SPECIAL 2020 FPS IC

A Comparison between Architects' and Residents' Perceived Living Quality in Wooden Multifamily Houses in Sweden

Fredrik Lindblad
Åsa Gustavsson

Abstract

There is currently great interest in the production of wooden multifamily houses in Sweden, due to increased environmental concern combined with a demand for modern building solutions. The focus in industry and academia alike has been dominated by new innovative building solutions along with increased industrialization of the building process, aiming to improve the overall building quality and the profitability for the involved actors. However, little attention has been paid to what the residents perceive as living quality. Understanding residents' perceived living quality—compared with architects' perceptions—allows the possibility of adjusting the modern building solution of wooden multifamily houses in order to meet residents' actual expectations and, in the long term, to increase the wood-building industries' market share.

The purpose of this article is to compare how residents and architects perceive living quality and whether these stakeholders' perceptions differ regarding building type and material choice (i.e., multifamily wooden or concrete buildings). A survey was sent out to 485 respondents in Sweden to gain insight into living quality perceptions. The results revealed discrepancies in what is perceived to be important in new housing development, although neither group was willing to pay more to live in a wooden building compared with a concrete building.

Sweden has seen a growth of the construction industry over the last decade; this, combined with the increased awareness of sustainability, increases the pressure on the construction industry (Lindblad 2019a). Consequently, various initiatives have been taken by the industry to reduce global warming. One of these initiatives involves increasing the usage of wood in new building projects for multifamily houses (Sanal 2018). Lately, wood has received increased interest as a building material, due to its characteristics of being both light and mechanically strong, as well as providing warmth for the building (Pajchrowski et al. 2014). Wood might not be considered ideal based on its constructional properties alone, but it is comparable to concrete in many cases, and it is crucial to developing an environmentally sustainable construction industry (Stehn 2010). Increasing the development rate of wood-based building solutions will improve opportunities for economies of scale due to increased volume, by extension reducing production cost and improving quality (Lindblad 2019b). The definition of *wooden buildings* used in this study is buildings that are built with wood as the construction material in the bearing structure; it does not suggest that any facade materials or other construction elements must be wooden (Sipari 2007, Stehn et al. 2008).

Several actors are involved in the modern construction industry, including municipalities, architects, and contractors. Each of these actors plays a different role in the construction process. The architect is a key actor in the building process, as their perceptions and actions impact innovation, design, and building planning, which in turn influence the development of the construction industry at large (Hemström et al. 2016). The contractor's role in Sweden is normally implementing the operational side of the construction project, as outlined by the client/developer. Due to the competitive nature of the industry, contractors favor short-term, cost-efficient solutions using existing

The authors are, respectively, Senior Lecturer and Senior Lecturer, Head of Department, Dept. of Accounting and Logistics, Linnaeus Univ., Växjö, Sweden (fredrik.lindblad@lnu.se [corresponding author], asa.gustavsson@lnu.se). This paper was received for publication in May 2020. Article no. 20-00031.

Forest Prod. J. 70(4):462–468.
doi:10.13073/FPJ-D-20-00031

knowledge and technologies rather than innovative solutions, which influences the development of the construction industry (Eriksson 2013). The architects consider the clients/developers and the contractors to have the most influence on the innovativeness of the Swedish construction industry (Hemström et al. 2016). However, all these activities are dependent on how the municipality acts, since the planning and agreements concerning new construction projects are controlled by the municipalities' detailed development plans (Lindblad 2019a).

One goal of the construction industry is to develop new sustainable housing projects that also take building quality and living quality into account at an early stage of the design phase (Lee et al. 2012). The architectural implications of the building process impact how the surrounding environment experiences building quality in terms of design, material choice, and general living standard, based on the general considerations taken into account during the design and construction process (Nylander and Forshed 2011, Lindblad 2019c).

Living quality is connected to residents' perceived value of their housing, which can be associated with the importance placed on quality, design, and originality (Rönn 1998). These factors alone might not improve the residents' perceived living quality, but are considered in addition to the craftsmanship and quality of work invested in the construction of new buildings. The construction of multifamily houses is affected by various decisions during the development and the design phases, such as material choice and building technique. This can be instrumental to an efficient production process that is financially profitable and that provides an opportunity for life-cycle cost assessments of new building projects (Lindblad 2019b). Thus, using more natural materials with which residents have a positive experience is often better over time in terms of maintenance costs, whereas choosing cheaper materials can lead to higher life-cycle costs due to increased maintenance requirements, as pointed out in the discussions by Nylander and Forshed (2011). Increasing the usage of sustainable, natural, and high-quality materials in new building projects is also perceived as providing the residents with long-term financial security (Nylander and Forshed 2011).

Increasing knowledge concerning the implications of different material choices and concerning the choices made by various actors in the building process, combined with a greater understanding of customer value perception, will support the development of a sustainable business model encompassing wooden multifamily houses. Thus, a well-designed business model that considers customer perceptions and customer values will enable market growth possibilities, which will strengthen competitiveness and reduce market barriers (Teece and Linden 2017, Lindblad 2019b). The business model related to the building process of new multifamily houses is influenced by different levels of market information, which is based on both macro- and microenvironmental perspectives (e.g., economic situation, market competitiveness, and customer preferences).

Generally, attention has mainly been focused on the external macro factors that influence the business model, and less attention has been paid to fully understanding what the residents perceive in terms of value, which is key in the industry's decision-making processes as they seek to increase their market share (Lindblad 2019c). The construction industry needs to meet residents' requirements when developing business models involving wooden multifamily houses in order to be profitable. Thus, the industry must find ways to make wooden multifamily houses compete as a building solution with concrete buildings, thereby increasing their market share in Sweden.

It is important for the industry to improve their understanding of the residents' (customer) and the architects' (supplier) perspectives. A study by Terzieva et al. (2019) highlights the complexity in the decision-making process, since it is influenced by individual human activities and preferences that need to be fully understood and is related to how value and perceptions can influence the design of business models. Still, it is important to determine how market information is structured in order to create a viable strategic decision-making platform—i.e., the difference between rational functions, intuitions, and perceptions. The value and utility functions of intuition and perceptions could in this context be considered as an analytic exemplification of empirical knowledge (Terzieva et al. 2019). This concept is also discussed by Keeney (2008), who highlights the importance of the value/utility functional model in assisting people and organizations in complex decision-making situations.

The importance of a business model focusing on how to capture value within the process is discussed by Teece (2010), who mentions that a balance is needed among creation, delivery, and capture of value in order to maximize the output derived from the business model. However, this balance is fleeting in nature, and value perceptions among the various actors within a business model might not remain valid or accurate for very long. Consequently, a structure capturing long-term value perception of customers' and suppliers' positions is important for long-term success.

The requirement of having a defined structure related to strategic analysis is based on the fact that various customer segments are linked to business models in different ways, which directly influences the strategic development of the company's or industry's value proposition (Teece 2010). Identifying the industry's or company's value proposition in relation to the customer's perception of value highlights the need to balance long-term economical, ecological, and social requests with customers' flexible value perceptions. This is a balance that is embedded in existing company practices, and understanding the different stakeholders' perceptions of value allows the process to evolve its services and product offerings to match the producers' and consumers' perceptions of value related to their business model (Doganova and Eyquem-Renault 2009).

The connection between a company's business model and value proposition on a targeted market, combined with their long-term success and competitiveness, is highlighted in a compact list provided by Schön (2012). Schön (2012) organizes the main business model components into three categories:

- Value proposition: product and service, customer needs, geography
- Revenue model: pricing logic, channels, customer interaction
- Cost model: core assets and capabilities, core activities, partner network

In Schön's (2012) list of business model components, the value proposition is understood as driving profitability and competitiveness. However, being able to develop value

creation is complex and no longer something that companies develop autonomously; in many cases, this is done by different companies acting with external parties to further increase awareness about the market's perception of value. Thus, cooperation among different actors within the same value chain will support the development of new value-based business models that consider the importance of collaborative ties, enhancing end-user value (Beattie and Smith 2013).

It is becoming increasingly important for a business model to define the manner by which it provides value to its customers—i.e., how the company persuades customers to pay more by increasing awareness and adjusting to the customers' perceived value of the product, which also increases profitability (Teece 2010). This combination of value, revenue, and cost in the business model is discussed by Chesbrough and Rosenbloom (2002). Chesbrough and Rosenbloom (2002) clarify that the business model embodies nothing less than the organizational and financial structure, which is based on implicit assumptions about customers' behaviors. Hence, ''a well-designed business model balances the provision of value to customers with the capture of value by the provider'' (Teece and Linden 2017).

Studying the business model and the building process by comparing the residents' and the architects' perceptions of living quality is relatively new. Consequently, the purpose of this article is to compare how residents and architects perceive living quality and whether these stakeholders' perceptions differ regarding building type and material choice (i.e., multifamily wooden or concrete buildings). By understanding the stakeholders' perceptions, we aim to identify potential patterns related to the research question (Davis 2016, 2017) and thus find ways in which wooden multifamily houses can compete as a building solution and increase their market share in Sweden.

Materials and Methods

Level of living quality is a studied phenomenon that calls for a large sample of respondents in order to ensure reliability and validity. The intent of this study was to compare residents' and architects' perceived levels of living quality. The data collection was initiated by identifying the stakeholders and the framework of the study (Robinson 2014, Zikmund 2016, Holmes et al. 2017). Selected respondents included residents living in buildings built with either concrete or wood, as well as the architects designing and controlling the progress of new building projects (McKendall and Wagner 1997). The sampling criteria for architects also included those operating in the Swedish market with an interest in the wood-frame construction industry.

The study's purpose determines the research design; using an online method of data collection is seen as a good choice for collecting and analyzing data related to the research design chosen for this study (Ellram 1996, Halldórsson and Aastrup 2003). A quantitative research design was selected in order to fulfil the study's purpose. Empirical data have been gathered through an online survey with multiple-choice questions. The questions were developed to identify the involved stakeholders' perceptions related to the living conditions. The questionnaire responses were compiled using a dedicated program, and the answers were analyzed to provide an understanding of living quality perceptions among different stakeholders associated with buildings using a wooden or concrete building frame.

The survey was sent to 485 selected respondents, which was deemed a satisfactory sample size that would provide suitable empirical data for this study. The respondents consisted of two categories: residents and architects. Residents were people who at the time of the questionnaire lived in wooden multifamily houses in Sweden; the building projects included the Vallen, Limnologen, Passet, Portvakten, Minnet, Förstäven, and Mesanseglet projects. The respondents from each building project were evenly spread. Architects included in this study were identified as active professionals in the construction industry with up-to-date, material-independent building design experience in Sweden. The response rate was 50 percent (49% for residents and 53% for architects), which was considered acceptable for this study. The survey was anonymous but was marked in a way to allow identification of differences between buildings using wooden or concrete frames. The survey was conducted April 20 to May 2, 2018.

Some of the questionnaire responses used a Likert scale, where the lowest level indicated no importance/no focus and the highest level indicated high importance/high focus. The Likert scale outcomes were created by calculating a score from the Likert scale responses, and the composite scores for the Likert scales were analyzed at the interval-measurement scale (Boone and Boone 2012). Additionally, several questions were designed as single-choice questions; the compiled scores derived from the specific questions were analyzed to classify the perceptions of the respondents. The online survey was designed to maximize transparency and objectivity for enhanced credibility (Halldórsson and Aastrup 2003). Furthermore, the study addressed validity and reliability by conducting presurvey interviews with representatives for each category of respondents, gaining their perspectives and experiences in order to validate the questions and results (according to suggestions by Whitten et al. 2004). Further, reliability was ensured by using a standardized measurement instrument, and eight follow-up interviews were conducted with representatives from both groups of respondents to further enhance reliability and external validity.

Results and Discussion

The ''Results and Discussion'' section reviews the following: how the respondents perceive the visual appearance of wood as a material choice, the perceived value of various internal living factors linked to the apartment, the value placed on the material choice, and whether the respondents are willing to pay more for an apartment based on a wooden building frame. Furthermore, this section will focus on the differences between the residents' and the architects' perceptions of value related to the studied topics.

The residents' perceived importance of visually displayed wood in the façade material is presented in Table 1 and is considered to be of average importance (5.5 on a scale from 1 to 10; see Table 2). However, the two Likert-scale values that received the most resident responses were 7 and 8 (Table 1), which together accounted for approximately 20 percent of the respondents. The architects considered this to be slightly more important and gave an average value of 6.71 (Table 2) with the same high frequency in responses at values of 7 and 8, with 35 percent of the respondents in this

Table 1.—Importance of wood in the external façade or as an internal material choice (1: no importance, 10: great importance). Data are percentages.

	1	2	3	4	5	6	7	8	9	10	Sum
Residents											
Q1. Externally	0.54	0.91	2.61	4.32	5.39	5.98	10.17	9.29	3.73	2.90	45.85
Q2. Internally	0.17	0.33	1.87	2.32	5.81	4.98	12.49	12.61	4.85	8.71	54.15
Architects											
Q1. Externally	0.00	0.00	0.00	0.00	4.90	5.88	27.45	7.84	0.00	0.00	46.08
Q2. Internally	0.00	0.00	0.00	0.00	0.00	0.00	20.59	23.53	0.00	9.80	53.92

group (see Table 1). Furthermore, the importance placed on wood as an internal and visible material choice in the apartment was rated slightly higher by both groups of stakeholders—6.53 by the residents and 7.86 by the architects (Table 2). Once again, the highest ranked frequencies are for 7 and 8 for both groups, but with a significantly higher proportion of the architects (44.5%) than the residents (25%) at these levels (see Table 1).

The different degrees of importance placed on wood as a material choice, both internally and externally, for the different groups of stakeholders are displayed in Table 2. The table indicates a disharmony among the responses from the residents, with a large variance for both the external and internal material choice. This is not the case for the architects, who display a more unified view of what they perceive as adding value in terms of the material choice, with a variance of 0.79 and 1.00, respectively regarding the external and internal material choice (Table 2). This could possibly be related to the generally higher awareness and value of the architects in material, sustainability, and aesthetics, which has been confirmed by Rönn (1998) in their discussion of the positive impact of high craftsmanship and material choice for the planning of new building projects. The residents appear to focus more on living costs and usability rather than on the aesthetics of a specific material choice, which has been discussed by Nylander and Forshed (2011) and by Lindblad (2019c) as having an impact on the design and construction phases of new building developments.

The living factors that influence the perceived value of an apartment were deemed to be important for the stakeholders; the 16 questions under this topic range in responses from 1 to 5 based on importance or perceived value. Location in the city was perceived to be the most valuable living factor by the residents, with an average value of 3.65, followed by the size of the apartment (3.53) and the number of bedrooms (3.13; Table 4). This highest average score was reconfirmed by the residents' responses related to the weighted average (WA), where the location in the city (Question 10 [Q10]) was still perceived as the most important living factor when choosing an apartment (Tables 3 and 4).

Table 2.—Specification in relation to Table 1.

	Residents		Architects	
Question	1	2	1	2
Average	5.50	6.53	6.71	7.86
Maximum	10	10	8	10
Minimum	1	1	5	7
Variance	5.59	4.89	0.79	1.00
SD	2.36	2.21	0.89	1.00

The responses from the architects' perspective were that location in the city is perceived to have the second-highest value, with a WA of 62.22 (Table 4). The highest perceived value was given to Q2, which received 20.95 percent (Table 3) of the architects' votes and had a WA of 92.19 (Table 4). The third most important living factor based on perceived value according to the architects was Q11, which had a WA of 46.67 (Table 4) from 13.33 percent of the respondents (Table 3).

Thus, in a comparison of the two groups of actors based on WA, Q10, Q9, and Q2 were perceived to have the greatest value by residents, while Q2, Q10, and Q11 were valued higher by the architects. Interestingly, both groups identified similar living factors as adding value when selecting an apartment from a WA perspective, merely differing in the order in which they value these living factors. However, it seems that the residents have a much more varied understanding related to their value perception of the defined living factors (Table 3) than do architects. This can possibly be due to the architects' professional preferences, which focus on design features and natural light, compared with the residents having a more practical approach towards actual limitations and value derived from living in the apartments.

The residents included in this study had a relatively vague preference concerning the building material (frame material), as specified in Q1 (Table 5). While 45.8 percent stated that they preferred wood as a building material, 36.8 percent had no preference, and 15.4 percent preferred concrete for their building material. The architects expressed their opinions, with a stronger preference toward wood (64.3%; Table 5). The difference between the groups could be derived from the professional interest of the architects, which could be influenced by the current discussions about increased sustainability and green construction, and which is not the focus in residents' value perceptions.

Understanding why the respondents chose a specific material sheds further light on material choice and the respondents' perceived values from the features defined in Q2 (Table 5). In this factor, 26.3 percent of the residents felt that their material choice is connected to environmental benefits, and 10.3 percent saw it as connected to living quality; interestingly, 48.1 percent of the residents didn't perceive the material choice as something that matters. The architects' responses display a much more focused view, with responses in only two categories—living quality (57.1%) and environment (42.9%; Table 5). The difference in perceptions can be a result of architects' more conscious choices and greater awareness than the residents, which contradicts the discussion by Terzieva et al. (2019), who

Table 3.—Importance of different living factors when choosing an apartment (1: no importance, 5: great importance). Data are percentages.

	Residents ($N = 201$)						Architects ($N = 42$)					
	1	2	3	4	5	Sum	1	2	3	4	5	Sum
Q1. Frame materials	0.13	0.07	0.30	0.00	0.33	0.83	0.95	0.00	0.00	0.00	0.00	0.95
Q2. Bright and large windows	0.36	2.06	3.98	2.79	6.97	16.15	0.00	0.00	0.00	11.43	9.52	20.95
Q3. Good sound insulation	0.96	2.59	2.29	3.85	3.81	13.50	0.95	1.90	0.00	0.00	0.00	2.86
Q4. Ceiling height	0.20	0.46	0.70	0.53	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Q5. Use of natural materials	0.43	0.86	1.39	0.40	0.83	3.91	1.90	1.90	0.00	0.00	9.52	13.33
Q6. Quality kitchen appliances	1.00	1.53	2.39	1.72	0.66	7.30	0.00	0.00	0.00	0.00	0.00	0.00
Q7. Open spaces	0.46	0.93	1.89	3.85	1.66	8.79	0.00	1.90	5.71	0.00	0.00	7.62
Q8. No. of bedrooms	0.43	0.60	1.09	1.99	2.32	6.43	0.00	0.00	0.00	0.00	0.00	0.00
Q9. Apartment size	0.46	1.19	2.59	5.31	6.47	16.02	0.00	3.81	0.00	0.00	0.00	3.81
Q10. Location	0.60	1.00	2.29	5.17	9.12	18.18	0.00	0.00	0.00	3.81	9.52	13.33
Q11. Furnishable	0.66	0.93	0.70	0.53	0.83	3.65	0.00	0.00	5.71	7.62	0.00	13.33
Q12. Public space (pool, guest apartment)	0.27	0.20	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.00	0.00
Q13. Spacious staircase	0.03	0.00	0.00	0.00	0.00	0.03	0.00	0.00	5.71	0.00	0.00	5.71
Q14. Bedrooms separated in the apartment	0.07	0.53	0.30	0.53	0.17	1.59	0.00	0.00	0.00	0.00	4.76	4.76
Q15. Floorplan	0.33	0.07	0.00	0.00	0.00	0.40	0.95	1.90	0.00	3.81	0.00	6.67
Q16. Design related to environment	0.27	0.33	0.10	0.00	0.17	0.86	1.90	1.90	2.86	0.00	0.00	6.67

Table 4.—Specification in relation to Table 3 (weighted average [WA] = [Σ Table 3 $\times$ average Table 4] $\times$ 100).

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Residents																
Average	2.50	3.36	2.85	2.38	2.46	2.34	3.08	3.13	3.53	3.65	2.20	1.27	1.50	2.67	1.09	1.67
WA	2.07	54.25	38.42	4.49	9.62	17.08	27.08	20.13	56.48	66.40	8.03	0.59	0.05	4.25	0.43	1.44
Maximum	5	5	5	4	5	5	5	5	5	5	5	2	2	5	2	5
Minimum	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Variance	2.50	1.70	1.92	1.11	1.57	1.41	1.63	2.15	1.71	1.89	1.76	0.22	0.50	1.29	0.09	1.67
SD	1.58	1.31	1.39	1.06	1.25	1.19	1.28	1.47	1.31	1.38	1.32	0.47	0.71	1.14	0.30	1.29
Architects[a]																
Average	1.00	4.40	1.50	n/a	2.80	n/a	2.67	n/a	2.00	4.67	3.50	n/a	3.00	5.00	2.33	1.75
WA	0.95	92.19	4.29	n/a	37.33	n/a	20.32	n/a	7.62	62.22	46.67	n/a	17.14	23.81	15.56	11.67
Maximum	1	5	2	0	5	0	3	0	2	5	4	0	3	5	4	3
Minimum	1	4	1	0	1	0	2	0	2	4	3	0	3	5	1	1
Variance	0.00	0.25	0.27	n/a	3.48	n/a	0.24	n/a	0.00	0.24	0.26	n/a	0.00	0.00	1.65	0.72
SD	0.00	0.50	0.52	n/a	1.86	n/a	0.49	n/a	0.00	0.49	0.51	n/a	0.00	0.00	1.28	0.85

[a] n/a = not applicable.

Table 5.—Importance of material choices and willingness to pay more to live in a wood building.

	Residents (%)	Architects (%)
Q1. What frame material would you prefer?		
Wood	45.8	64.3
Concrete	15.4	35.7
Steel	2.0	0.0
Others	36.8	0.0
Q2. Why did you choose the material?		
Sound transmission	10.3	0.0
Environment	26.3	42.9
Lower cost	5.1	0.0
Living quality	10.3	57.1
Doesn't matter	48.1	0.0
Q3. Pay more for an apartment using a wood frame?		
Yes	23.9	50.0
No	76.1	50.0

mentioned the importance of understanding the different stakeholders' value perceptions in order to optimize the outcome for a business model.

Based on the respondent's choice of material and perceived value of that choice, the willingness to pay more for an apartment in a multifamily wooden building was also a topic of interest, since these are currently sold at a slightly higher cost (Lindblad 2019b). Despite both architects and residents preferring wood as building material, they are not willing to pay extra for this option: only 23.9 percent of the residents and 50.0 percent of the architects considered a wood building solution as adding additional qualities or value for which they are prepared to pay extra. This runs somewhat counter to the discussion by Nylander and Forshed (2011), who mention that people are more willing to pay a premium for natural materials, which would provide a better return on investment. This increased understanding about multifamily wooden buildings can strengthen business models, based on the improved knowledge of the value derived from wood-based building solutions—which, according to Teece and Linden (2017),

can strengthen its competitiveness and reduce market barriers towards other alternatives on the market.

Conclusion

This study reveals the dissimilarities between architects' and residents' living quality perceptions concerning wooden multifamily houses in Sweden and the differences between these stakeholders' identified perceptions related to value. According to Teece (2010) and Beattie and Smith (2013), this provides important information that can influence the strategic development of companies in the construction industry that build wooden multifamily houses, and it contributes to the development of an efficient value-based business model for these companies. Further, this study enables identification of transferable conceptualizations of living quality related to building materials, conceptualizations derived from the respondents in this study (Lucero et al. 2016).

This study reveals that architects prefer wood as a building material over other materials, which is also the case for residents, albeit not as strongly. In addition, the living quality in wooden multifamily houses is perceived to be higher by the architects, more so than by the residents. The architects are also seen as being more willing to pay additionally for the value of living in wooden multifamily houses than are residents, which is a result aligned with the concept discussed by Teece (2010). This can create an issue, since the architects favor material choices that are more expensive based on their professional preferences, and they appear to fail in understanding the residents' value perceptions and willingness to pay for specific features.

In terms of the importance of various living factors when choosing an apartment, architects rank bright and large windows, the geographical location of the apartment, and the apartment having a design enabling easy furnishing as the three most important parameters, while the residents rank the geographical location of the apartment, apartment size, and bright and large windows as the three most important living factors when choosing an apartment. Despite these initial similarities between architects and residents, the remaining living factors are given quite different values, which can create issues in developing a successful value-based business model, as discussed by Doganova and Eyquem-Renault (2009).

The identified differences between architects' and residents' perceived living quality in multifamily houses call for additional questions that should be studied further. The architects, as the professionals who design buildings (including the apartments), have a preconceived view of what constitutes ''value'' and ''living quality'' for residents, based on their own perceptions. This study has identified that residents' perceptions do not align with the perceptions of architects, which can lead to different priorities in new building projects that in turn can incur suboptimization within the building process.

The differences between architects' and residents' perceived value from the living factors (Table 3) are important according to Teece and Linden (2017), since a well-designed business model balances both the value to the customer and how well this is encapsulated and utilized by the provider (in this case, the architect). Furthermore, the residents clearly share that they are not willing to pay extra for a wood-based building solution, which differs from the perception of the architects. According to similar discussions made by Schön (2012) and Teece (2010), this can influence the outcome of a building development of wooden multifamily houses, since understanding the customer's needs affects the ability to fulfil the revenue and cost goals included in a value-based business model. The general notion is that using wood as a building material creates a higher price, stemming from higher production costs. This study indicates that residents are not willing to pay a higher price; consequently, the cost structure needs to be adjusted to remain competitive.

This study was conducted in Sweden and is therefore limited to the Swedish context. Furthermore, this study was conducted on relatively new building projects to address the latest building regulations. Establishing a method to capture residents' perceived value of living quality (compare to that of architects) facilitates the development of an adjusted business model that considers the actual demands for new developments of wooden multifamily houses. Increasing awareness around what residents expect from their apartment helps the industry producing wooden multifamily houses to sell or rent apartments, which could facilitate the decision-making process toward a better business model, according to Keeney (2008).

The results found in this study can be used to design and build quality housing units that meet residents' requirements and can serve as a basis for architects and contractors as they adjust to a resident-focused, value-based business model. In addition, understanding the perceptions of the involved actors provides information about customer barriers that will enable market growth due to improved competitiveness of wooden multifamily houses in the Swedish industry (Teece and Linden 2017, Lindblad 2019b). Finally, this study calls for further research related to cost structures and life cycle analysis that combines residents' and architects' perspectives as well as the views of municipalities, specialized contractors, and craftsmen, for a more comprehensive understanding of the building process.

Acknowledgments

Special thanks to Daniel Beijbom and Fredrik Hög for their contribution during the data collection process.

Literature Cited

Beattie, V. and S. Smith. 2013. Value creation and business models: Refocusing the intellectual capital debate. *Bri. Account. Rev.* 45(4):243–254.

Boone, H. N. and D. A. Boone. 2012. Analyzing Likert data. *J. Extens.* 50(2):2TOT2.

Chesbrough, H. and R. S. Rosenbloom. 2002. The role of the business model in capturing value from innovation: Evidence from Xerox Corporation's technology. *Ind. Corp. Change* 11(3):529–555.

Davis, K. 2016. A method to measure success dimensions relating to individual stakeholder groups. *Int. J. Proj. Manag.* 34(3):480–493.

Davis, K. 2017. An empirical investigation into different stakeholder groups perception of project success. *Int. J. Proj. Manag.* 35(4):604–617.

Doganova, L. and M. Eyquem-Renault. 2009. What do business models do? Innovation devices in technology entrepreneurship. *Res. Policy* 38:1559–1570.

Ellram, L. M. 1996. The use of case study method in logistics research. *J. Bus. Logist.* 17(2):93–138.

Eriksson, P.-E. 2013. Exploration and exploitation in project-based organizations: Development and diffusion of knowledge at different organizational levels in construction companies. *Int. J. Proj. Manag.* 31:333–341.

Halldórsson, A. and J. Aastrup. 2003. Quality criteria for qualitative inquiries in logistics. *Eur. J. Oper. Res*. 144(2):321–332.
Hemström, K., K. Mahapatra, and L. Gustavsson. 2016. Architects' perception of the innovativeness of the Swedish construction industry. *Construct*. *Innov*. 17(2):244–260.
Holmes, M., T. Abimbola, M. Lusiana, S. Pallas, L. M. Hampton, R. Widyastuti, I. Muas, K. Karlina, and S. Kosen. 2017. Resource needs for the trivalent oral polio to bivalent oral polio vaccine switch in Indonesia. *J. Infect. Dis*. 216(1):209–216.
Keeney, R. 2008. Applying value-focused thinking. *Military Oper. Res*. 13(2):7–17.
Lee, T., S. Cho, and J. Kim. 2012. Residents adjusting behaviour to enhance indoor environmental comfort in apartments. *Indoor Built Environ*. 21(1):28–40.
Lindblad, F. 2019a. Barriers in the public procurement process: Restricting long-term sustainable construction of wooden buildings. *Scand*. *J. Public Admin*. 23(2):13–33.
Lindblad, F. 2019b. Market development barriers for the Swedish wooden multi-family house industry. *Int. J. Eng. Technol*. 11(3):187–195.
Lindblad, F. 2019c. Living quality in wooden multi-family houses. *Pro Ligno* 15(4):434–441.
Lucero, J., N. Wallerstein, B. Duran, M. Alegria, E. Greene-Moton, B. Israel, S. Kastelic, M. Magarati, J. Oetzel, C. Pearson, A. Schulz, M. Villegas, and E. R. White Hat. 2016. Development of a mixed methods investigation of process and outcomes of community-based participatory research. *J. Mixed Methods Res*. 12(1):54–74.
McKendall, M. A. and J. A. Wagner. 1997. Motives, opportunity, choice and corporate illegality. *Organ*. *Sci*. 8(5):1–24.
Nylander, O. and K. Forshed. 2011. Bostadens Omätbara Värden. HSB Riksförbund, Stockholm. (In Swedish.)
Pajchrowski, G., A. Noskowiak, A. Lewandowska, and W. Strykowski. 2014. Materials composition or energy characteristic—What is more important in environmental life cycle of buildings? *Building Environ*. 72:15–27.
Robinson, O. 2014. Sampling in interview-based qualitative research: A theoretical and practical guide. *Qualitat*. *Res. Psychol*. 11:25–41.
Rönn, M. 1998. Aspekter på arkitektonisk kvalitet. KTH, Stockholm. http://kth.diva-portal.org/smash/get/diva2:839824/FULLTEXT01.pdf. Accessed March 5, 2020.
Sanal, I. 2018. Discussion on the effectiveness of cement replacement for carbon dioxide (CO_2) emission in concrete. *Greenhouse Gases: Sci. Technol*. 8(2):366–378.
Schön, O. 2012. Business model modularity—A way to gain strategic flexibility? *Consult*. *Manag*. 56(2):73–78.
Sipari, P. 2007. Sound insulation in timber buildings: The Finnish experiment. *Building Acoustic* 14(2):133–142.
Stehn, L. 2010. Träbyggande är respekt för framtiden. Samhällsbyggaren. http://ltu.diva-portal.org/smash/get/diva2:979029/FULLTEXT01.pdf. Accessed March 4, 2020.
Stehn, L., L.-O. Rask, I. Nuygren, and B. Östman. 2008. Byggandet av flervåningshus i trä—Erfarenheter efter tre års observationer av träbyggandets utveckling. Technical Report. Luleå Tekniska Universitet, Sweden. (In Swedish.)
Teece, D. J. 2010. Business models, business strategy and innovation. *Long Range Plann*. 43(2):172–194.
Teece, D. J. and G. Linden. 2017. Business models, value capture, and the digital enterprise. *J. Organ*. *Design* 6(1):8.
Terzieva, V., K. Todorova, Y. Pavlov, R. Andreev, and P. Kademova-Katzarova. 2019. Value-based management of a furniture factory. *In:* 12th International Scientific Conference WoodEMA 2019, September 11–13, 2019, Varna, Bulgaria; WoodEMA, i.a., Zagreb, Croatia. pp. 3–26.
Whitten, J. L., L. D. Bentley, and K. C. Dittman. 2004. Fundamentals of System Analysis and Design Methods. 6th ed. McGraw-Hill Irwin, Boston.
Zikmund, W. G. 2016. Exploring Marketing Research. 11th ed. Cengage Unlimited, Independence, Kentucky.