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Perceptions, Tensions, and Contradictions in Timber Construction: Insights from End-Users in a Chilean Forest City

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Abstract: The study addresses the underutilisation of wood in construction in Chile, particularly given the country's robust forestry sector. The research investigates perceptions, tensions, and contradictions among end-users regarding timber construction in Valdivia, a city with a mixed forestry industry. Methods included a comprehensive survey of 96 households across various socioeconomic clusters, utilising descriptive and exploratory statistical analyses. Key findings reveal persistent negative perceptions about wood's durability, fire resistance, and maintenance costs. However, positive aspects, such as lower construction costs and adequate thermal comfort, were also noted. Surprisingly, concerns were raised about wood's environmental impact, including deforestation and its role in combating climate change, contrasting with the material's known ecological benefits. The study concludes that these perceptions are deeply influenced by ideological and sociopolitical factors, suggesting that mere marketing strategies may not suffice to alter public opinion. Instead, a collaborative effort involving public policy, industry advancements, and transparent scientific communication is essential to promote the benefits of timber construction and address the entrenched biases.

Keywords: timber construction; perceptions; end-users; forest city

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1. Introduction

1.1. Perception of Timber Construction

In Chile, the National Statistics Institute [1] reports that roughly 12% of newly approved construction square meters involve projects utilising wood as both a wall material and a structural component. This figure increases to 16% when accounting for using wood alongside other materials. Chile's status as a nation with an extensive forestry sector, including vast areas designated for cultivating trees for lumber and cellulose production, makes one question why these percentages remain so modest and consistent over time. Examining the issue across different regions, especially given Chile's climatic variety, this relative statistic escalates as one travels further south, excluding the most southerly regions.

The underutilisation of wood in constructing building walls and enclosures presents an intriguing discrepancy between its availability and its use; this could be attributed to

the perceptions held by home buyers regarding this material. How people perceive social phenomena is influenced by their sensory experiences and how they interpret them. These interpretations lead to ideas that organise, rank, and make sense of these sensory inputs and their context and engagement levels. Such a conceptual framework can be referred to by several terms, one of which is 'ideology'. This set of concepts, promoting greater environmental consciousness within society, is developing and finding its place. With a growing number of consumers seeking sustainable alternatives, there lies a promising chance for wooden construction methods to expand their presence in the market. In exploring the notion of ideology as it pertains to environmental, structural, or technological paradigms, Slavoj Zizek's analytical perspective on ideology becomes pertinent. Here, ideology is understood as the logical framework underlying these concepts, navigating the interplay between ambition and actuality, the idealised versus the tangible [2]. It shifts the focus towards the emotive dimension in forming these notions. The critical aspect of probing into is how aspiration, knowledge substantiation, and empirical truth are interconnected with the perception of wood-based construction (and its corresponding industry) as an ideological notion amidst the climate emergency.

The perception of end users of wooden houses in Chile, or the general population as potential users of these houses, has not yet been widely studied. This is probably because, beyond the so-called emergency housing or individual wooden houses, there are few experiences of housing complexes where users and the observing population are aware of the materiality of their homes and the role that wood plays in them. Furthermore, some studies evaluate the well-being and satisfaction of users of wooden houses, which generally show that residents are satisfied with their homes and positively evaluate the technical aspects. However, these studies do not adequately capture the preferences and perceptions of the public regarding wooden construction.

Existing studies show a lower quality of wooden houses than brick or concrete houses, specifically those based on census information and national databases. However, when incorporating other dimensions, such as income levels, it is observed that wooden houses are associated with lower incomes compared to other materials, conditioning the poor quality of the housing. These data from secondary sources are consistent with a market study conducted nearly 20 years ago by the Wood Innovation and Development Centre of the Pontificia Universidad Católica de Chile [3]. The willingness of respondents (N = 560) to acquire a wooden house was low, particularly in the capital city, Santiago. The main argument for this resistance was the preference for a "solid" home, as wooden structures are perceived as unreliable and offer a lower "valuation". Here, critical elements emerge that have been repeated over time: fire resistance, insect pest problems, and lower durability.

On the other hand, the study developed by the Forest Institute [4] to understand the Chilean population's perception of the attributes of wood in construction concludes that wood is positioned among the population as the most environmentally friendly material, with the most visual appeal, and with good seismic performance. The negative attributes highlighted were vulnerability to fire and susceptibility to biotic and abiotic agents. These conclusions are based on surveys that show low representativeness in cities with a wood vocation. They are mainly concentrated in the metropolitan area of Santiago, making it especially relevant to deepen the specific characterisation of cities in southern Chile. In addition, the results of this study show significant differences in gender, age group, macro-region, occupation, educational level, and economic sector (related or not related to the wood industry). Among the most notable differences is the gender variable, where several positive attributes of wooden construction were rated higher by females than males. Another variable on which dependence was detected is the economic sector to which the respondents belong, particularly regarding fire vulnerability and the effect of climatic factors. This is especially relevant in cities with a wood industry, where more people are likely linked to this industry. The macro-region also showed an impact on the valuation of attributes, especially regarding the perception of positive environmental aspects, such as wood being the construction system with the lowest carbon footprint, and the negative

attributes, such as wood used in construction not always being responsibly harvested and involving the creation of monoculture forests. In this aspect, there are conflicting perceptions about the sustainability of wood as a building material, so it is of special interest to identify the characteristics of the users and the contexts that determine these perceptions. This reinforces the need to deepen the understanding of users' perceptions and preferences regarding wooden construction, specifically in the southern macro-region of the country where the industry is located and is related to the generally low valuation of context-associated characteristics [5], which are more complex to identify and measure, compared to socioeconomic characteristics, which are easier to obtain from national databases.

The conflicting perceptions of environmental aspects can be explained because, despite the widely recognised environmental benefits of wood construction, there is a negative perception of the Chilean forestry model that has developed since the 1970s. This perception extends beyond housing users to professionals in the field, such as architects, designers, and builders. Studies and reports from public agencies and academic institutions highlight wood's environmental attributes, particularly its potential to capture and retain CO_2 throughout its lifecycle. They compare these benefits to other construction systems like steel and concrete [6]. Wood's potential for industrialisation is also advantageous, allowing more efficient construction processes with reduced on-site environmental impact and waste generation [7,8].

However, these construction benefits contrast Chile's forestry model's environmental and political issues, leading to a negative public perception. Since the 1970s, Chile's plantation area has increased by 727%, mainly focusing on pine and eucalyptus species. This expansion, driven by cost-cutting and profit-maximising strategies, has severely reduced native forests [9]. This disparity between plantation and native forest sectors is rooted in the neoliberal model implemented in the mid-1970s, which prioritised industrial privatisation and economic liberalisation with far-reaching environmental, sociocultural, and economic impacts. Environmentally, the most significant damage has been the loss of native forests and associated species, with plantations encroaching on high-biodiversity areas [10,11]. Socially, expanding plantations has led to a decline in rural quality of life, affecting productivity, water access, infrastructure, and cultural values.

Furthermore, the forestry sector has recently faced significant criticism due to the role of extensive pine and eucalyptus plantations in the mega wildfires that occurred in south-central Chile in 2017 and 2023, as well as the conflicts between forestry companies and indigenous communities [12,13]. Focusing solely on the environmental benefits of wood as a construction material is insufficient without addressing the broader issues and moving towards a more sustainable forestry model.

In the last decades, the forestry sector in Chile has developed its production and contribution to the national economy based on wood consumption coming largely from exotic plantations, supplying 98.6% of the total wood consumption in the industry's logs at the national level [14]. These plantations correspond to 2,303,886 hectares, of which 55.8% are radiata pine and 37.3% eucalyptus. It should be noted that much of the strengthening of the industry is associated with Decree Law 701 (1974), which established incentives and subsidies for forestry activities and also the vertical integration systems between the forest and the industry in the large companies that lead the national production, creating economies of scale and a high economic concentration and control of the market.

In the case of the Los Rios Region, where the city of Valdivia is located, there is a mixed forestry industry that is not only based on plantations but also has an important component associated with native forests. In fact, of the 14.4 million hectares of native forest in the country, 908,530 hectares are located in this region, which corresponds to 49% of the regional land use and of which it is estimated that 126 hectares correspond to productive land [15]. In this context, the forestry industry is a key development sector in the region, contributing nearly 14% of the regional forestry and agriculture GDP and generating 26% of the region's employment [16].

However, despite the development acquired and the great potential of the native forest, the timber products have become increasingly less relevant in traditional markets at the national level. Thus, the share of native species in the industrial consumption of logs has dropped to less than 1% in recent years, with consumption of 133,282 m3swb in 2022 by the sawmill sector and, to a lesser extent, the panel sector [14]. Among the multiple factors that can explain this decrease in national production are poor quality of the native resource, less homogeneous forests, uncertainty in supply, legal aspects, accessibility to the resource, scarce value addition and product innovation, lack of standardisation, production and drying aspects, poor infrastructure, high harvesting and transportation costs, among others [17]. In addition, around 70% of the native forest is owned by small landowners; therefore, since they cannot obtain high-value products, they have focused mainly on unplanned firewood extraction and animal fodder, causing the degradation of these forests [18,19].

Therefore, the sustainable management and productive development of native forests are challenging for Valdivia and the region. In this context, the regional development strategy and other public policy initiatives focus on encouraging the production of value-added products that do not have to compete with the traditional products developed by the forest plantation industry and on strengthening local production chains [16,17,20].

1.2. Bibliometric Analysis

The bibliometric analysis of the Web of Science database [21] was used to assess the topic's current status with the help of the *bibliometrix* package in the statistical software *R* version 4.4.1 [22]. The search used the following concepts: timber AND construction AND (consumer OR user) AND (perception OR attitudes OR influence). The alternatives with the Boolean operator OR were employed to avoid limiting the options to a single disciplinary or methodological approach. For instance, the notion of "consumer" is usually linked to research related to markets or economic viewpoints, which is different from including the idea of "user". This search yielded 43 articles from journals indexed in the Web of Science, spanning 2009 to 2024. However, more than half of these articles are concentrated from 2021 onwards, reflecting that, although the end-user perception about timber construction has been a concern for over a decade, the bulk of knowledge production has been concentrated in recent years.

The first visualisation of the bibliometric results shows the predominance of Scandinavian countries, especially Finland, in scientific production and their strength as forestry nations (Figure 1). This is seen not only in the authors' or their academic institutions' countries but also in the places where they study the link between timber, construction, and society (as seen in the main topics of these articles). The analysis also reveals that around 40% of the chosen articles relate to the five journals that have the most relevance in terms of quantity, and some of these journals appear again when looking at the sources that these articles cite the most. A similar pattern emerges when examining the articles, where the three most widely cited articles also cluster the references within the restricted group of the 43 chosen (Table 1). This indicates the consolidation of a body of knowledge developed with a certain degree of autonomy and likely employing established and common approaches and methodologies.

Table 1. Bibliometric data for different indicators. The figures in brackets represent the reference.

The Five Most Relevant Sources	The Five Most Cited Sources	The Five Most Cited Articles	The Five Most Cited References
Sustainability (6 articles),	*Journal of Cleaner Production* (88 articles),	[23] 85 citations,	[23] 16 citations,
Canadian Journal of Forest Research (3 articles),	*Energy and Buildings* (44 articles),	[24] 49 citations,	[24] 14 citations,
Journal of Cleaner Production (3 articles),	*Building and Environment* (41 articles),	[25] 46 citations,	[25] 14 citations,
Energy and Buildings (2 articles),	*Forest Policy and Economics* (39 articles),	[26] 32 citations,	[28] 13 citations,
Forest Products Journal (2 articles)	*Sustainability* (36 articles)	[27] 30 citations	[29] 11 citations

The synthesis of findings from the reviewed papers emphasises user perspectives and perceptions regarding the use of wood in construction, revealing a nuanced landscape of appreciation and scepticism. Users generally recognise wood's aesthetic and environmental advantages, appreciating its ability to enhance well-being and contribute to ecological sustainability. Gold and Rubik outline a critical gap between the positive perceptions of wood's aesthetic and environmental benefits and the persistent concerns about its practical attributes, such as fire resistance and durability. They highlight that while consumers appreciate wood for its ecological and aesthetic qualities, these factors alone are insufficient to drive more substantial changes in construction material choices [23]. Similarly, Larasatie indicates a general unfamiliarity with tall wood buildings but a slightly positive perception among those aware of them, especially concerning aesthetic and environmental attributes. However, concerns about fire risks and maintenance persist among the public, suggesting a need for more targeted communication to alter these perceptions [29].

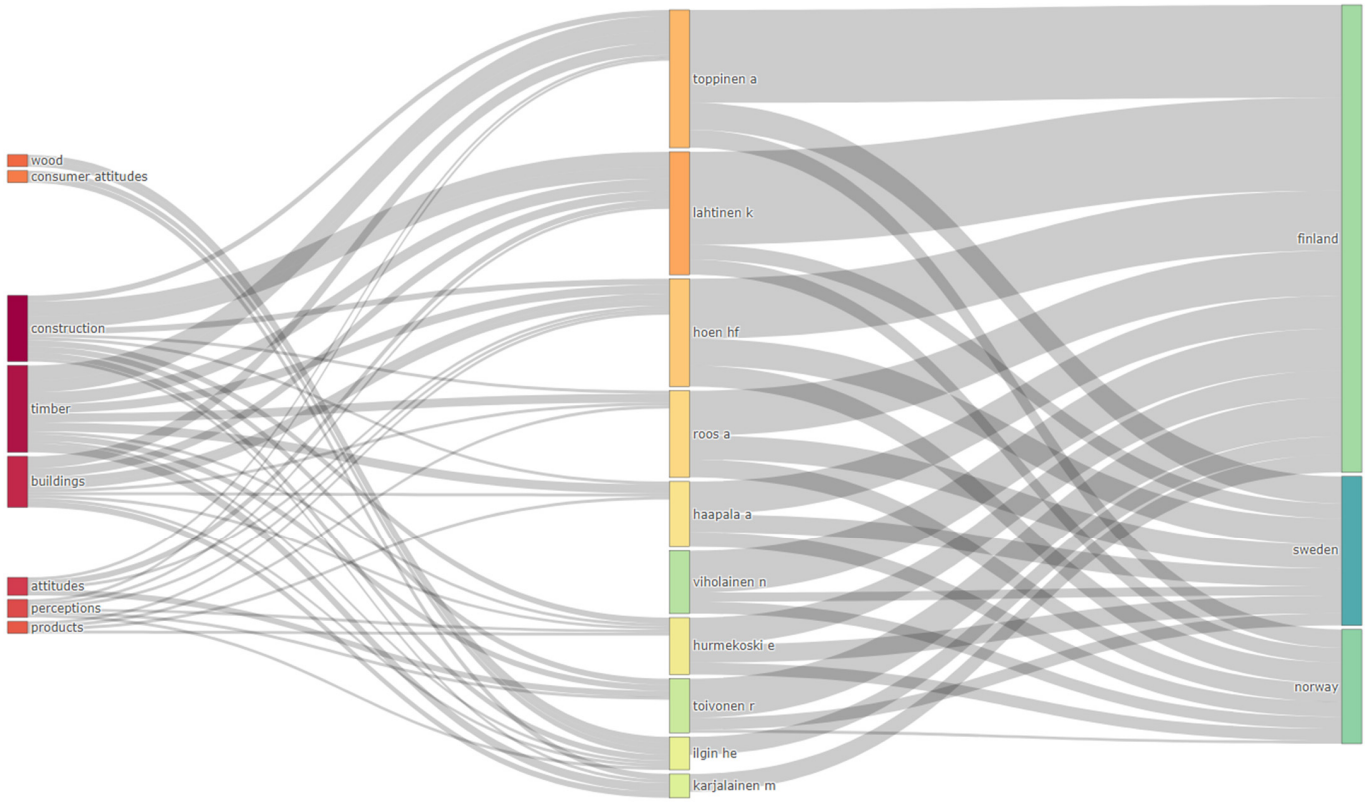


Figure 1. Bibliometric Three-Field Plot based on the first ten records, including the principal authors (**middle**), main topics (**left**), and countries of origin (**right**).

In their respective articles, Kylkilahti et al. [27] and Viholainen et al. [30] discuss the Finnish context, noting a solid ecological appreciation for wood and its benefits for well-being and comfort. Nonetheless, they also reflect on the ongoing concerns about wood's technical performance, which can hinder its acceptance despite the growing ecological awareness. On the other hand, Hoibo et al. [24] and Lahtinen et al. [25] further corroborate these themes within their studies, emphasising that while there is increasing recognition of wood's potential for sustainable development, consumer hesitations due to perceived risks and the lack of technical trust remain significant obstacles. The findings suggest a crucial need for the construction industry to enhance communication strategies, focusing on educating users about technological advancements in wood products that address these practical concerns, thus bridging the gap between positive perceptions and actual consumer hesitancy in widely adopting wood in construction.

In analysing the most recent scholarly articles on consumer perceptions and expectations towards wooden buildings, a central theme that emerges is the appreciation for the environmental benefits of wood, recognised for its sustainability and reduced carbon footprint emerges as a central theme, which aligns with global environmental sustainability goals. However, despite these positive perceptions, concerns about wood's performance, particularly regarding fire safety, durability, and maintenance needs, persist. For example, Nyrud et al. examined public attitudes towards multi-storey wood buildings, where the population's views significantly varied depending on regional construction traditions and exposure to wood as a building material [31]. Roos et al. discuss how dwelling requirements affect material preferences, noting that while wood is favoured for its aesthetic and ecological properties, its perceived vulnerability to fire and questions about its long-term resilience often deter prospective residents [32]. Similarly, Mergel, Menrad, and Decker identify a gap between the ecological benefits of wood and its adoption as a primary building material, emphasising the need for improved communication strategies to address misconceptions and educate the public about modern wood construction technologies [33]. Furthermore, Harju and Lähtinen [34] and Caniato et al. [35] reflect on the architectural and consumer demand perspectives, suggesting that while designers are optimistic about the performance of green timber buildings, consumer acceptance is contingent upon addressing the practical concerns through innovative solutions and enhanced regulatory frameworks.

In methodological terms, these studies target the general population, citizens, homeowners, professionals [35] or university students [27], usually focusing on a single country, such as Germany [23,25,33] or Finland [34], or a specific region, such as the Pacific Northwest in the USA [29], predominantly through telephone surveys [23] or online applications [31,33–35]. A particular study is that of Nyrud et al. [31], which surveyed 7007 citizens across seven European countries (Austria, Denmark, Finland, Germany, Norway, Sweden, and the United Kingdom) intending to account for varying building traditions, industrial backgrounds, and market sizes, and providing comparative insights into cross-country differences in attitudes.

Finally, the categorisation of topics proposed by the bibliometric analysis (through cluster analysis) serves as a good indicator of how they are organised within this body of literature (Table 2). The "motor themes" correspond to the main drivers of the theme, leading the development and situated at the centre of the discussion. The topics of "attitudes and perceptions" and "wood and behaviour" guide the present article, based on the knowledge gaps identified at national and international levels from the literature review.

Table 2. Main topics categorised by the results of the bibliometric cluster analysis. The numbers in parentheses show the frequency of occurrences.

Basic Themes	Motor Themes	Emerging Themes	Niche Themes
Construction timber buildings (including architects, construction sector, concrete, and finish) (59); Energy and consumption (including life cycle assessment) (10)	Attitudes and perceptions (including products, barriers, elements, forest, and preferences) (30); Wood and behaviour (including frame houses, consumer attitudes, and transition) (19); Energy efficiency (including thermal comfort and user satisfaction) (6)	Multiobjective optimization (including life cycle) (4)	Frame multi-storey construction (including consumers, price, and willingness-to-pay) (8); Innovation and technologies (4)

2. Methodology

2.1. The Survey

The data collection instrument was created using a survey methodology carried out in person by trained interviewers. The design aimed to balance gathering the maximum amount of information and ensure a reasonable duration to prevent refusal to participate or loss of interest during the application. Consequently, it was initially decided that the survey would consist of a maximum of 30 questions, incorporating closed-ended and easily answerable responses. In terms of content, the definition of indicators, dimensions, and items was informed by previous experience with similar surveys in the national

context [36–38], preliminary fieldwork involving interviews with relevant stakeholders (companies and researchers in the forestry sector, as well as public policy decision-makers), and recent references from the international state of the art [30,39–41], as identified in the preceding bibliometric analysis.

Accordingly, three major indicators were defined for the questionnaire, each comprising a set of categorical or ordinal variables (Table 3). Arguably, the most important indicator from a content perspective is the perception of wooden houses by end users, which correspond to a total of 17 questions, further divided into six dimensions: durability, fire resistance, climate change, sustainability and comfort, costs, flexibility in construction, and industrialisation possibilities. All these questions were defined based on a 5-point Likert scale (strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree). The statements forming these variables were piloted with city residents and adapted to ensure comprehension, which also determined the positive or negative framing of the questions (for example, "a wooden house burns easily" has a negative connotation initially, but it is how people understand and interpret it more easily). The other two dimensions, sociodemographic characterisation (N = 8) and decision variables for acquiring or constructing a wooden house (N = 5), are relevant for characterising and contextualising the perception responses obtained, which was crucial for identifying respondent profiles. Appendix A presents the survey questionnaire in English regarding the "perception of wooden houses" section (the original version was administered in Spanish).

Table 3. Definition of the data collection instrument.

Indicator	Dimension	Items
Sociodemographic characterisation	Age	1 ordinal variable
	Gender	1 dichotomic variable
	Education level	1 ordinal variable
	Occupation	1 ordinal variable
	Household	3 categorical variables
	Tenure or occupancy regime	1 ordinal variable
	Subtotal	8 variables
Perception of wooden houses	Durability	3 categorical variables (Likert scale)
	Fire resistance	2 categorical variables (Likert scale)
	Climate change, sustainability and comfort	4 categorical variables (Likert scale)
	Costs (construction and maintenance)	2 categorical variables (Likert scale)
	Flexibility in construction	3 categorical variables (Likert scale)
	Industrialization possibilities	3 categorical variables (Likert scale)
	Subtotal	17 variables
Decision variables for acquiring or constructing a wooden house	Housing types associated to timber construction	1 categorical variable
	Environmental actions in daily life	1 categorical variable
	Factors that would encourage buying a wooden house	1 categorical variable
	Perception of the reputation of the wood industry	1 categorical variable
	Willingness to buy a wooden house	1 categorical variable (1 to 10 scale)
	Subtotal	5 variables
Total		30 variables

2.2. The Spatial Sampling

The evolving societal landscape and complex processes in human geography underscore the need for more efficient data collection methodologies. Following issues with the 2012 and 2017 Chilean population censuses [30] and the Socio-economic Characterisation Survey (CASEN, in Spanish), there is a growing demand for alternative sampling techniques to address biases and duplicated information, particularly in spatial autocorrelation phenomena [42]. Spatial autocorrelation, a prevalent phenomenon, challenges the representativity of demographic measurement instruments due to the violation of the independence assumption of observations. As a result, methodologies based on regionalisation and clustering processes offer the potential for significant sample size reduction [43]. The main difference between regionalisation and clustering is that clustering does not

require individuality and contiguity constraints [44], allowing for better performance in creating homogeneity based on a stratification variable. Regionalisation is typically used in surveys that follow a panel logic and require primary sampling units. At the same time, clustering is more effective for smaller surveys, reducing the sample size. This article will outline the clustering methodology for the survey, detailing steps to reduce sample size based on the autocorrelation captured by stratification variables. As mentioned in regionalisation studies [43], the smaller the scale of the aggregation variable, the greater the homogeneity. Therefore, working at the block level was preferred, seeking a variable correlated with the socioeconomic level (a socio-material-territorial indicator), specifically the head of household education index [45,46].

The GeoDa 1.22.0.4.9 software tool used the K-Means method to prioritise the spatial result and as an equivalent partition algorithm to max-p, which has proven to be the best performance for regionalisation topics [47,48]. For the case of Valdivia, given its moderate size, iterations and initialisations were optimised to 5000 and 500, respectively, with range-adjusted normalisation. The elbow method was employed to achieve convergence in clusters (K). This involved analysing the point at which the delta of the ratio between the total sum of intra-cluster variance and total variance becomes insignificant. Moreover, this approach was supplemented by ensuring correspondence with socioeconomic segmentation, aiming to achieve a balance in the interpretation of the results and the quantitative consistency of the method. For the convergence of K, three main factors were considered:

- When the increase in the ratio is marginal with the growth of K clusters.
- The ratio is greater than 0.85, and the within-cluster variance is less than one year of individual education for all clusters.
- That no overlap occurs in cluster recognition and that it is assimilable to a concept, in this case, socio-economic.

The partition that considers these three factors is K = 6, with the following results:

- The total within-cluster sum of squares: 2.27763
- The between-cluster sum of squares: 52.4369
- The ratio of the between-cluster sum of squares to the total sum of squares: 0.958373

The sample size calculation is based on the results, considering minimal variance and taking the total households in Valdivia: 49,825. Considering the different sampling typologies, the results are:

- Traditional Methodology with 100 cases: 9.79% margin of error
- Traditional Methodology with 360 cases: 5.15% margin of error
- Spatial Sampling with 88 cases: 6% margin of error
- Spatial Sampling with 100 cases: 5.5% margin of error

Finally, 6 clusters representing socioeconomic levels were defined according to the criteria used by Chile's Association of Market Research Companies [49] (Figure 2). Using a spatial sampling of 100 cases, the distribution of households for each of these clusters was defined, including the universe of households, heterogeneity, and confidence interval (Table 4).

With the described results, an online map resource was generated to facilitate the random selection of blocks where cases will be surveyed for each cluster and replacement blocks chosen randomly and used if the original blocks are unsuccessful (Figure 3). Each record also includes the details of the households and their corresponding classification, allowing the surveyor to verify their location and the situation of the selected block. The survey was carried out in November 2023 and involved 96 households and 24 blocks, considering four selected households per block on average (Table 5). Three field interviewers surveyed people. When the originally selected 24 blocks had no available households, adjacent replacement blocks were used. This was primarily seen in areas with a high presence of informal settlements and difficulty of access.

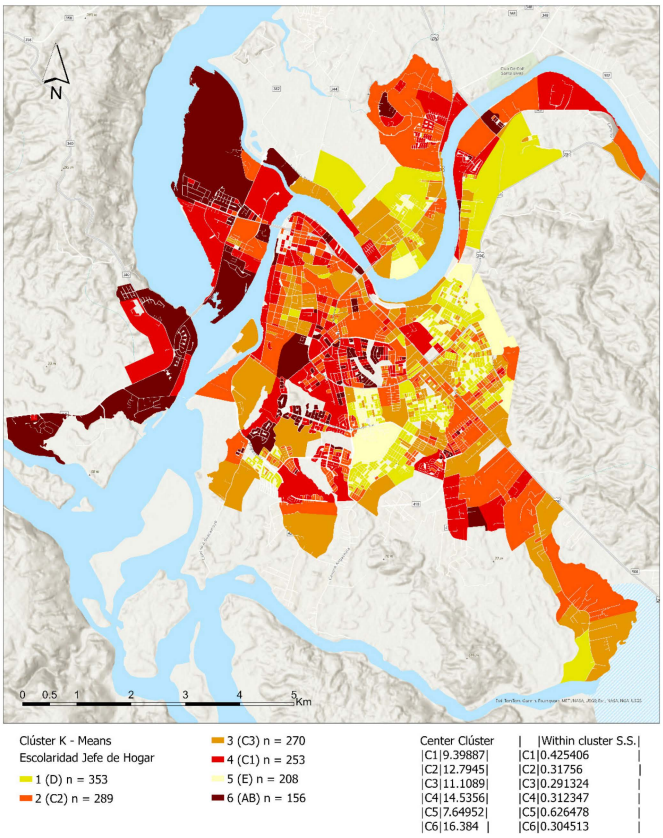


Figure 2. Cluster analysis based on the head of household education index with six representative clusters of the socioeconomic levels in Valdivia.

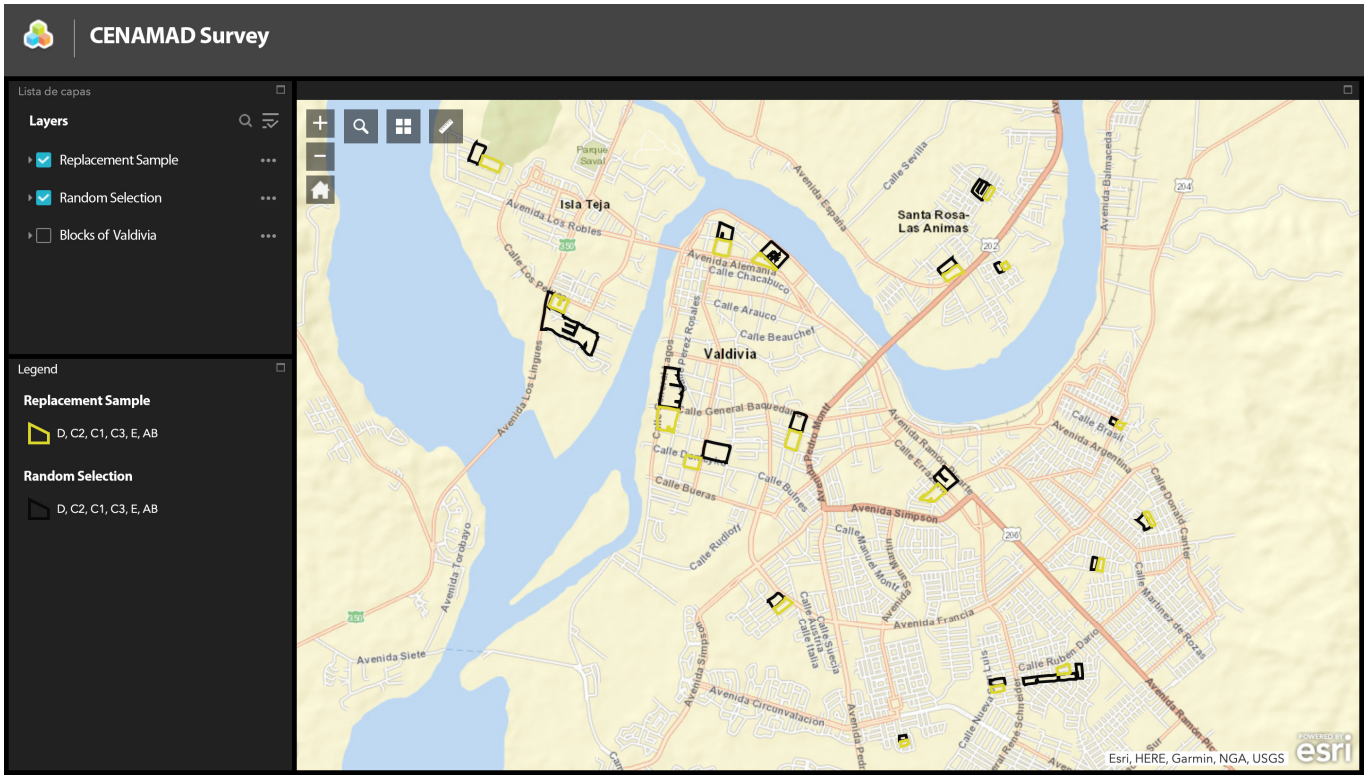


Figure 3. Online map resource for field work, including the random selection of blocks (in black) and the replacement blocks (in yellow).

Table 4. Definition of clusters for spatial sampling.

Cluster	Socioeconomic Level	Households	*p*-Value	Within Clusters	Heterogeneity	*N*
AB	high	4310	0.95	0.274513	0.5%	8
C1	medium-high	9515	0.95	0.312347	0.72%	11
C2	medium	12,151	0.95	0.31756	0.71%	11
C3	medium-low	10,983	0.95	0.421324	1.35%	21
D	low	11,371	0.95	0.625406	2.1%	32
E	very low	5505	0.95	0.386478	1.1%	17

Table 5. Definition of the number of surveys per cluster.

Cluster	Socioeconomic Level	Number of Surveys	Percent of Surveys	Households per Block	Number of Blocks
AB	high	8	8.3%	4	2
C1	medium-high	18	18.8%	4	4
C2	medium	15	15.6%	4	4
C3	medium-low	12	12.5%	4	3
D	low	30	31.3%	4	8
E	very low	13	13.5%	4	3
Total	Total	96	100.0%		24

2.3. Principal Component Analysis and Cluster Analysis

The survey results were analysed using both descriptive and exploratory statistical analysis techniques. Descriptive analysis was applied to the questions associated with the perception of wooden houses by end user's indicator, represented through bar charts. Multivariate techniques were used for the exploratory analysis. Initially, a Principal Component Analysis (PCA) was conducted, a technique that reduces the dimensions of a large set of observed variables. The resulting new variables are called components and are a linear combination of the original ones. This method helps to identify underlying dimensions within a correlation matrix to understand the structure of relationships among a specific set of variables. For this study, the PCA procedure was chosen to reduce the extensive amount of information collected from specific survey questions, enabling further analysis with this condensed information.

Given its exploratory nature, which allows for identifying latent structures within the dataset, PCA (Principal Component Analysis) was the first technique used for multivariate analysis. However, discriminant analysis was also explored to identify groups based on predictor variables. Initially, it was decided not to include the last question of the questionnaire, which referred to the willingness to pay for a wooden house: "Assuming your budget allows it, and you find a house you like in size and location. On a scale from 1 to 10 (where one is least and ten is most), how willing would you be to buy or rent this house if it were made of wood?" This decision was made due to the low variance in the results (where, for instance, 63% expressed a strong willingness to buy or rent a wooden house), which is consistent with a city that has a strong wood-related tradition. Therefore, the model was ultimately applied to the question regarding the perception of the reputation of the wood industry: "What is your perception of the wood construction industry in terms of its contribution to the country?" This model passed most goodness-of-fit tests. Although it is not the primary technique discussed in this article, Appendix C presents the visualisation of the results for the grouping of observations, as it aids in interpreting the outcomes of the other models.

In addition to this, a cluster analysis was used for classification [50]. The primary objective of this method is to identify a group of entities such as people, markets, and organisations that share common characteristics such as attitudes, purchase propensities, or habits. The hierarchical technique was chosen as the clustering method for this study. This technique classifies through stages with a process that follows the structure of a tree, with each stage generating a new branch. While no standard rules dictate the appropriate survey

clusters, a graphical representation known as a dendrogram can illustrate the successive stages of the classification. The researcher is responsible for determining the adequate number of clusters based on the dendrogram obtained and previous technical background. In this case, the decision was complemented with a comprehensive descriptive analysis of each cluster to the sociodemographic variables for solutions with several clusters ranging from 4 to 7. The aim was to find the solution that allowed the best group configuration with internal consistency and differentiation, enabling an interpretation that sheds light on different user profiles about the perception of wooden construction. Additionally, the selection of the factor scores of the PCA as variables for the procedure is justified as it allows for the correction of interdependencies due to their orthogonal rotation. Furthermore, the non-equivalence of metrics among the original survey variables suggests using this procedure.

3. Results

3.1. Descriptive Analysis

The descriptive analysis offers an initial insight into end users' perceptions of various aspects of wooden construction, as outlined in the survey dimensions. Depending on the wording of the questions, the Likert scale responses convey different viewpoints on the aspects in question, leading to perceptions being categorised as positive, neutral, or negative. For example, regarding the durability of wooden construction, most respondents express concerns about the exposure to insects (typically termites) and, to a somewhat lesser extent, about its long-term resilience (Figure 4). However, in the case of structural strength, the results are more evenly split, with nearly equal positive and negative perceptions. Similarly, the perception of costs associated with wooden construction yields expected outcomes, with predominantly positive views on initial investment costs but some reservations about maintenance expenses over time (Figure 5).

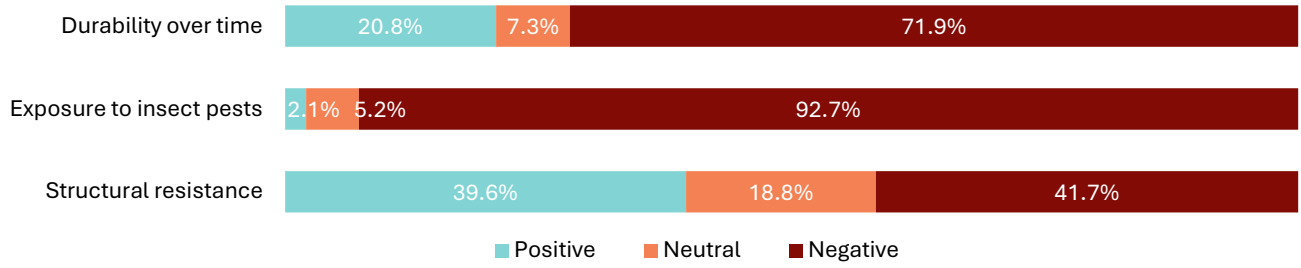


Figure 4. Descriptive result of the perception of wood construction regarding durability.

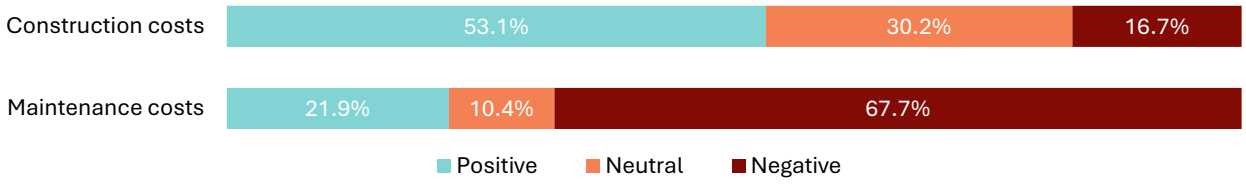


Figure 5. Descriptive result of the perception of wood construction regarding costs (construction and maintenance).

On the other hand, fire resistance presents a very high percentage of negative perception, highlighting one of the most widespread and cross-cutting fears of wooden construction: that it burns easily. However, a significant percentage also believes that the fire risk in a wooden house can be technically resolved. This opens up possibilities to reverse one of the arguments against wood, likely more entrenched in the collective imagination, through information (Figure 6). Conversely, one of the most significant findings of this study is the emergence of a negative perception in one of the areas that constitute the strength of wooden construction: its sustainability. Indeed, while the results show an

expected positive perception of thermal comfort, especially in a country with low energy performance standards, a very high percentage indicates that wooden construction causes deforestation (Figure 7). This initially seems counterintuitive since it is based on wood stocks from forest plantations. Still, the contradiction is exacerbated by 42% of respondents' perception that wooden construction does not contribute to combating climate change. This may be concerning as a phenomenon from a forestry country, even contradicting most of the literature, which generally expresses positive perceptions of wood regarding sustainable construction. However, some articles raise concerns about forest management practices as a prerequisite for accepting wood as a construction material [30]. However, to better understand what type of user represents this view, it is necessary to delve into the exploratory analysis.

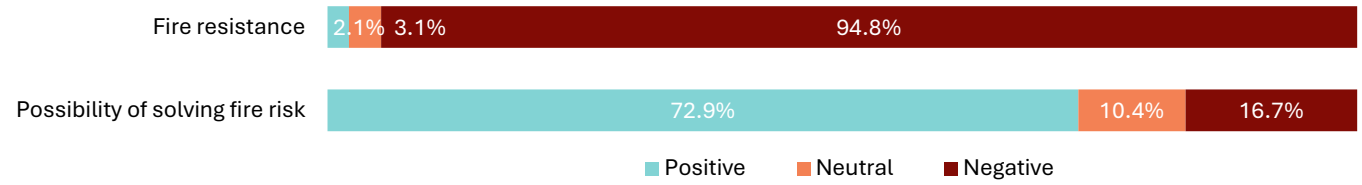


Figure 6. Descriptive result of the perception of wood construction regarding fire resistance.

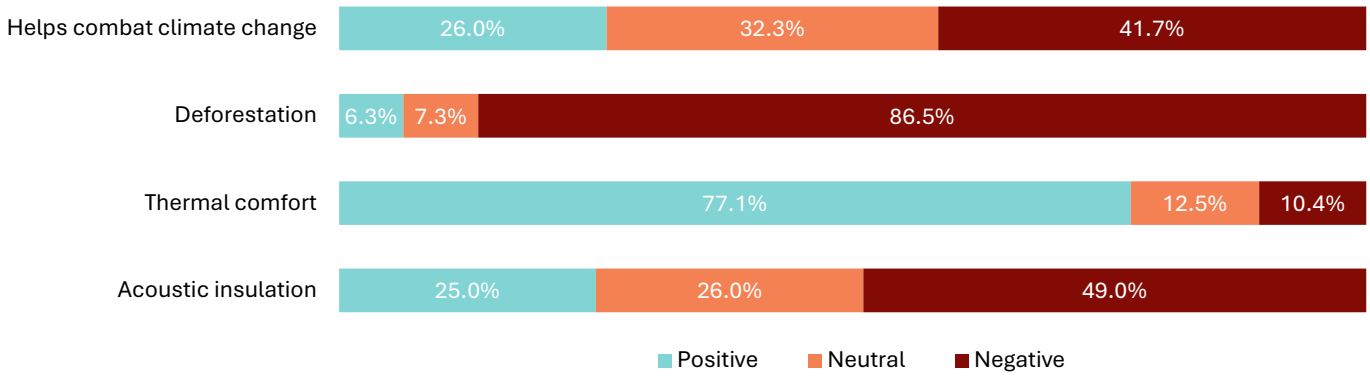


Figure 7. Descriptive result of the perception of wood construction regarding climate change, sustainability and comfort.

3.2. Exploratory Analysis

Principal component analysis (PCA) was used to analyse all the perception and sociodemographic variables, resulting in 17 variables. Initially, 17 components (as many as variables) were extracted, but this number was reduced to 7 using the Kaiser criterion. As per this criterion, components with eigenvalues less than 1.0 were excluded from the model because they contributed less variance than the original variables. Since the main objective of the procedure is to capture the maximum variance with the fewest components, it was determined that retaining seven components accounted for 68.3% of the total variance (Table 6). The model also passed the goodness-of-fit tests, including Bartlett's test of sphericity and the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy, where the KMO value of 0.6 was considered acceptable for exploratory purposes. A significant Bartlett's test of sphericity ($p < 0.05$) indicates a significant correlation among the variables, suggesting that it is possible to reduce the dimensionality of the data through factor analysis. Conversely, a KMO index close to 1 (typically above 0.6) indicates that the variables exhibit sufficient partial correlation, which is suitable for grouping into factors.

Finally, the 17 variables included in the solution have communalities (understood as an estimate of the shared variance among them) greater than 0.5. This means that they can explain at least half of the variance of each variable and, therefore, contribute sufficient information [51]. The PCA component matrix represents the extraction of these components according to their importance, meaning that the first components are better able

to summarise the linear combinations of the data contained in the model, with explanatory quality decreasing until reaching the last component considered significant (in this case, the seventh). For this solution, the matrix was additionally rotated orthogonally using the VARIMAX method to facilitate the interpretation of the components (as it simplifies the information in the rows and columns). Each of the extracted components will then be defined based on a series of the original variables, considering the direction of the sign of the factor loadings for their interpretation. For example, component 1 (C1) is constituted by the variables of durability over time, exposure to insects, maintenance costs, and limitations in design possibilities due to industrialisation, highlighting concerns from a rather negative perception of these issues (Table 7).

Table 6. Eigenvalues and variance percentages per component of the Principal Component Analysis.

	Components						
	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**
Eigenvalues	2.49	1.93	1.82	1.71	1.36	1.23	1.07
Percent of variance	14.6%	11.3%	10.7%	10.0%	8.0%	7.3%	6.3%
Cumulative percent	14.6%	26.0%	36.7%	46.7%	54.7%	62.0%	68.3%

Table 7. Rotated component matrix [1] using Varimax.

Variables	**Components**							**Communalities**
	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	
Educational level			0.89					0.81
Occupation			0.76					0.68
Durability over time	0.73							0.65
Exposure to insect pests	0.59							0.58
Structural resistance							0.58	0.66
Fire resistance				0.75				0.65
Possibility of solving fire risk						0.60		0.75
Contribution to combat climate change			−0.64					0.62
Deforestation				0.80				0.68
Construction costs		0.64						0.65
Maintenance costs	0.69							0.52
Speed of construction		0.73						0.73
Ease of expansion		0.71						0.71
Possibility of multi-storey buildings						0.88		0.82
Architectural design possibilities	0.65							0.58
Lower construction costs					0.84			0.80
Less generation of construction waste							0.80	0.71

[1] Component loadings > |0.6| were significant according to the sample size criterion [51].

Each component was then defined with a concept to facilitate understanding and suggest interpretations that will later be complemented with sociodemographic segmentation variables. Accordingly, the seven components are interpreted as follows:

- Major disadvantages (C1): is associated with negative perceptions of wooden construction in terms of low durability over time, high exposure to insect pests, high maintenance costs, and limitations in architectural design when industrialised.
- Major advantages (C2): is associated with positive perceptions of wooden construction in terms of lower construction costs, speed of construction, and ease of expansion.
- The denialist drift (C3): is associated with the denial of wooden construction's contribution to combating climate change and a high socioeconomic level (understood as higher educational and occupational levels).
- Urgent concerns (C4): is associated with the perception that wooden houses burn easily and that their construction process causes deforestation.
- The great advantage of industrialisation (C5)**:** corresponds to lower construction costs.

- Hope for solution (C6): openness to the possibilities of technically solving the fire risk in wooden houses and the potential for constructing high-rise wooden buildings.
- Less popular advantages (C7): associated with positive perceptions of wooden construction regarding its structural strength and lower waste generation.

As noted in the methodology, the next step was to apply a cluster analysis to classify the variables associated with perception and sociodemographic segmentation, which are contained in the components resulting from the PCA procedure. Given the relatively limited number of observations (N = 96), a hierarchical clustering method utilised the resulting dendrogram as a judgment element for determining the number of clusters. Using the factor scores from the PCA for each observation resolves a priori one of the main issues associated with hierarchical methods: the influence of outliers. Following the logic of this geometric approach, Euclidean distance was used as the distance measure for clustering, which is also recommended in combination with the Ward method for agglomeration [51]. In this method, the distance between clusters is the sum of squares between two clusters summed for all variables, and it is also commonly used due to its tendency to combine clusters that contain a reduced number of observations (Table 8).

Table 8. Settings and variables for cluster analysis.

Clustering Method	**Agglomerative Hierarchical Clustering (AHC)**
Proximity type	Euclidean distance
Agglomeration method	Ward's method
Number of observations	96
Input variables	C1, C2, C3, C4, C5, C6, C7 [1]
Truncation	Number of clusters = 5

[1] Obtained through the Principal Component Analysis.

The dendrogram suggested grouping the observations into clusters with similar features and distinct sociodemographic profiles (Figure 8). Five clusters were identified (Figure 6), which can be described by the following characteristics (the percentages in parentheses show the frequency of responses given):

- Conservative Profile (cluster 1, N = 23): Mostly linked to high and middle-high socioeconomic levels (52%), men (61%) aged 45–65 (57%) with university education and mid-level executive roles (78%), who recycle regularly (87%) and have a good perception of the wood industry (43%).
- Disaffected Profile (cluster 2, N = 23): Mainly connected to a low socioeconomic level (57%), women (65%) with secondary education (57%) who view wooden construction as related to first-time homeownership (91%) state that their environmental contribution is only domestic recycling (57%) and have a bad perception of the wood industry (57%).
- Progressive Profile (cluster 3, N = 13): Mostly linked to a middle socioeconomic level (53%), balanced in terms of gender (46% for each sex), with university (23%) and postgraduate education (15%), employed (54%), and having a mixed opinion on wooden housing (54% for first-time homeownership and 31% for second home to vacations). They report using public transport (38%) and bicycles (23%) as environmentally friendly actions.
- Moderate Profile (cluster 4, N = 15): Mainly connected to middle-high and middle socioeconomic level (54%), women (60%) with diverse educational levels who view wooden construction as related to first-time homeownership (93%) state that they implement energy efficiency measures at home (47%), and likely pragmatic in decision-making regarding wooden housing (59% express willingness for a home that has environmental or construction quality certification, and 36% value the concrete savings that wooden construction can offer) and neutral to the wood industry (60% for the answer "neither good nor bad").
- Vulnerable Profile (cluster 5, N = 22): Mostly connected to low and very low socioeconomic level (54%), men (59%) with basic or secondary education (86%), unemployed

or with low or informal jobs (55%), with a notable perception of wooden construction associated with social housing (25%). They convey willingness and interest in incentives for acquiring a wooden home and are neutral to the wood industry (59%).

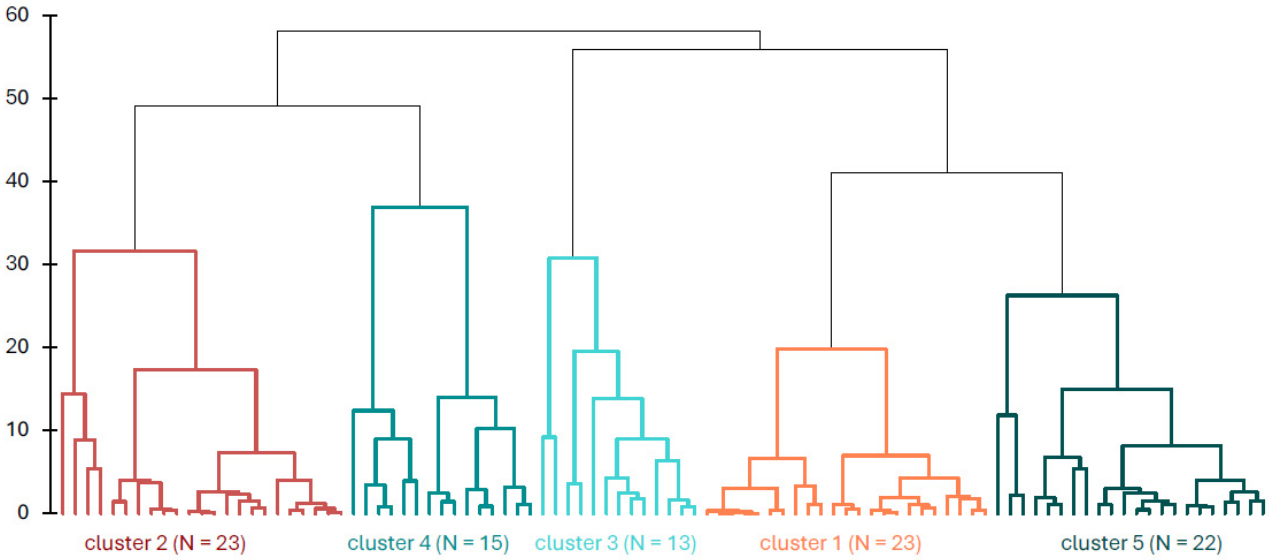


Figure 8. Dendrogram of the hierarchical cluster analysis. Dissimilarity values in the *Y* axis.

4. Discussion

To provide a more detailed interpretation of the obtained profiles, perceptual maps were generated from the centroids of the factor loadings on the PCA components. This allows for a broader discussion based on the exploratory analysis, delving into those aspects that may represent tensions and contradictions in the perception of wooden construction. It is interesting to observe, for instance, how, in the cross-section of the first two components (Figure 9, left), the conservative and vulnerable profiles are the most aware of the main advantages and disadvantages of wooden construction. From a communication perspective, it is likely necessary to inform with specific and concrete arguments (for example, in terms of costs vs. benefits) to improve their disposition towards wooden construction (overcoming some apprehensions regarding its disadvantages).

Then, the moderate and progressive profiles present the opposite situation, with a low perception of both positive and negative aspects (Figure 9, left). In both cases, it would be necessary to investigate whether this is due to a lack of information or simply disinterest. Given the sociodemographic characteristics of the progressive profile, it is likely not due to a lack of knowledge but rather deeply rooted convictions. On the other hand, the disaffected profile expresses a much more pronounced perception of disadvantages than advantages, making them probably more resistant to address through information campaigns or public policy. Unfortunately, from this perspective, no cluster appears in the most favourable quadrant (top left), characterised by a greater perception of advantages over disadvantages. This is an important point to investigate concerning the projection of this research.

Next, in the cross-section of the profiles with components C3 and C4 ("The Denialist Drift" and "Urgent Concerns," respectively), an apparent contradiction emerges. Both the conservative and progressive profiles believe that wooden construction does not help combat climate change (Figure 9, right). However, the progressive profile also expresses one of the "urgent concerns" of the fourth component: that constructing a wooden house causes deforestation. While the initial temptation would be to propose an information campaign targeting this group, the higher educational level of this profile suggests that this communication strategy would require a particular design. With the conservative profile, more doubts arise regarding the underlying motivations (for example, could it be an authentic denial of climate change?).

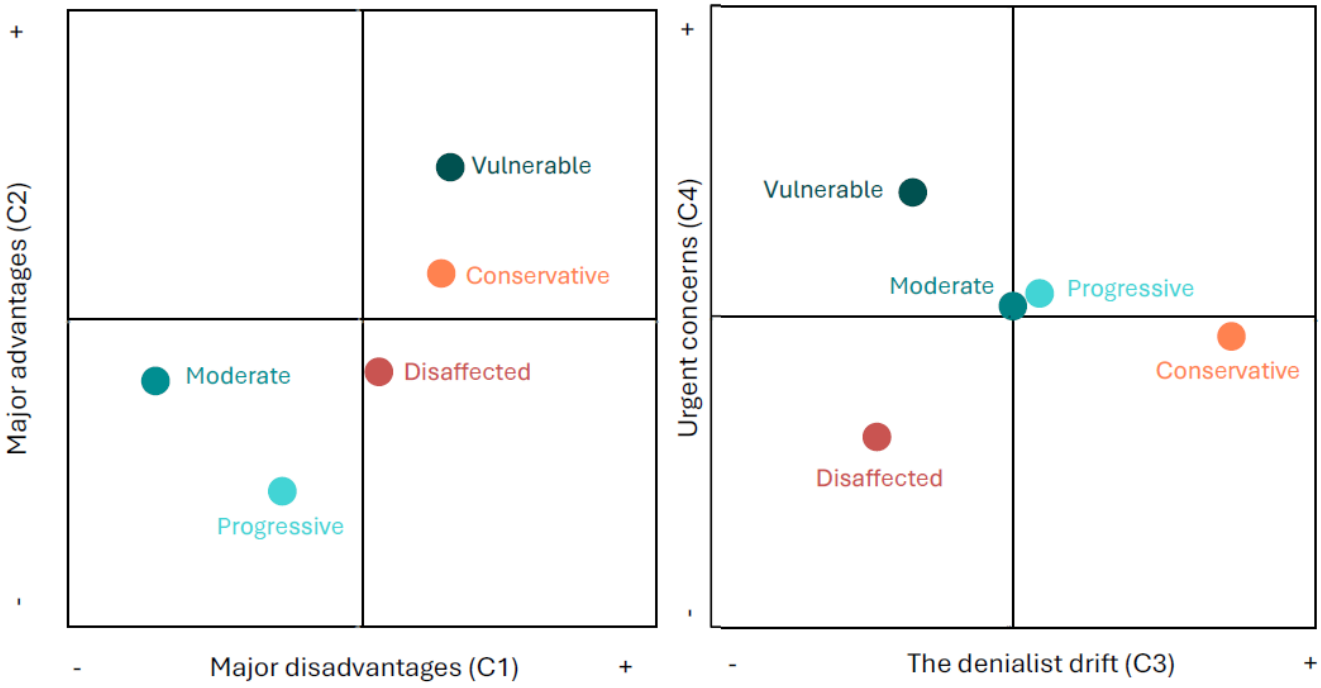


Figure 9. Perceptual maps of profiles (clusters) centroids according to PCA components.

Additionally, the discriminant analysis results, presented as complementary in Appendix C, suggest an important role that the perception of the national wood industry and its reputation could play in this discussion. This is because they form independent groups based on their opinions in the model, with a very positive category standing out clearly from the rest (Figure A1). This finding is relevant because this question is part of the definitions of the profiles generated from the cluster analysis of the survey and introduces considerations related to development models and environmental and cultural values. Likely, in both cases, these perceptions are closer to ideological considerations, as noted at the beginning regarding Zizek, invoking a broad range of intellectual and emotional categories.

These findings represent an initial quantitative approach, which will be further enriched by subsequent data collection through qualitative tools, such as in-depth interviews. Nonetheless, it is possible to find correspondence with the existing literature on the subject. One of the primary aspects is understanding how socioeconomic variables, educational level, and occupation can influence attitudes and perceptions toward wooden construction. For example, higher-income groups value timber for its environmental benefits, aesthetic appeal, and contribution to well-being. However, these groups also express concerns about timber's durability, fire resistance, and long-term stability, often seen as barriers to its wider adoption in construction [23,34]. Education also significantly shapes attitudes toward timber, especially regarding environmental awareness. Individuals with higher education levels generally support using sustainable materials like timber. However, their support is tempered by technical concerns, such as the structural performance of timber in urban construction and its long-term viability [24,30]. In this sense, for higher-income and educated groups, interventions should focus on showcasing the technological advancements in timber that address durability and safety concerns, thus aligning with their sustainability and long-term investment values.

Regarding environmental concerns, the study from Viholainen et al. identified narratives associated with concerns about deforestation and the negative impact on wildlife habitats in seven European countries while simultaneously seeking a "balance between harvested wood and planted trees" [30]. Such reflections are likely also present in the case of Valdivia, especially since—unlike other forestry cities in southern Chile—it shares the presence of forest plantations with native forests in relatively similar proportions. Regarding the dimension linked to climate change, a study by Forest & Wood Products Australia

reveals a general lack of knowledge about the contribution of wooden construction to reducing emissions and its carbon storage capacity. This is reflected in 40% of respondents in a survey of end-users in Australia (N = 281) being neutral and 29% disagreeing that CO_2 emissions from wooden construction are lower than alternative materials such as steel or concrete [52]. This scenario should certainly be a concern for promoting wooden construction, as it affects one of the main strengths associated with production (which, often taken for granted, is not emphasised enough).

Finally, Table 9 presents the centroid values of each component for each of the defined profiles (clusters), including their interpretation (depending on the formulation of the questions and the sign of the factor scores) as either a positive or negative perception. This matrix of perceptions reveals a complex pattern, where no group appears completely committed or entirely resistant to wooden construction. In this sense, there are no "positive greens" nor "honestly disengaged" categories as proposed by the Department for Environment, Food and Rural Affairs (DEFRA) report [53,54]. However, the intermediate categories do not find a direct correspondence either, except the moderate profile—not as affected by the disadvantages of wooden construction, but not entirely convinced of its advantages, pragmatic in their view, optimistic about the possibilities of industrialisation and technical solutions—resembling the "sideline supporters" segment defined by this report. However, this profile did not offer clear perceptions of the more ideological components, so it cannot be interpreted from the consumers' perspective. To further delve into the rest of the profiles, a future study that includes in-depth interviews and qualitative content analysis is proposed beyond this paper's scope.

Table 9. Centroid values and their interpretation [1] by PCA components according to the different profiles (clusters).

	Major Disadvantages (C1)	Major Advantages (C2)	The Denialist Drift (C3)	Urgent Concerns (C4)	The Great Advantage of Industrialization (C5)	Hopes of Solutions (C6)	Less Popular Advantages (C7)
Conservative	0.40	0.22	1.08	−0.09	−0.32		0.21
Disaffected	0.09	−0.26	−0.68	−0.58	0.20	−0.28	0.80
Progressive	−0.41	−0.84	0.13	0.11	0.29	−1.24	−1.15
Moderate	−1.05	−0.30			0.27	1.36	
Vulnerable	0.45	0.74	−0.50	0.60	−0.23		−0.41

[1] Positive perception Negative perception.

Global trends in sustainable construction and decarbonisation goals emphasise the importance of reducing the carbon footprint of building materials. As countries worldwide aim to reduce emissions in the construction sector, timber is increasingly recognised for its potential to replace more carbon-intensive materials like concrete and steel. In addition, advanced engineered wood products have further strengthened this potential, enabling timber to be used in larger and taller structures and contributing to the creation of greener cities.

Public policies at the local, national, and regional levels are crucial in promoting timber as a sustainable building material. According to an FAO review [55], these policies mainly focus on two main objectives: promoting the advantages of timber as a building material and enhancing well-being through timber construction. Countries with significant forestry sectors, such as Australia, Canada, the U.S., Finland, France, Germany, Japan, New Zealand, Sweden, Switzerland, and the UK have established policies to promote timber construction. A notable trend is the increasing focus on high-rise timber buildings, supported by public policies. These policies are implemented through the collaboration of various government ministries, including agriculture, forestry, economy, environment, housing, science and research, and energy. In some countries, policies encourage the use of timber in public-sector construction, while in others, the focus is on private-sector initiatives.

Regarding national public policies, it is important to note that Chile is at a favourable moment in promoting timber construction. The country has established the initial institutional, regulatory, and legal foundations; there are numerous studies and research initiatives, and although the timber industry is heterogeneous, it is consolidated in many aspects [4]. Most importantly, there is an urgent need to address environmental challenges,

reduce the current housing deficit estimated at around 550,000 homes [56], and meet the carbon neutrality goals set by the country for 2050. This is especially significant considering Chilean forests offset approximately 59% of the country's annual CO_2 emissions [57].

The results of this study highlight that promoting and positioning the technical and environmental advantages of timber construction is crucial, but this must be accompanied by a structural change that allows for a thorough review and improvement of the entire forestry model to change the current negative perception of this sector. The recent constituent process in Chile proposed establishing environmental protection as a fundamental principle and an institutional framework that assures the state's role in preventing and adapting to the climate and biodiversity crisis risks [58]. To achieve this, it is necessary to incorporate a concept of territory that is better aligned with how we understand the relationship between people and ecosystems today. The challenge lies in implementing territorial planning that, in coordination with existing instruments, recognises differences in ecosystems, culture, and needs, prioritising a territorial over a sectorial vision [59]. Implementing these concepts requires effective coordination between urban and rural perspectives and considering a comprehensive landscape approach that includes industry and people. In this context, it is important to resume these discussions to move toward a sustainable forest landscape management model that considers its multifunctionality.

Advancing these structural changes creates the opportunity to develop a public policy model based on the sustainable use of forest resources. This will allow for the promotion and positioning of timber attributes, especially its advantages related to carbon capture throughout its life cycle. This aspect must be quantified in projects for proper valuation. Quantifying the environmental performance of timber is crucial in a context where the construction industry has significant environmental impacts, accounting for 33% of energy consumption and 30% of greenhouse gas (GHG) emissions nationwide [60]. There is a gap in information and traceability that can be addressed through research and development, which would better highlight the environmental performance of wood-based construction. In this regard, Building Information Modelling (BIM) can promote wood construction by improving efficiency, accuracy, and collaboration in design and construction processes. BIM allows for better visualisation and precise modelling of structures, addressing potential concerns about durability and performance. By optimising design through detailed simulations, BIM can help organisations overcome traditional barriers to adopting new materials, such as scepticism about its structural capabilities [61].

Developing demonstrative projects can reduce uncertainty and change people's perceptions of timber's technical performance. The Ministry of Housing and Urban Development has already addressed and promoted this aspect in collaboration with public, private, and academic actors. It should continue to be promoted to address the misinformation that affects users' perceptions regarding timber construction. International experience shows that urban infrastructure projects incorporating wood can be pivotal in changing public perceptions of this material. Historically, urban planning prioritised rapid, vehicle-centric development, sometimes neglecting community cohesion and quality of life [62]. However, there is a growing emphasis on sustainable and equitable urban development, which includes using environmentally friendly materials like wood, which can promote its broader adoption in urban development.

In this same vein, public housing subsidies could prioritise implementing pioneering projects focused on timber construction that demonstrate their sustainability attributes and incorporate sustainability construction standards such as life cycle analysis, CO_2 emissions limitation, and waste generation regulation [6]. Moreover, in the context of the current housing deficit, there is a strong push for high-value industrialised timber construction and the promotion of labelling for construction timber, which presents an opportunity to increase transparency regarding product quality and standardisation, addressing some of the gaps identified in this study concerning technical performance.

Optimising wooden structures could significantly transform public perception of this material by showcasing its advanced technical capabilities. The strategic optimisation of

wooden structures can maximise their durability, safety, and effectiveness under various conditions. Using sophisticated methods like topology optimisation, wooden structures can be tailored to perform exceptionally well, even under challenging dynamic loads such as those in seismic areas [63,64]. This approach can foster increased trust and acceptance of wood as a reliable material in urban and infrastructure projects, ultimately reshaping how users perceive and value it.

In this context, a proposal that supports technological development involves promoting the industrialisation of small and medium-sized enterprises (SMEs), incorporating local technologies, and developing new products with an emphasis on engineered products. Additionally, building capacities, both at the technical and professional levels, are crucial to spreading knowledge about the potential and benefits of timber construction for those involved in developing construction projects and for the end users. Moreover, innovation and education in sustainability and forest ecosystems should be incorporated, starting from the preschool and school levels.

Finally, it is important to note that local experts in the forestry and construction sectors have emphasised the need to strengthen incentive policies that build on existing tools, developing regulatory and financial instruments that motivate the entire construction chain to incorporate timber among its options. It is also essential to have an institutional figure that acts as a coordinating entity capable of articulating the initiatives of Ministries, the public sector, the private sector and academia. In this regard, cooperation and joint work between the forestry and construction sectors is decisive in consolidating and promoting timber construction among the public in Chile [65].

5. Conclusions

Nowadays, wood occupies a modest place in the construction sector for new homes compared to other materials, a long-standing trend. This undoubtedly contrasts with the conception of a forestry country, particularly in several regions, due to the industrial development level for producing pulp and wood, among many other products and by-products with varying levels of added value. Given the increasing environmental concerns and the commitments made by the country in these matters, particularly those related to climate change, one would also expect a boost in adopting the constructive and technological possibilities of wood as a building material. However, does this message reach the population? Are potential homebuyers aware of these advantages of wood? Has the perception of the traditional barriers of wooden construction—such as fire resistance, insect pests, and acoustic comfort—improved, for which technical solutions exist? These questions were addressed through the survey presented in this article, choosing an intermediate-scale forestry city in southern Chile as a case study.

The survey results confirm the expected findings but reflect little progress over the last 20 years (compared to the study from the Wood Innovation and Development Centre [3]). Thus, negative perceptions about durability over time, insect exposure, maintenance costs, fire resistance, and acoustic insulation are expressed. However, interesting aspects emerge, such as the technical possibility of resolving the fire risk and other positive attributes like lower construction costs and adequate thermal comfort. The question arises then, what should be done (different from what has been completed so far) to break the inertia of perceptions—probably well-rooted—of the disadvantages of wood as a construction material, which, given contemporary experience, should no longer be the case.

However, what should be of greater concern to decision-makers associated with wooden construction are the concerns or doubts affecting the main values with which wood is promoted and conceived today: environmental sustainability and the fight against climate change. While indeed there are aspects that should be strongly communicated, such as the fact that structural wood for housing construction comes from forest plantations (and not from the exploitation of native forests), it must be considered that what probably appears here are ideological conceptions and sociopolitical implications, which cannot be addressed as a marketing strategy. Attempting to tackle the complexities of these

perceptions, tensions, and contradictions towards wooden construction by merely viewing end-users as consumers will likely only contribute to reproducing existing prejudices. It can already be suggested that public–private collaboration, the industry's commitment to advancing more and better regulations for housing sustainability in Chile, and the availability of objective, transparent, and independent scientific information on the advantages of wood could help advance these issues.

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Appendix A

The following questionnaire corresponds to the second section of the survey: perception of wooden houses. The 5-point answers based on a Likert scale are: ( ) Strongly agree; ( ) Agree; ( ) Neither agree nor disagree; ( ) Disagree; ( ) Strongly disagree.

Q9. A wooden house lasts less than a brick or concrete construction.
Q10. A wooden house is more exposed to insect pests.
Q11. A wooden house is as resistant as a brick or concrete construction.
Q12. A wooden house burns easily.
Q13. The fire risk in a wooden house can be technically resolved.
Q14. Wood construction helps combat climate change.
Q15. The use of wood in construction leads to deforestation.
Q16. A wooden house offers better thermal comfort than a brick or concrete construction.
Q17. A wooden house has acoustic insulation problems.
Q18. Building a wooden house is cheaper than a brick or concrete construction.
Q19. A wooden house is more expensive to maintain.
Q20. A wooden house is faster to build than a brick or concrete construction.
Q21. A wooden house is easier to expand according to the family's needs.
Q22. With wood, houses and also high-rise apartment buildings can be constructed.
Q23. Architectural design possibilities are more limited in a prefabricated wooden house (where components and modules are built in a factory and assembled on-site).
Q24. A prefabricated wooden house is cheaper to build than one built traditionally (where it is completely completed on-site).
Q25. The construction of a prefabricated wooden house generates less waste and debris than one built in a traditional way (where it is completely completed on-site).

Appendix B

Table A1 presents the frequency results, quantity and percentage for each response on the Likert scale for the 17-wood housing perception indicator questions. The identification code for each question corresponds to the one presented in Appendix A.

Table A1. Frequency results for the indicator of perception of wooden houses from the questionnaire.

Questions	Strongly Disagree		Disagree		Neither Agree nor Disagree		Agree		Strongly Agree		Don't Know/ No Opinion	
	N	%	N	%	N	%	N	%	N	%	N	%
Q9			20	20.8%	7	7.3%	65	67.7%	4	4.2%		
Q10			2	2.1%	5	5.2%	76	79.2%	13	13.5%		
Q11	2	2.1%	38	39.6%	17	17.7%	38	39.6%			1	1.0%
Q12			2	2.1%			57	59.4%	34	35.4%	3	3.1%
Q13	1	1.0%	15	15.6%	9	9.4%	68	70.8%	2	2.1%	1	1.0%
Q14	4	4.2%	36	37.5%	28	29.2%	25	26.0%			3	3.1%
Q15			6	6.3%	6	6.3%	65	67.7%	18	18.8%	1	1.0%
Q16			10	10.4%	8	8.3%	61	63.5%	13	13.5%	4	4.2%
Q17			24	25.0%	24	25.0%	44	45.8%	3	3.1%	1	1.0%
Q18	1	1.0%	15	15.6%	29	30.2%	47	49.0%	4	4.2%		
Q19			21	21.9%	9	9.4%	61	63.5%	4	4.2%	1	1.0%
Q20	1	1.0%	7	7.3%	21	21.9%	58	60.4%	8	8.3%	1	1.0%
Q21			3	3.1%	1	1.0%	67	69.8%	24	25.0%	1	1.0%
Q22	8	8.3%	67	69.8%	9	9.4%	12	12.5%				
Q23			9	9.4%	11	11.5%	70	72.9%	6	6.3%		
Q24			1	1.0%	6	6.3%	81	84.4%	7	7.3%	1	1.0%
Q25			3	3.1%	19	19.8%	70	72.9%	3	3.1%	1	1.0%

Appendix C

Figure A1 presents the visualisation of the observations for the principal factors of the discriminant analysis to the question *What is your perception of the wood construction industry in terms of its contribution to the country?* and its five response options. The centroids for each of the obtained groups are also shown. Both factors (F1 and F2) account for 61.8% of the total variance. The solution of the presented model passes the goodness-of-fit tests of Wilks' Lambda test (Rao's approximation), Pillai's trace, and Roy's greatest root, as it rejects the null hypothesis and accepts the alternative hypothesis (Ha) that at least one of the mean vectors is different from another, suggesting significant differences between the groups. On the other hand, the Hotelling–Lawley trace cannot reject the null hypothesis, which could indicate that these differences are distributed in a way not captured by this measure.

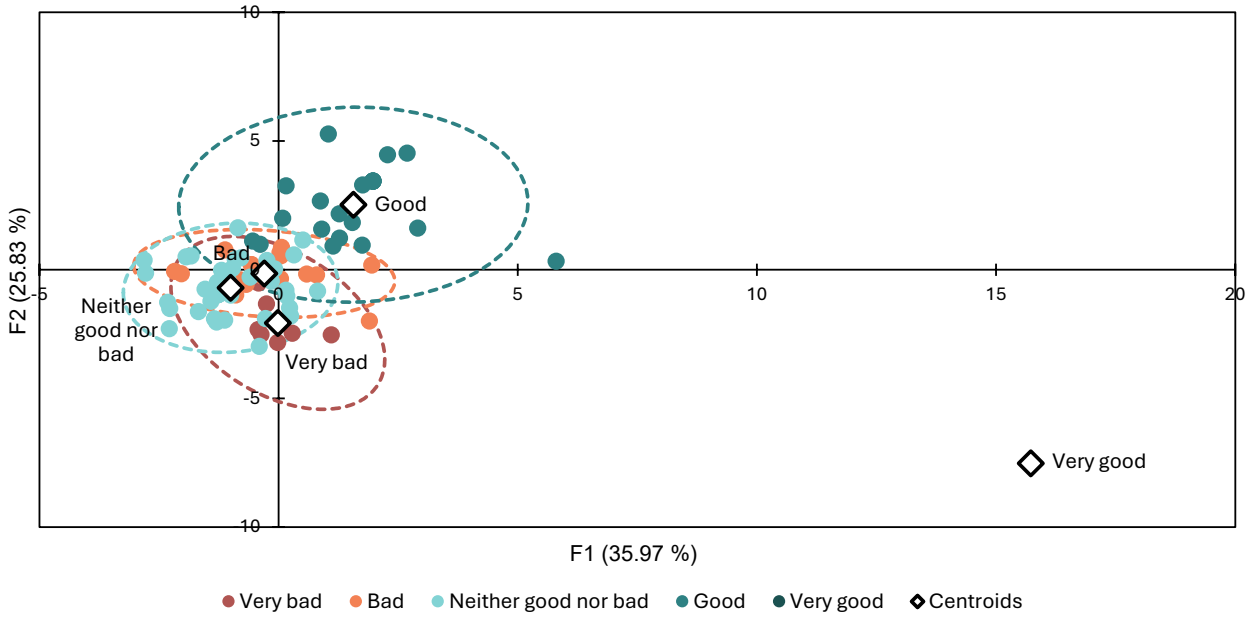


Figure A1. Observations for the two main factors in the discriminant analysis, according to the results of the question regarding the perception of the reputation of the wood industry.

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