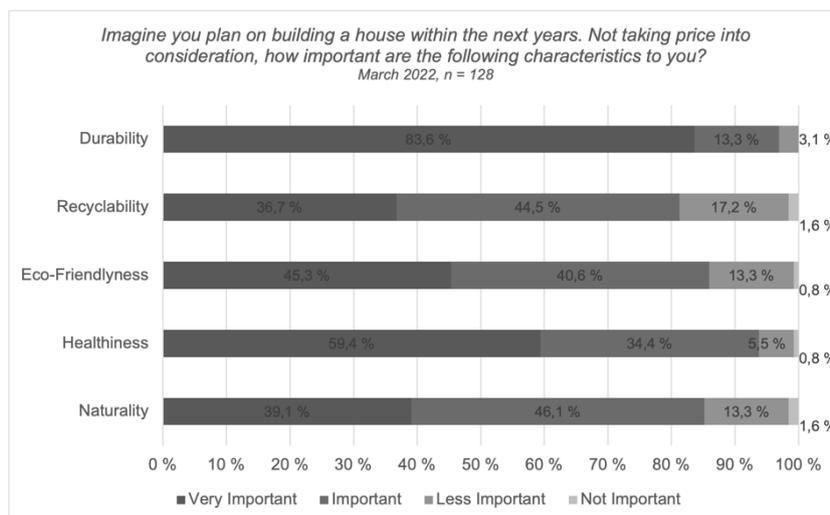


Fig. 1.
Consumer Priorities (Mühlbacher 2022).

As results from Fig. 2, the 36-45-year-old participants, 8 in total, show a significantly higher interest in ecological aspects and less interest in “Durability”. This could be caused by the relatively low sample size, however this being the only reason is unlikely. Both the age group 19-25 years and 26-35 years show very similar results – mainly within a margin of about 3% – and are very close to the average of all age groups in all aspects. Note that the age groups ≤ 18 years and ≥ 45 years were not considered individually but are part of the calculation of the all participant averages in Fig. 1 and Fig. 2.

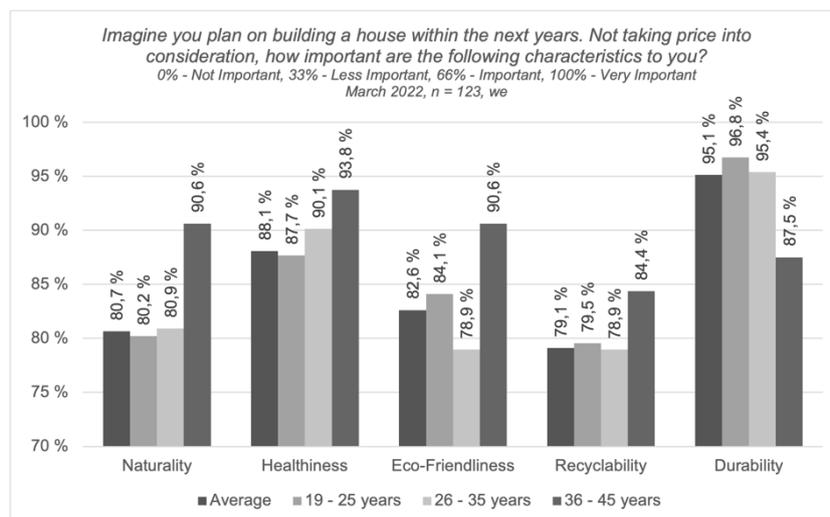


Fig. 2.
Consumer Priorities per Age (Mühlbacher 2022).

While students, both with and without a side job, show, with the exception of Neutrality, similar results within a margin of 2-3%, the difference between questionnaire participants working full- or part time and earning more than 30.000 € and those earning less than 30.000 € annually is more significant. With the exception of “Healthiness”, where both groups were very similar, the higher-paid participants rated all aspects significantly lower than other groups, especially the environmental aspects “Naturality”, “Eco-Friendliness” and “Recyclability”, indicating that higher-earning questionnaire takers tended to care more about the features and value stability of their property (Healthiness and Durability), showing more individualistically motivated thinking, while lower-earning participants tended to care more about environmental aspects (Naturality, Eco-Friendliness and Recyclability), showing more sociologically motivated thinking. These assumptions are further confirmed when looking at the two groups of students. Students without a side job tended to rank environmental aspects, with the exception of Recyclability, slightly higher than those who do have a side job (Mühlbacher 2022) (Fig. 3).

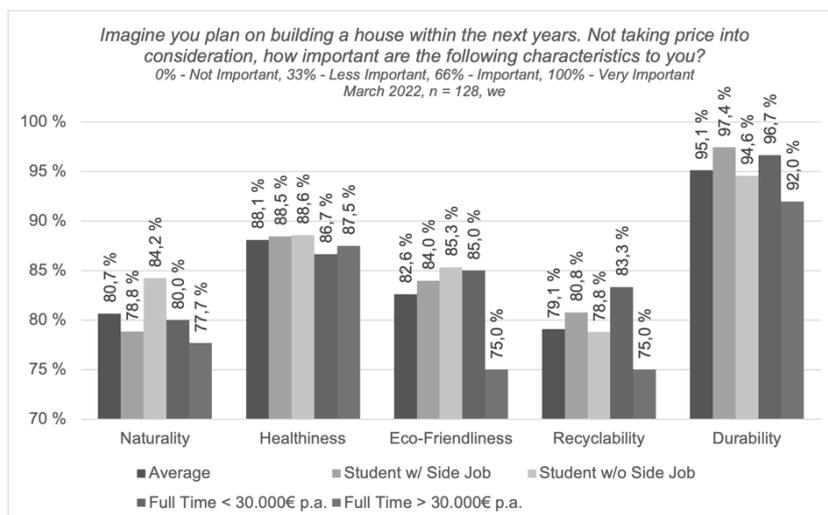


Fig. 3.
Consumer Priorities per Status of Employment (Mühlbacher 2022).

Understanding how consumers perceive wood as a construction material is the key to communicating efficient and eco-friendly building methods – by using timber as the primary construction material – to the consumer. While the vast majority of participants agreed with timber being natural (98% stating “Fully Agree” or “Agree”), healthy (95%) and high quality (95%), certain aspects of timber as a construction material were not seen as positively, mainly its expensiveness (77%, note that agreement is negative in this case) and durability (82%) (Fig. 4). In generally, the results were very positive with the only exception regarding price and durability of timber construction. When comparing the results to Petruch & Walcher (2021) there are certain similarities. The latter measures the agreement of participants on a 5-point Likert scale, where climate-friendly has an agreement rate of 3,58, high quality 3,31 and expensive 3,09, all of which are very similar – within a certain margin – to this study. In addition stability, short-lived and weathering are the second, fourth and fifth, respectively, most often named disadvantage of timber construction in Petruch’s study, a possible explanation for durable being the second-worst rated aspect in this study (Mühlbacher 2022). See Fig. 4.

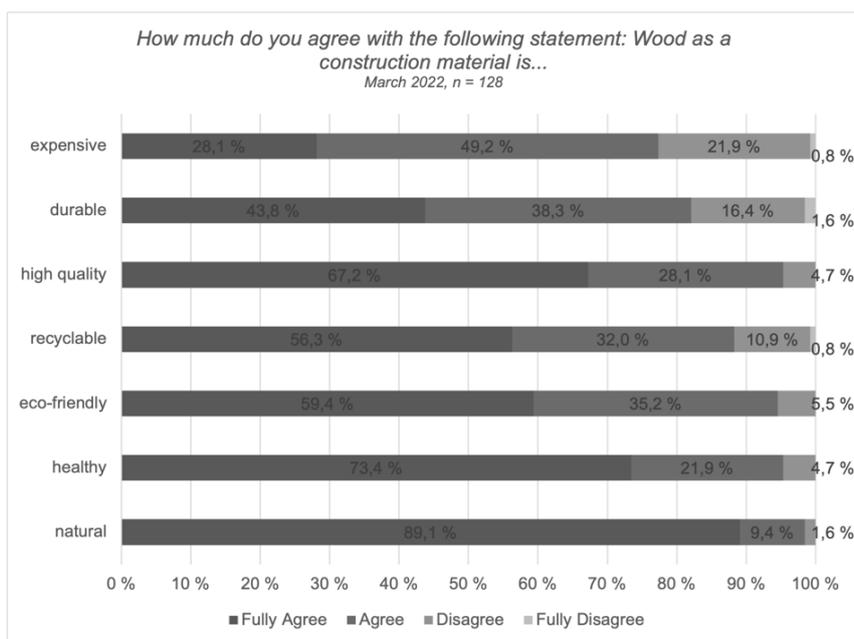


Fig. 4.
Consumer Attitude towards Wood (Mühlbacher 2022).

When comparing the survey results per age, there is a noticeable and significant difference between the individual age groups. As results from Fig. 5, the age group 36-45 years agree more with aspects directly

influencing their living experience and the conservation of property value – mainly durable, high-quality and healthy – while younger age groups favour ecological aspects like natural and eco-friendly. These results are contrary to what was expected because, looking at Fig. 2, the age group 36-45 years cares more about ecological aspects than younger age groups. This indicates that, in reality, the public perception of wood as a construction material is more negative than portrait by this study, as the group which cares the most about its ecology rates it the worst. Younger age groups also tended to agree more with wood as a construction material being expensive (Mühlbacher 2022). When comparing these results to Fig. 2 it can be seen that the age group which ranks “Naturality” and “Eco-Friendliness” as the most important out of all groups, age group 36-45 years, ranks the naturality and eco-friendliness of wood as the worst. The age groups 19-24 and 26-35 years, which in Fig. 2 rank “Durability” as the most important out of all the age groups, rank the durability of wood as the worst.

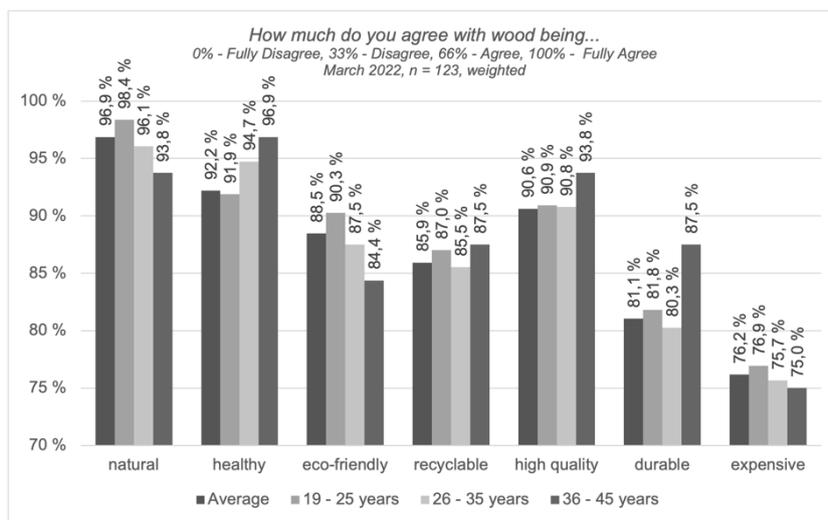


Fig. 5.
Consumer Attitude towards Wood per Age (Mühlbacher 2022).

Analyzing the participants' perception of wood as a construction material by status of employment in Fig. 6 shows an evident pattern, similar to what can be seen in Fig. 3, where higher-earning participants ranked ecological aspects as less important than lower-earning participants. Participants working full- or part-time and earning over 30.000 € annually consistently had the worst perception of wood as a construction material while those earning less than 30.000 € annually had the highest or second highest level of agreement in all categories. Students show a similar pattern; students without a side job rate wood higher than those with a side job in all categories but healthy and eco-friendly. When combining the findings of Fig. 3 and Fig. 6 it can be concluded that higher-earning participants care less about ecological aspects and have a worse perception of wood than lower-earning participants.

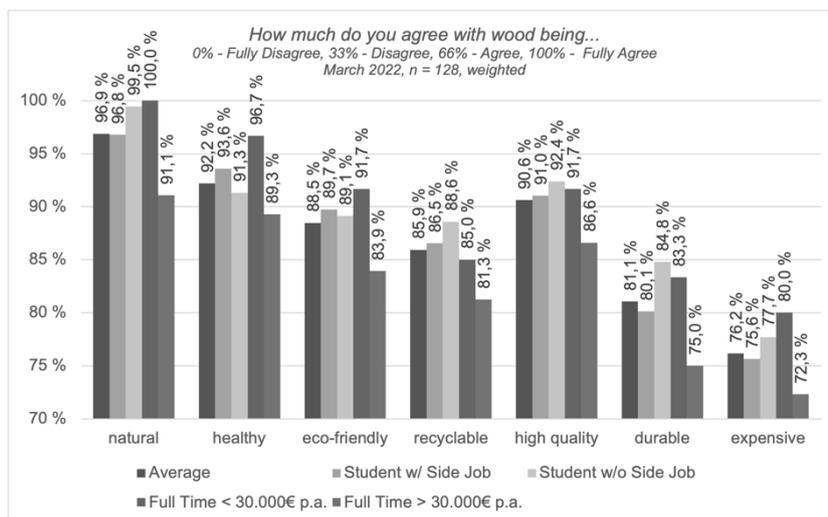


Fig. 6.
Consumer Attitude towards Wood per Status of Employment (Mühlbacher 2022).

Both questions – consumer priorities and consumer demand – were also sorted by gender and education, however neither analysis showed any significant results. When asked about their priorities when building a house, women tended to care slightly more (3%) about “Healthiness”, men slightly more (2%) about “Recyclability”. A possible explanation could be psychology. Females tend to not only be more concerned about their health (Pop et al. 2021) but also talk more openly about it (Ek 2015), while males tend to be more interested in technology and technical aspects (Su et al. 2009). When looking at the participants’ education there is a slight trend showing that less educated participants care more about environmental aspects while higher educated ones cared more about value conservation and living experience related aspects. An explanation could be age. Generally, higher education correlates with higher age and older participants tended to show more individualistically oriented thinking while younger participants showed more sociologically motivated thinking.

Insulation is one of the most critical components of eco-friendly housing (Adamczyk and Dylewski 2017). Recyclable, ecological and eco-friendly insulation materials need to be a top priority when designing and planning a house. As part of the online survey participants were questioned whether they would get involved in the process of choosing the right insulation material for their house and – on a scale of 0 to 5 – how important ecological and recyclable insulation material is for them. Only 4% answered with 0, 14% with 1 or 2 (4%, 10%) and 82% with 3, 4 or 5 (19%, 28%, 25%), showing that there is significant consumer demand for eco-friendly insulation materials. Considering that participants have little to no experience in the construction industry those results could also show a significant customer demand for eco-friendly construction or construction materials in general. When questioned if ecology and sustainability were deciding factors for the participants’ previous buying or renting decisions, 15% answered with Yes, very, 41% with Yes, a bit and 44% with No. While more than half of all survey takers took ecological aspects into consideration, only every seventh participant actually based their buying or renting decision largely on sustainability. These results are in accordance with the results found in the previous questions of the study and those of (Gold and Rubik 2009).

DISCUSSION

This study shows a similar pattern to the research of (Petruch and Walcher 2021), where participants were divided into Passive Preservers (24%, negative attitude toward timber construction, not communicative about it), Passive Supporters (31%, positive attitude, not communicative), Active Preservers (19%, negative attitude, communicative) and Active Supporters (26%, positive attitude, communicative). In general, the authors of this study found that 43% of the 757 Austrian 20- to 26-year-olds have a rather negative attitude towards timber construction – mainly because they see it as old-fashioned, low quality and harmful to the Austrian forests – while the other 57% had a rather positive attitude towards it. The Passive Preservers and Active Preservers together had a slight majority of female members, were slightly younger than the Supporters, mainly lived in urban environments and were more critical of its ecological advantages. In this study female participants tended to rank timber construction as slightly lower than male participants, however, the younger questionnaire takers did not perceive it as worse, instead often ranking wood higher – mainly because of its ecological benefits – than older ones. In the study (Petruch and Walcher 2021) Passive Supporters and Active Supporters had an equal amount of female and male members and mainly lived in urban environments, they also showed high ecological awareness. While many factors are playing a significant role, the main difference between Preservers and Supporters was most likely their ecological awareness. Given that the 128 participants in this study not only mainly lived in rural areas but also claimed to be very ecologically aware – most likely being categorized as Supporters by Petruch’s cluster and fitting the profile of the Supporters group – the overall very high agreement with wood being a sustainable and ecologically beneficial construction material but also the lower agreement with wood being durable in this study corresponds with Petruch’s and Walcher’s results. The negative opinions about timber construction – mainly its price/expensiveness and durability/value stability – were also found to be the primary named negative aspects in the previous studies of (Gold and Rubik 2009). Similar to the findings of (Ranacher et al. 2018) and (Toppinen et al. 2018) the younger audience showed more critical thinking and saw wood – especially its environmental aspects – more negatively than the older audience, however, because the opinions within the broader public vary significantly (Rametsteiner et al. 2009), (Ranacher 2017); (Petruch and Walcher 2021) these trends are only assumptions. Note that, due to the study having been conducted in an online format with primarily multiple-choice questions, there is potential for noticeable selection bias. There certainly is high demand for sustainable building methods. In the online survey, 82% of participants thought that ecological insulation materials are important, even without background knowledge in the field of (timber) construction. Given that insulation is one of the decisive components in sustainable building (Adamczyk and Dylewski 2017) and in this study the age group 36-45 years – the target audience for buying real estate (National Association of Realtors 2020) – showed a more positive attitude towards timber sustainability than younger generations, these results are a very desirable trend for the timber industry as

good thermal insulation was found to be seen as one of the strongest advantages of timber construction (Gold and Rubik, 2009). While it was the least negatively seen aspect of wood as a construction material in this study, 75% of participants still agreed with wood being expensive, and while timber or mass timber buildings are – typically – slightly more expensive than concrete equivalents (Ahmed and Arocho 2021) the general public's opinion might overexaggerate this difference.

CONCLUSION

Consumers care more about aspects influencing their living experience and their real estate's value stability – higher-earning consumers more than lower-earning ones – while ecological factors are seen as somewhat important, but mostly not influential on their buying decisions. Drawing an illusion of what this means for the timber industry is not entirely possible. While all participants questioned thought favourably of wood as a construction material, there were certain aspects viewed more positively – mainly its naturalness, healthiness and high quality – with its eco-friendliness and recyclability being viewed more neutrally. The most negatively viewed aspects were its expensiveness and durability.

Older participants are more eco-conscious but see the sustainability of wood slightly more negatively. Information campaigns with facts about timber construction, its recyclability and carbon storage could convince eco-conscious target groups to see timber more positively. Higher-earning participants were less eco-conscious and see the sustainability of wood much more negatively than lower-earning participants, possibly caused by a more conservative mindset and no thorough knowledge of modern timber engineering. A possible explanation could be that modern timber construction and mass timber is a relatively new technology and – in certain regions and demographic or sociographic clientele – is not well established yet. It is likely that those more conservatively, individualistically thinking customers are going to change their views once timber construction's long-term durability and value stability is proven, something that is going to be accelerated by large-scale investments in timber real estate and the move towards diversified, green portfolios by large banks and investors (Verma et al. 2021).

This study's limitations include mainly the relatively small sample size of 128 participants – causing the underrepresentation of certain age groups – and the delivery method. Not only is there a potential for selection bias due to the survey being conducted online, but the primary distribution amongst students in the state of Salzburg overrepresents in-state students and underrepresents out-of-state students. To achieve more representative results the study should be extended, in addition, the implementation of focus groups or other methods of qualitative research should be considered.

REFERENCES

- Aboulnaga M, Elsharkawy M (2022) 'Timber as a Sustainable Building Material from Old to Contemporary Experiences: Review and Assessment of Global and Egypt's Examples', in Sayigh, A. (ed) *The Importance of Wood and Timber in Sustainable Buildings*, Cham, Springer International Publishing, pp. 89–129.
- Adamczyk J, Dylewski R (2017) 'The impact of thermal insulation investments on sustainability in the construction sector', *Renewable and Sustainable Energy Reviews*, vol. 80:421–429.
- Ahmed S, Arocho I (2021) 'Analysis of cost comparison and effects of change orders during construction: Study of a mass timber and a concrete building project', *Journal of Building Engineering*, vol. 33:101856.
- Bajno D, Grzybowska A, Bednarz Ł (2021) 'Old and Modern Wooden Buildings in the Context of Sustainable Development', *Energies*, vol. 14(18):5975.
- Bundeskanzleramt (2020) *Demographische Struktur. Frauen und Männer in Österreich - Zahlen, Daten Fakten*, Bundeskanzleramt Österreich.
- D'Amico B, Pomponi F, Hart J (2021) 'Global potential for material substitution in building construction: The case of cross laminated timber', *Journal of Cleaner Production*, vol. 279:123487.
- Ek S (2015) 'Gender differences in health information behaviour: a Finnish population-based survey', *Health promotion international*, vol. 30(3):736–745.
- Generalova EM, Generalov VP, Kuznetsova AA (2016) 'Modular Buildings in Modern Construction', *Procedia Engineering*, vol. 153:67–172.
- Gold S, Rubik F (2009) 'Consumer attitudes towards timber as a construction material and towards timber frame houses – selected findings of a representative survey among the German population', *Journal of Cleaner Production*, vol. 17(2):303–309.

- Hijikata K, Mita A (2006) 'Damage detection of wooden buildings using chaos analysis and system identification', *Smart Structures and Materials 2006: Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems*. San Diego, CA, Sunday 26 February 2006, SPIE, 617410.
- Kazulis V, Muizniece I, Zihare L, Blumberga D (2017) 'Carbon storage in wood products', *Energy Procedia*, vol. 128:558–563.
- Marsili R, Rossi G, Speranzini E (2017) 'Fibre Bragg Gratings for the Monitoring of Wooden Structures', *Materials (Basel, Switzerland)*, vol. 11, no. 1.
- Milner HR, Woodard AC (2016) 'Sustainability of engineered wood products', in *Sustainability of Construction Materials*, Elsevier, pp. 159–180.
- Mühlbacher D (2022) *The Influence of Sustainable Thinking on the Timber Industry: Bachelor Thesis, Salzburg University of Applied Sciences*.
- Myllyviita T, Soimakallio S, Judl J, Seppälä J (2021) 'Wood substitution potential in greenhouse gas emission reduction—review on current state and application of displacement factors', *Forest Ecosystems*, vol. 8, no. 1.
- National Association of Realtors (2020) *2020 Home Buyers and Sellers Generational Trend Report* [Online]. Available at <https://www.nar.realtor/sites/default/files/documents/2020-generational-trends-report-03-05-2020.pdf>.
- Petruch M, Walcher D (2021) 'Timber for future? Attitudes towards timber construction by young millennials in Austria - Marketing implications from a representative study', *Journal of Cleaner Production*, vol. 294, p. 126324.
- Pop LM, Iorga M, Şipoş LR, Iurcov R (2021) 'Gender Differences in Healthy Lifestyle, Body Consciousness, and the Use of Social Networks among Medical Students', *Medicina (Kaunas, Lithuania)*, vol. 57, no. 7.
- Rametsteiner E, Eichler L, Berg J (2009) *Shaping forest communication in the European Union: public perceptions of forests and forestry*, European Commission – DG Agriculture and Rural Development Tender no. AGRI-2008-EVAL-10 [Online]. Available at https://agriculture.ec.europa.eu/system/files/2020-02/ext-study-forest-comm-annex_2009_en_0.pdf.
- Ranacher L (2017) *Where Sector and Society Meet: Empirical Research to Tailor the Communication of the Forest-Based Sector to the General Public* (Doctoral Thesis, University of Natural Resources and Life Sciences Vienna), pp. 19-27).
- Ranacher L, Höfferer K, Lettner M, Hesser F, Stern T, Rauter R, Schwarzbauer P (2018) 'What would potential future opinion leaders like to know? An explorative study on the perceptions of four wood-based innovations', *Die Bodenkultur: Journal of Land Management, Food and Environment*, vol. 69(1):47–59.
- Reinprecht L (2016) *Diagnosis, Sterilization and Restoration of Damaged Timber Structures*, Technical University in Zvolen, Faculty of Wood Sciences and Technology.
- Statista.at (2022) *Bevölkerung in Österreich nach Altersgruppen und Geschlecht 2022* [Online]. Available at <https://de.statista.com/statistik/daten/studie/718077/umfrage/bevoelkerung-in-oesterreich-nach-altersgruppen-und-geschlecht/> (Accessed 24 November 2022).
- Statistik Austria (2021a) *Bildung in Zahlen* [Online]. Available at www.statistik.at/statistiken/bevoelkerung-und-soziales/bildung/bildungsstand-der-bevoelkerung.
- Statistik Austria (2021b) *Jährliches Personeneinkommen* [Online]. Available at www.statistik.at/web_de/statistiken/menschen_und_gesellschaft/soziales/personeneinkommen/ (Accessed 25 November 2022).
- Stingl R, Zukal ML, Teischinger A (2011) 'Holzbauanteil in Österreich. Statistische Erhebung von Hochbauvorhaben', *ProHolz*, 2011:1–24.
- Su R, Rounds J, Armstrong PI (2009) 'Men and things, women and people: a meta-analysis of sex differences in interests', *Psychological bulletin*, vol. 135(6):859–884.
- Toppinen A, Röhr A, Pätäri S, Lähtinen K, Toivonen R (2018) 'The future of wooden multistory construction in the forest bioeconomy – A Delphi study from Finland and Sweden', *Journal of Forest Economics*, vol. 31:3–10.
- United Nations Climate Change (2022) *COP 27 - UN Climate Change Conference* [Online], Sharm el Sheikh, United Nations Framework Convention on Climate Change. Available at <https://unfccc.int/cop27>.

Valsta L, Lippke B, Perez-Garcia J, Pingoud K, Pohjola J, Solberg B (2017) 'Use of Forests and Wood Products to Mitigate Climate Change', in Bravo, F., LeMay, V. and Jandl, R. (eds) *Managing Forest Ecosystems: The Challenge of Climate Change*, Cham, Springer International Publishing, pp. 205–218.

Verma S, Mandal SN, Robinson S, Bajaj D, Saxena A (2021) 'Investment appraisal and financial benefits of corporate green buildings: a developing economy case study', *Built Environment Project and Asset Management*, vol. 11(2):392–408.

Zubizarreta M, Cuadrado J, Orbe A, García H (2019) 'Modeling the environmental sustainability of timber structures: A case study', *Environmental Impact Assessment Review*, vol. 78:106286.