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Criteria in Utilizing Engineered Wood in Residential Construction: A Community Preference Analysis

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Abstract

The phenomenon of global warming continues to intensify, with the construction sector emerging as a significant contributor due to its extensive use of non-biomass materials, which are major sources of carbon emissions. In response, engineered wood has gained attention as a sustainable alternative, offering the potential to reduce emissions and sequester carbon. This study aims to explore public perceptions of engineered wood, focusing on how these perceptions shape preferences and interest in its application for residential construction. The study does not evaluate technical characteristics directly, but rather community interpretations of them. A mixed-methods approach was employed, beginning with qualitative research through online questionnaires that featured open-ended questions designed to capture homeowners and prospective buyers preferences. The responses were then analyzed using content analysis to identify emerging themes. In the second phase, quantitative research was conducted by distributing closed-question questionnaires informed by the findings from the initial phase. The data was analyzed using factor analysis, distribution analysis, and multivariate regression techniques. The study identified three key dimensions influencing material preferences: sustainability, material durability, and material performance. Additionally, three significant dimensions related to construction characteristics were uncovered: design appreciation, construction methods, and material availability. These findings provide valuable insights for the integration of engineered wood into residential construction, offering a pathway to more sustainable building practices.

INTRODUCTION

Global warming continues to intensify each year, presenting a significant challenge in the modern era. Greenhouse gas emissions have been steadily increasing since 2009 (Duan, 2023). Data from the United Nations Environment Programme reveals that, in Southeast Asia, buildings were responsible for 25% of total energy consumption and CO_2 emissions in 2022 (United Nations Environment Programme, 2022). As such, the construction sector remains one of the primary contributors to energy use and environmental degradation (Balasbaneh & Sher, 2024). Reducing energy consumption and carbon emissions in buildings is crucial to mitigating the environmental impact of development, particularly as global energy demand continues to rise (D'Amico et al., 2021; Dong et al., 2019).

The energy and carbon emissions associated with construction are largely attributed to the production and processing of materials (Shin et al., 2023). One effective strategy to reduce the environmental impact of construction is the use of materials that have lower carbon emissions and require less embodied energy throughout the building process (de Serres-Lafontaine et al., 2024; Islam et al., 2022). While steel and concrete are commonly used in construction, these materials are energy-intensive and significant sources of carbon emissions (Larasati et al., 2023; Su & Zhang, 2016; Younis & Dodoo, 2022). In contrast, wood is a more sustainable alternative, requiring less embodied energy, absorbing carbon, and exhibiting a lower global warming potential (GWP) than steel and concrete (Costa et al., 2024; Ibrahim, 2023). The innovation and development of engineered wood products (EWP) present promising solutions for more sustainable building structures (Eslami et al., 2024).

Engineered wood, a more sustainable alternative to natural wood, is created through chemical, physical, and mechanical enhancements, offering superior strength, hardness, dimensional stability, and mechanical properties compared to its natural counterpart (Fasasi, 2024; M. Gong, 2019; Gysling et al., 2023; Singh et al., 2021; Triwibowo et al., 2020). It exhibits a significantly better strength-to-weight ratio than steel, making it a highly efficient material for construction (He & Zhu, 2024). Due to its numerous advantages, engineered wood is increasingly recognized as a viable construction material for residential building typologies (Bhandari et al., 2023; Tannert & Loss, 2022). Beyond its structural capabilities, engineered wood is valued for its aesthetic appeal, adding visual warmth and natural beauty to spaces (Koutsianitis et al., 2021).

Several types of engineered wood, including glue-laminated timber, cross-laminated timber, and laminated veneer lumber, are commonly used in construction (Bayat, 2023; Maximo et al., 2022). Glue-laminated timber, consisting of layers of wood glued and pressed together, addresses the issues of wood scarcity and defects, making it suitable for structural applications such as beams, columns, and roofs (Gao et al., 2019; M. Gong, 2019; Y. Gong et al., 2024; Vida et al., 2023; Wei et al., 2019). Cross-laminated timber, made from layers of softwood glued together at 90-degree angles, offers strength comparable to concrete or steel. It is also environmentally friendly and versatile, with applications in floor slabs, shear walls, and load-bearing walls (Abdurrahman et al., 2018; Brandner et al., 2016; Crovella et al., 2019; D'Amico et al., 2021; Sandoli et al., 2021). Laminated veneer lumber, composed of thin layers of wood veneer arranged in parallel and glued together, is more efficient than solid wood. It is used in load-bearing applications such as beams, columns, floor joists, roof trusses, and walls (Bhkari et al., 2023; Diredja et al., 2021; Purba et al., 2019; Romero & Odenbreit, 2023).

Engineered wood is increasingly acknowledged as a more environmentally sustainable alternative to conventional construction materials such as concrete and steel, primarily due to its renewable nature and lower embodied carbon (Koutsianitis et al., 2021; Morin-Bernard et al., 2020). In the context of intensifying global efforts to mitigate climate change, it becomes critical to understand the factors that can promote the adoption of engineered wood in residential construction.

This study aims to examine public perceptions of engineered wood as a construction material, with specific emphasis on the subjective attributes associated with its use. Rather than evaluating the technical accuracy of these perceptions, the research focuses on identifying the perceived qualities that influence and motivate individuals to consider engineered wood as a viable material choice. Utilizing an inductive approach to analyze open-ended survey responses, the study provides insights into the cognitive and affective factors that shape material preferences.

These insights are expected to inform strategies aimed at promoting broader public acceptance and market integration of engineered wood in the residential construction sector. The identified preferences encompass various concerns and expectations related to material quality, safety, aesthetics, environmental impact, and affordability (Høibø et al., 2018; Mulyano et al., 2020). Understanding and addressing these dimensions can enable industry stakeholders to align engineered wood products more effectively with public demand, thereby enhancing their market acceptance.

While previous research has extensively addressed engineered wood from technical and environmental perspectives, including life cycle assessments and structural performance, there remains a notable gap in understanding the social dimensions—particularly the behavioral and perceptual factors that shape material choice in the residential sector. Few studies have examined how communities evaluate engineered wood in relation to conventional materials or how perceptions influence willingness to adopt it.

This study addresses that gap by investigating the criteria that influence community preferences for engineered wood as a housing material. Specifically, it seeks to answer the research question: *What material and construction-related factors shape public perception and acceptance of engineered wood in residential buildings?* By exploring these relationships through a mixed-methods approach, the study aims to inform targeted education and promotion strategies that foster greater acceptance and integration of engineered wood into sustainable housing development.

METHODS

This study employs a sequential mixed-methods approach, incorporating both qualitative and quantitative research stages, as outlined by Creswell & Creswell (2017). The research design includes both explorative and explanatory phases. The explorative qualitative stage is used to gather information regarding the motivations and reasons behind respondents' choices of housing materials. In contrast, the explanatory quantitative phase aims to establish causal relationships between public perceptions and preferences for engineered wood as a housing material.

Data Collection Method

Data were collected using an online survey distributed through multiple social media platforms, including Facebook, Twitter, Instagram, and WhatsApp. A non-probability convenience sampling strategy was employed to efficiently access a broad and diverse audience, particularly those active in digital communities with interests related to housing, residential construction, or material selection. While the sampling was not random, the outreach targeted individuals with potential relevance to the topic. To enhance relevance and data quality, participants were required to meet specific inclusion criteria: they had to be 17 years of age or older and express an interest in housing—either as prospective homeowners, renters, or individuals involved in residential design, material selection, or general home improvement.

Although the voluntary nature of participation may introduce self-selection bias and limit representativeness, measures were taken to mitigate the risks of limited technical knowledge among respondents. Specifically, the survey instrument included a concise and neutral introduction to engineered wood—its definition, general characteristics, and typical applications—prior to the main set of questions. This was intended to establish a baseline level of understanding and reduce misinterpretation or uninformed responses. While the study did not aim to test technical comprehension, it sought to capture perceived attributes of engineered wood that shape material preference from a layperson's perspective. Future studies could build on this approach by incorporating stratified or purposive sampling methods to ensure a more technically informed respondent base, especially when aiming for generalizable or expert-driven conclusions.

In the first phase, conducted from March 3 to March 28, 2024, qualitative data were gathered using open-ended questions. A total of 102 individuals participated, consisting of 59.8% females and 40.2% males, with ages ranging from 19 to 42 years and educational backgrounds from high school to Master's level (S2). Respondents were located in various cities across Indonesia. Participants were asked to describe their general motivations for selecting housing materials, and specifically their views on solid versus engineered wood. Responses were analyzed using content analysis, allowing researchers to identify recurring themes and keywords from the narrative data.

The second phase was conducted from May 25 to June 1, 2024, using a quantitative close-ended questionnaire derived from themes identified in the first phase. The survey employed Likert-scale items to measure respondents' motivations for choosing engineered wood as a construction material. This phase involved 109 participants, with 51.4% male and 48.6% female respondents, aged 17 to 42 years, and similar educational backgrounds to the first sample. Data were analyzed using factor analysis and multivariate regression to explore patterns and causal relationships between material preferences and various influencing factors.

In both phases, participants provided informed consent before participating in the survey. They were informed that their responses would be kept confidential and used solely for academic purposes. No personally identifiable information was collected, ensuring compliance with ethical research standards.

To provide greater clarity regarding the structure and content of the instruments used in this study, selected examples of the questions from both phases of data collection are outlined here. In Phase 1, participants responded to open-ended questions designed to explore their general perceptions and motivations. Before answering, they were given a brief description of engineered wood to ensure a basic level of familiarity with the material. The open-ended items included questions such as: "*In your opinion, what material is most suitable for residential construction? Please explain why you chose this material*," and "*If you were to use wood as a material for your house, would you prefer solid wood or engineered wood? Please explain your choice*." These questions aimed to elicit unstructured, subjective insights into how individuals evaluate materials for housing purposes and the reasoning behind their preferences.

In Phase 2, the study employed a structured questionnaire consisting of 32 items categorized into four domains: material characteristics, user perceptions, preferences for using engineered wood, and application preferences. Respondents evaluated most items using a 7-point semantic-differential scale. Examples of the statements under material characteristics included "*The material is environmentally friendly*" and "*The material has good long-term durability*." Items related to user perceptions asked respondents to assess statements such as "*The material enhances the aesthetics and texture of a building*" and "*The material is easy to maintain*." To gauge their preference toward engineered wood, participants were asked questions like "*Based on your understanding, would you consider using engineered wood in your home?*" and "*Would you be willing to pay more for sustainable, durable, and efficient engineered wood products?*" The application preference section further explored intended use, with items such as "*If using engineered wood, would you prefer it for structural framing or for structural wall components?*" (options: structural frame / structural wall), and "*Would you prefer the engineered wood to be left exposed or covered?*" (options: exposed / covered). The full set of items used in the second phase is available from the author upon request.

Data Analysis Methods

In the qualitative stage, the analysis method employed is conventional content analysis using inductive coding, which allows for the identification of data patterns without relying on pre-existing categories from previous research or theories. Inductive coding is conducted through grounded theory analysis, specifically open coding. Open coding involves dividing the data into meaningful segments and assigning labels based on the content. These labels are then grouped into one or two words that represent each concept. This process is followed by refining the words to accurately reflect the categories derived from the previous stage.

The results of the content analysis in the qualitative stage served as the foundation for developing the second-stage questionnaire, which focused on material characteristics, perceptions, and preferences regarding engineered wood. These findings were translated into semantic-differential (SD) scale items, with responses rated on a 1 to 7 scale. Table 1 provides examples of some questions used in the second-stage online questionnaire. Themes that frequently appeared in the open-ended responses—such as sustainability, durability, affordability, aesthetics, and ease of use—were systematically translated into measurable items using the SD format to capture public attitudes toward these key attributes.

Table 1. Example question with SD method

Categories	Example								
Durability	Engineered wood material has good durability ?								
	Totally Disagree	1	2	3	4	5	6	7	Totally Agree
Aesthetic	Engineered wood materials can make the visual aspect of the building beautiful ?								
	Totally Disagree	1	2	3	4	5	6	7	Totally Agree

In addition to material characteristics, first-stage responses also revealed public perceptions regarding broader contextual factors associated with the use of engineered wood, including design flexibility, construction process efficiency, and accessibility of materials. These emergent themes were also transformed into 19 semantic-differential scale items to form a distinct category representing non-material factors that potentially influence public acceptance.

To validate the structure of the questionnaire and identify latent dimensions underlying the responses, Principal Component Analysis (PCA) was conducted as an initial step. PCA is a data reduction technique used to summarize the variability in a set of observed variables while retaining as much information as possible. This step helped identify which items grouped together, thus refining the constructs to be tested. Following PCA, Factor Analysis (FA) with varimax rotation was employed to confirm the dimensionality and improve the interpretability of each factor grouping.

To explore the relationships between perceived attributes and the willingness to use engineered wood in housing, a multiple linear regression analysis was conducted. This statistical approach was chosen to determine the extent to which various material and non-material perceptions predict the dependent variable—namely, the intention to use engineered wood. The regression model allowed the identification of key predictors, controlling for the influence of other variables within the dataset.

To ensure methodological transparency, the full questionnaires from both Phase 1 (open-ended) and Phase 2 (close-ended) are provided in the Appendix, along with a complete list of semantic-differential scale items, factor loadings, and the results of the regression analysis.

RESULTS AND DISCUSSION

Community Preferences and Perceptions of Generals Materials and Wood or EWP

The first stage of qualitative/content analysis involves conducting open coding based on the responses from the first questionnaire. For instance, an example of open coding might be the following respondent's answer: *"Wood looks aesthetic, its strength is also unquestionable, and it is environmentally friendly" (respondent 85).* From this response, the keywords identified are "aesthetics," "material strength," and "environmentally friendly." These keywords were then grouped into higher-order categories based on thematic similarity across responses. The process was repeated across all 102 responses, resulting in a set of dominant themes such as sustainability, aesthetics, and durability. These themes served as the foundation for constructing close-ended items in the second-stage questionnaire.

The results from the qualitative content analysis were then used to develop closed-ended questions regarding housing materials in general. Ten categories were identified for this purpose: material application, durability, efficiency, aesthetics, material strength, design experienced, affordability, availability, easy maintenance, and sustainability (Figure 1).

In the analysis related to preferences for solid and engineered wood materials, similar categories were established, with a slight modification. Eleven categories were created for the closed-ended questions regarding solid and EWP: material application, durability, effectiveness, efficiency, aesthetics, material strength, design experienced, affordability, availability, easy maintenance, and sustainability (Figure 1). These categories help to frame the respondents' preferences in the second phase of the study.

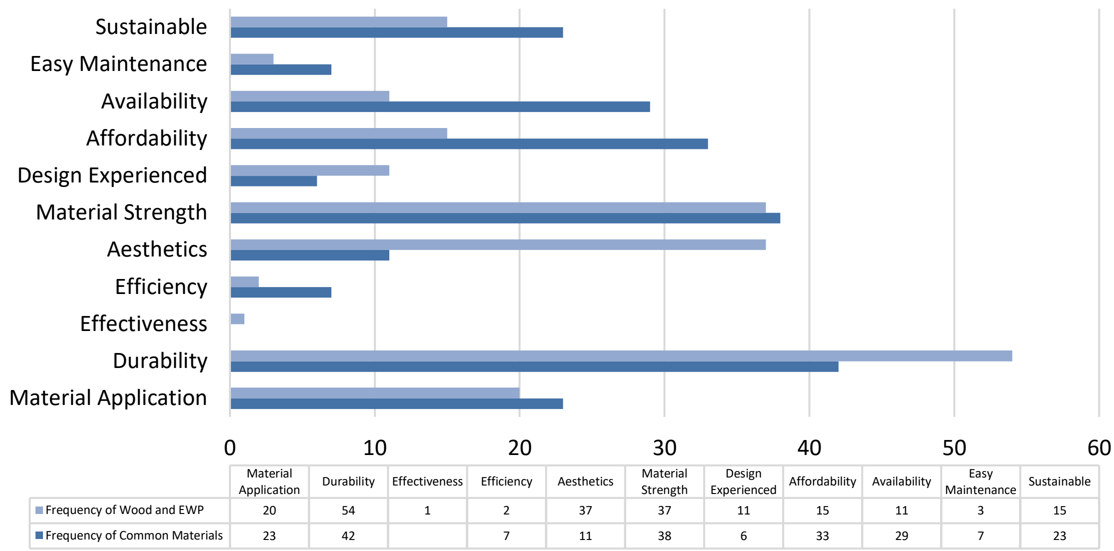

Fig. 1. Community Preferences and Perceptions of General Materials and Wood or EWP

The results of the open coding of the first stage of the questionnaire (open-ended questions) in accordance with the categories, it was found that in choosing materials for housing, people tend to choose materials by paying attention to several categories. People consider durability to be an important aspect in selecting materials for housing. In the general material questions, durability, material strength, affordability, and availability came first. For the questions of wood and EWP, people tend to choose these materials because of their durability, material strength, aesthetics and material application.

In general materials, the value of sustainable has a high frequency because in general materials there are biomass materials, such as wood, EWP, and bamboo. The choice of material is what makes people give sustainable reasons. Availability and affordability have a high frequency in general materials when compared to wood and EWP. This makes general materials such as concrete and brick more likely to be used by people for residential materials compared to wood and EWP. Wood and EWP have a positive perception in society when these materials are utilized in housing. These materials have better aesthetic value and durability than other materials.

Community Perception of EWP

The research phase to determine community perception of EWP was conducted in several stages of research, determining principal component analysis (PCA), factor analysis (FA), distribution and regression analysis. Data was obtained from the second stage of the questionnaire (close-ended questions). After completing PCA, the next step is FA to obtain latent variables using variable names that are easy to understand. FA is performed by rotating the main components using varimax orthogonal rotation, so that the components become uncorrelated. Factor loading on measured variables related to latent variables is determined with the larges possible value, and factor loading that is not related to latent variables is determined with a close to zero.

To assess how respondents perceived the characteristics of engineered wood products (EWP), a set of 13 perception-based items was developed and analyzed using Principal Component Analysis (PCA) followed by Factor Analysis (FA). PCA was conducted to identify the underlying structure among the observed variables, and three principal components were retained based on the cumulative variance criterion. These components were further interpreted through FA with varimax rotation, resulting in the identification of three latent factors, as shown in Table 2: "Sustainable Material," "Material Durability," and "Material Performance."

These latent variables represent conceptual groupings formed by the public in evaluating EWP attributes. The "Sustainable Material" factor includes perceptions related to environmental friendliness and renewability; "Material Durability" encompasses attributes such as strength, lifespan, and wear resistance; while "Material Performance" captures practical aspects such as structural reliability, thermal comfort, and functional efficiency. It is important to note that these constructs reflect subjective public perceptions, not technical assessments. Thus, the interpretation of each factor is situated within the cognitive and affective frameworks that inform how non-expert users understand material properties.

The statistical outcomes support these interpretations. The "Sustainable Material" factor exhibits the highest variance (3.50), indicating a greater diversity of opinions among respondents regarding environmental aspects. Moreover, respondents rated sustainability as the most influential consideration (mean = 5.31), followed closely by material performance (mean = 5.25) and durability (mean = 4.67). The internal consistency of the instrument is confirmed by Cronbach's alpha values exceeding 0.7 for all three factors, indicating a reliable grouping of items within each construct.

Notably, the variable "environmentally friendly" shows a strong correlation with the "Sustainable Material" factor, underscoring the prominence of ecological values in shaping public attitudes toward EWP. These findings highlight that beyond functionality, members of the general public increasingly associate EWP with sustainability and performance, suggesting strategic entry points for promoting its adoption in the residential construction sector.

Table 2. Factor analysis of material characteristics

Measured Variables	Sustainable Materials	Material Durability	Material Performance
Variance	**3.5**	**2.74**	**2.41**
Percent	**26.95**	**21.1**	**18.57**
Cum Percent	**26.95**	**48.06**	**66.63**
Mean	**5.31**	**4.67**	**5.25**
Cronbach's α	**0.89**	**0.86**	**0.85**
Environmentally friendly	**0.747**	0.199	0.325
Low carbon footprint	**0.676**	0.281	0.331
Durable	**0.664**	0.513	0.344
Lightweight	**0.662**	0.250	0.185
Stable	**0.572**	0.263	0.533
Insect resistant	0.273	**0.810**	0.228
Fire resistance	0.204	**0.709**	0.360
Weather resistance	0.532	**0.619**	0.293
Sturdy	0.313	0.352	**0.741**
Material strength	0.428	0.407	**0.569**
Material safety	0.426	0.429	**0.529**
Thermal	0.521	0.276	**0.470**
Acoustics	0.387	0.372	**0.349**

In addition to material characteristics, this study examined broader contextual perceptions that influence public interest in using engineered wood. These contextual themes—emerging inductively from open-ended responses in the first-phase questionnaire—highlighted not only what people think about engineered wood as a material, but also how they imagine it functioning within the residential design and construction process. Specifically, themes related to design familiarity, construction practicality, and access to materials were frequently mentioned in the first stage (as summarized in Figure 1), and were systematically translated into a group of 19 semantic-differential scale items in the second-stage questionnaire. These items were designed to capture user concerns and expectations about the usability, familiarity, and logistics surrounding engineered wood in real-world housing contexts.

Using Principal Component Analysis (PCA) followed by Factor Analysis (FA) with varimax rotation, three latent variables were extracted and are presented in Table 3: (1) Design and Experience, which reflects perceptions related to aesthetic appeal, design flexibility, and spatial ambiance; (2) Construction Management, encompassing issues of installation ease, time efficiency, and on-site handling; and (3) Material Availability, which addresses concerns over product access, distribution, and procurement processes.

These latent variables reflect not only material evaluations, but broader cognitive frameworks that the public uses to evaluate new construction materials. The variable Design and Experience exhibited the highest variance

(6.48), indicating a broad diversity of opinion. It also had the highest mean score (5.44 on a 7-point scale), suggesting that aesthetic and experiential dimensions are especially influential in shaping acceptance of engineered wood. This was followed by Construction Management (mean: 4.99) and Material Availability (mean: 4.77). The reliability of the instrument for this construct group was confirmed, with Cronbach's alpha values exceeding 0.70 for all three factors, indicating strong internal consistency. Notably, the item related to aesthetics exhibited one of the strongest factor loadings within the Design and Experience dimension, suggesting that visual and tactile qualities of engineered wood are central to public valuation.

Table 3. Factor analysis of community perception

Measured Variables	Design and Experience	Construction Management	Material Availability
Variance	**6.48**	**3.75**	**3.19**
Percent	**34.13**	**19.77**	**16.81**
Cum Percent	**34.13**	**53.9**	**70.71**
Mean	**5.44**	**4.99**	**4.77**
Cronbach's α	**0.94**	**0.87**	**0.83**
Aesthetics	**0.834**	0.134	0.214
Natural impression	**0.819**	0.197	0.196
Beautiful	**0.817**	0.296	0.227
Comfort	**0.740**	0.401	0.192
Many variations	**0.733**	0.144	0.348
Luxury impression	**0.731**	0.282	0.084
Warm impression	**0.715**	0.404	0.082
Interior/exterior application	**0.667**	0.463	0.262
Design flexibility	**0.654**	0.269	0.421
Scent	**0.557**	0.185	0.438
Easy to apply	**0.524**	0.472	0.437
Easy maintenance	0.273	**0.783**	0.219
Construction Effectiveness	0.447	**0.711**	0.384
Construction Effiency	0.425	**0.696**	0.306
Precision size	0.483	**0.637**	0.210
Construction understanding	0.073	**0.595**	0.382
Affordable availability	0.219	0.202	**0.785**
Affordable price	0.165	0.384	**0.784**
Commonly used	0.307	0.305	**0.740**

These findings clarify how the first-phase qualitative results informed the development of the second-stage closed-ended questions. They also demonstrate that community preferences are multidimensional, shaped not only by intrinsic material properties but also by perceptions of practicality, familiarity, and accessibility—all of which are essential for fostering greater public acceptance and adoption of engineered wood in residential construction.

Application of EWP as Structure and Aesthetics

Based on the data obtained from the questionnaire, the community perception of the application of EWP for structural functions shows a relatively balanced distribution. With the results in Table 4, 55 respondents (50.45%) chose the use of EWP as a structural wall element, while 54 respondents (49.55%) chose its application for building frames. This indicates that the community is quite flexible towards the use of EWP as a structural element of buildings.

Meanwhile, on the aesthetic aspect (Table 5), the majority of respondents tended to prefer EWP to be exposed to show the character of the engineered wood, with 70 respondents (64.22%). In contrast, 39 respondents (35.78%) preferred to cover the EWP. This majority preference to expose the material shows that the natural aesthetic value of EWP is still the main attraction in its application.

The distribution of this data shows that the community's preference for functional EWP as a structural material tends to be evenly distributed, both in structural walls and building frames. Whereas on aesthetics aspect, people tend to prefer to expose the material, which indicates that natural visuals are the main attraction. Thus, EWP is not only seen as a structural material in buildings, but also able to provide added value to building designs through the natural visual aspects of EWP.

Table 4. Distribution of structural application of EWP

Application of Structure	Count	Prob
Structural wall (load-bearing wall)	55	0.504
Building frame (column, beam, floor frame)	54	0.495

Table 5. Distribution of application of EWP Aesthetics

Aesthetic Application	Count	Prob
Exposing engineered wood	70	0.642
Covering engineered wood	39	0.357

Engineered Wood Application Interest

There is no literature that explicitly discusses community preference for engineered wood. So the results of factor analysis on material characteristics and community perception of EWP were re-analyzed using multivariate regression analysis on the preference of interest in the application of EWP in housing. Multivariate regression analysis is used to determine the causal relationship. In causal relationship, the independent variable must be a precursor to the dependent variable. Preference for application interest can only be obtained when the characteristics and perceptions of EWP are known. Therefore, in this study, latent variables about characteristics and perceptions are used as independent variables, while application interest or material use is treated as the dependent variable. The results of multivariate regression analysis are shown in Table 6 and Table 7.

The multivariate regression analysis was conducted in two stages. The first stage was to see the causal relationship generated by the latent variables of material characteristics and community perception on the interest in applying EWP as housing material (Figure 2). The second stage is to see the causal relationship generated by the latent variables of material characteristics and community perception on the interest in applying EWP as a housing material when the factor "extra cost" is added to the dependent variable (Figure 3).

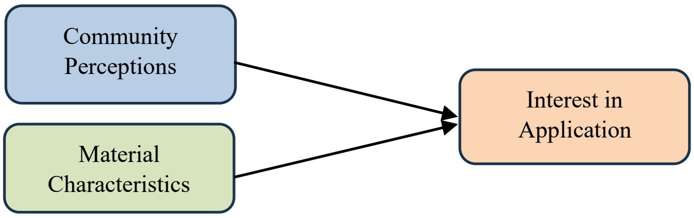

Fig. 2. First stage regression analysis diagram

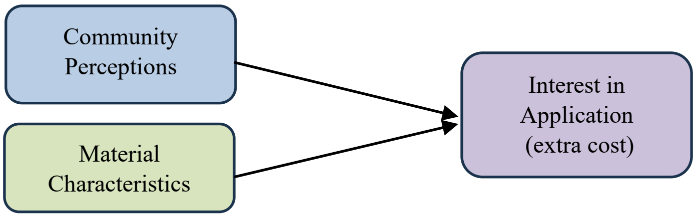

Fig. 3. Second stage regression analysis diagram

Ther results of the multivariate regression analysis in Table 6 show a significant causal relationship between interest in material application with design and experience (ß=0.72, p= <0.0001), and material performance (ß=0.27, p= 0.023) as determinants of community's preference in the application of EWP as housing materials. Of all the dimensions in application interest, "design and experience" and "material performace" have the greatest influence in the application interest factor. The design and experience dimensions represent community perceptions of EWP aestehetics The material performance dimnesion represents the material characteristics required by the community in the application interest.

Ther results of the multivariate regression analysis in Table 7 show significant causal relationship in construction management (ß=0.45, p=0.0014) and sustainable materials (ß=0.29, p=0.1107) as the dominant factors causing community application of EWP as housing materials with the factor of willingness to spend more to be used in housing materials. In the application interest dimension ("extra cost"), construction management and sustainable materials tended to be the main factors. When the willingness to spend more is questioned, the construction management of EWP is the most important factor. The construction management dimension represents community perceptions, where construction effectiveness and efficiency are the main things considered in this dimension. The sustainable material dimension represents material characteristics, in which the environmentally friendly nature of the material is prioritized in community preferences when spending more on EWP.

Table 6. Multivariate regression analysis of interest in application

Independent \ Dependent		Interest in Application	
		RSq = 0.664394	
		ß	P-Value = <.0001
Material Characteristics	Sustainable Materials	0.017	0.911
	Material Durability	-0.101	0.54
	Material Performance	**0.268**	**0.023**
Community Perceptions	**Design and Experience**	**0.723**	**<.0001**
	Construction Management	0.151	0.221
	Material Availability	-0.061	0.531

Table 7. Multivariate regression analysis of interest in applicattion (extra cost)

Independent \ Dependent		Interest in Applicattion (extra cost)	
		RSq = 0.559137	
		ß	P-Value = <.0001
Material Characteristics	**Sustainable Materials**	**0.287**	**0.1107**
	Material Durability	0.144	0.425
	Material Performance	-0.073	0.569
Community Perceptions	Design and Experience	0.052	0.789
	Construction Management	**0.445**	**0.0014**
	Material Availability	0.025	0.81

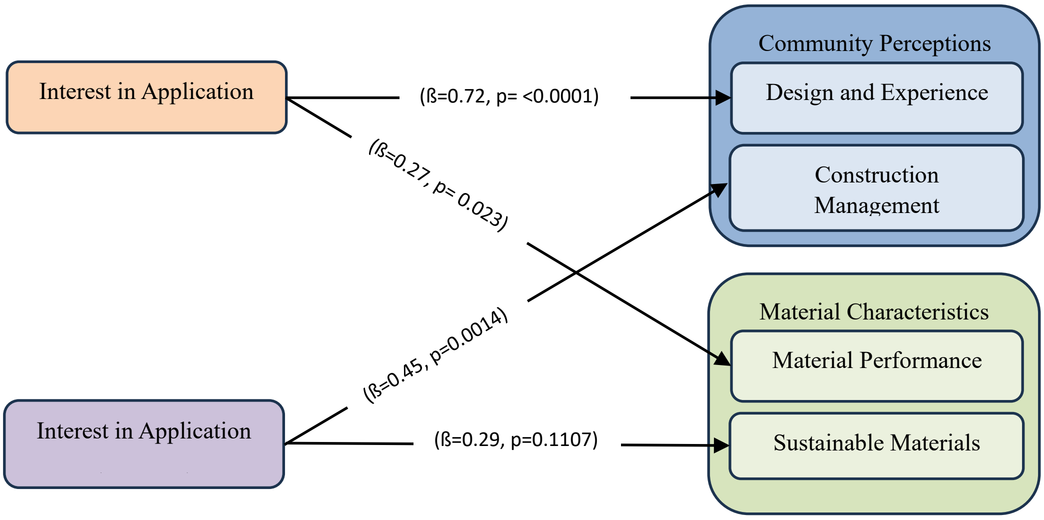

Fig. 4. Multivariate regression analysis result model

From these two dimensions, it can be seen that that community perception is the main factor in the preference of interest in the application of EWP in housing because it has the largest regression weight than material characteristics. As a result of the multivariate regression analysis in Figure 4, it can be seen that community preferences in the application of EWP in housing, the main factors of interest in the application of EWP are design and experience which represents community perceptions and secondly the material performance which represents material characteristics. But when it comes to spending more money, people will tend to pay attention to construction management which represents community perception and sustainable materials which represent material characteristics for the main factor. The results of the regression analysis can show that community perception is very influential in the preference for the application of EWP for housing materials without and with the involvement of higher cost factors.

These results are consistent with previous studies showing that accessibility, awareness, and challenges to adoption have a major impact on the adoption of sustainable construction materials (Fatima et al., 2022; Puttamanjaiah et al., 2024). However, this study adds nuance by differentiating between general interest and willingness to adopt. The multivariate analysis shows that when extra cost is considered, construction management and sustainability become dominant factors. This suggest that decision-making is not solely based on technical merit, but is intertwined with social constructs, perceived value, and economic conditions. Preference for EWP may thus be moderated by income level, financing access, or policy incentives. Overall, while EWP is perceived positively in terms of design and sustainability, economic realities such as affordability and access to financing continue to shape the public's willingness to adopt it. This highlights the need for more inclusive strategies that consider both perceptual and financial dimensions of material adoption. Future studies should further explore how economic literacy, urban-rural differences, and household typologies mediate these preferences, offering a more inclusive roadmap for EWP-based housing policy development.

CONCLUSION

This research reveals community preferences towards the use of engineered wood as a housing material, focusing on aspects of material characteristics, community perceptions, and its potential applications in buildings. The results show that although conventional materials such as concrete and brick are still the main choices, enginnered wood offers advantages in terms of aesthetics, sustainability, and durability. By considering various factors, this research provides community preferences and perceptions in viewing engineered wood.

In choosing materials for housing, people have various considerations according to their needs and priorities. People consider 10 main aspects in selecting materials in general. However, when choosing wood or EWP for housing materials, people will consider 11 main aspects. Durability is the most important factor, while availability and affordability are the ain concerns for general materials compared to wood or EWP. This has led to general materials being more widely used for housing. However, wood and EWP are still perceived positively, especially for their aesthetics and durability, which are higher than conventional materials.

The characteristics of EWP and community perceptions of these materials are summarized into several latent variables. In material characteristics, there are thress latent variables, namely sustainable materials, material durability, and material performance, where the environmentally friendly aspect in the sustainable material category is the most prominent. Meanwhile, community perception includes three latent variables, design and experience, construction management, and material availability, with aesthetics in the design and experience category being the dominant factor.

The utilization of EWP as a structural element shows flexibility, with 50.45% of respondents choosing it as a structural wall and 46.55% choosing it as a wall frame. In terms of aesthetics, the majority of people (64.22%) prefer to expose EWP, which shows the natural visual appeal of EWP to be the main advantage. Thus, EWP not only serves as a structural element but also enriches the building design through its aesthetics and natural appearance.

Community preference of EWP was analyzed through causal relationship with multivariate regression. The main factors influencing application interest were design and experience ($ß=0.72$, $p= <0.0001$), and material performance ($ß=0.27$, $p= 0.023$). However, considering the extra cost factor, the preference shifted to construction management ($ß=0.45$, $p=0.0014$) and sustainable materials ($ß=0.29$, $p=0.1107$). The results of the regression analysis can show that community perception is very influential in the preference of applying EWP for housing materials both without and with additional costs.

To strengthen the practical relevance of this study, several strategic recommendations are proposed. While this research reveals the public's positive perception of EWP in terms of aesthetics, sustainability, and durability, broader adoption remains limited due to economic and practical considerations. Therefore, first, policymakers should develop incentive mechanisms and establish clear regulatory frameworks that support the use of sustainable construction materials, including Engineered Wood Products (EWP), especially in the residential sector. Second, housing developers are encouraged to initiate pilot or demonstration projects using EWP to allow the public and stakeholders to experience its structural integrity and visual appeal in real settings. Third, targeted public education initiatives should be implemented to raise awareness of EWP's advantages, including environmental benefits, aesthetic quality, and long-term performance.

Although this study offers meaningful insights, it is limited by diversity of respondents and geographic scope. Future research should involve broader socio-economic groups and explore perceptions of EWP's long-term performance in tropical climates. In addition, further investigation into cost-benefit aspects, such as lifecycle analysis and investment feasibility, is needed to facilitate more inclusive and widespread acceptance of EWP in the housing sector.

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