Sustainable Material Awareness, Belief and Readiness in Housing Development

Kim Dung Thi Vu, Bao Ngoc Nguyen*
Faculty of Construction Economics and Management,
National University of Civil Engineering, Hanoi
*Corresponding author's e-mail: ngocnb@nuce.edu.vn

ABSTRACT

The construction industry is one of the industries accounting for a large proportion of Vietnam's overall GDP. It is also one of the least sustainable industries with extensive use of non-renewable resources. A study on the current situation of occupational awareness of sustainable building materials, identifying factors that prevent the diffusion of sustainable building materials is critical. The present study raised the theoretical basis of using sustainable building materials for the construction industry. Questionnaire data from 130 valid responses were used to carry out statistical analysis and make interpretation of results. The results indicate no significant difference between the two groups of respondents in awareness, belief, and readiness towards sustainable materials. The awareness and readiness levels are higher among construction practitioners who have experience. The present findings might suggest several courses of action to solve the problem of sustainable materials being overlooked. Our research suggests that it is essential for policymakers to encourage stakeholders to consider sustainability more seriously. The research findings have profound managerial implications that experienced practitioners might significantly impact the decision-making process in the realm of sustainable orientation. Future work should concentrate on integrating sustainable building materials into innovative and transformative practices in the construction industry.

Keywords: sustainable materials; awareness; belief; readiness; Vietnam; construction industry

INTRODUCTION

The concept of sustainable building materials or green building materials was first mentioned at the 1988 International Conference on Materials Science and Technology, where the term "Green" was mentioned as the degree of contribution to sustainable development (Anink, Boonstra, Mak, & Morris, 1996). However, in 1922, a new definition was born in the international academic community, describing green building materials as materials that have minimal impact on the earth's environment and do not harm human health (Khatib, 2016). Sustainable building materials have outstanding advantages such as safety for human health, reduced energy consumption and other resources, healthy indoor environment (Reddy, Kumar, & Raj, 2019). Nevertheless, the application of sustainable building materials in construction works in general and in housing works in particular still faces specific difficulties and barriers and has been mentioned in many studies.

The construction industry in Vietnam is one of the industries accounting for a large proportion of the overall GDP (Vietnam General Statistics Office, 2020). It is also one of the least sustainable industries with extensive non-renewable resources (Nguyen & Nguyen, 2014). However, sustainable building materials, one of the leading resources for constructing sustainable works with negligible adverse impacts on the environment, have not yet been widely used in the construction industry in general and housing development in particular in Vietnam. Therefore, a study on the current occupational awareness of sustainable building materials and identifying factors that prevent sustainable building materials diffusion is significant.

BACKGROUND TO THE STUDY

According to RSMeans (2011) and Koç and Christiansen (2018), green building materials are defined as materials with the following properties:
- Healthy in the home environment - does not cause air quality problems due to the production of harmful volatile organic compounds (VOCs) such as urea-formaldehyde or harmful fibers and does not cause harmful effects and health problems with workers who make products.
- Healthy outdoors - does not increase the likelihood of photochemical SBMog, wreak havoc on the environment, deplete scarce resources, create harmful byproducts or over-process waste, or cause health problems with people who exploit the resources to create the product.
- Help reduce the building's energy consumption - not the product of material extraction or energy-intensive manufacturing. (Materials with multiple recyclable components may meet this standard if the recycling process does not consume much energy.)
- Durable, recyclable, recyclable, and/or biodegradable - will not need to be quickly replaced and become waste or, worse, hazardous waste.
- Local mining - supports the local economy and does not require much transportation from material extraction and production facilities to installation and usage

There are many green building Assessment tools in general and green materials in particular used in the world. These Assessment tools (also known as certificates) are used to evaluate whether buildings meet the green standards and requirements. These Assessment tools can differ in approach and can be applied at many green building stages from planning and design, construction, operation and maintenance, renovation, and demolition. The Assessment tools also provide specific tools for each building, such as a home, a commercial facility, or a specific area. Some popular frameworks are applied to the housing sector, such as BREEAM, EDGE, LEED, Green Star. Sustainable construction materials have outstanding advantages such as safety for human health, reduced energy consumption and other resources, and a healthy indoor environment. However, sustainable construction materials in construction work in general and in housing projects still face specific difficulties and barriers.

The study of Meex, Knapen, and Verbeeck (2017) in the Flander region, Belgium, shows the barriers to the use of sustainable building materials for housing design and construction are classified into three main groups: 1) lack of awareness; 2) lack of knowledge about sustainable use of construction materials and evaluation tools; 3) Lack of legal regulations. Akadiri, Chinyio, and Olomolaiye (2012) conducted a survey and three case studies on the main barrier when construction professionals use sustainable materials in Nigeria. Research shows that concerns about rising costs and the lack of sustainable building materials are the leading barriers to sustainable building materials in Nigeria. Another study was carried out in Nigeria by Oyekanmi and Abisuga (2014) about organisational factors influencing the choice of sustainable materials by contractors and construction professionals. Research shows that the factors that lack awareness and knowledge, economic feasibility and cost and feasibility, the business's passive culture, the level of leadership support, and business goals are internal factors of the business organisation that influence the adoption of sustainable building materials.

Meanwhile, factors beyond the firm's control include research and development, human resources knowledge and skills, learning processes, national and local governments. In Southeast Asia, the issue of using sustainable building materials is also of concern. Research by Tey, Goh, Seow, and Goh (2013) in Malaysia shows that the main barrier to applying sustainable building materials in Malaysia's construction industry is the high initial cost. Most Vietnamese engineers' limited scientific and technical level also impedes the widespread application of sustainable building materials (Đông, 2009; Nguyen & Nguyen, 2014; Pham, Kim, & Luu, 2020).

Despite economic growth, Vietnam still has a significant shortage of quality housing. According to the World Bank statistics, in November 2015, about 20% (approximately 4.8 million) of households in Vietnam live in deprived conditions. Population growth and urbanisation have outstripped the government's ability to ensure that its residents have access to safe and affordable housing (Samad et

al., 2015). In addition, in the Vietnam report: Inclusive and Sustainable Growth Assessment 2016-2020 conducted by the Asian Development Bank in August 2016: Vietnam is assessed to be facing many environmental challenges due to the unsustainable use of natural resources and climate change. To create ecologically sustainable housing units, developers must bear the responsibility for their environmental credentials (Shaw & Ozaki, 2015). Therefore, the application of sustainable construction materials to build quality housing for residents is essential and in urgent need of research. Sustainable development in general and sustainable construction development was mentioned early in the legal document system of Vietnam. However, the number of standards, regulations and specific regulations on sustainable housing construction and materials for building sustainable houses is still lacking. This can make it challenging to develop sustainable housing construction and sustainable housing construction materials.

RESEARCH METHODOLOGY

An online survey was conducted using the Google Forms survey tool. Data obtained from the survey were encoded and analysed using SPSS analysis software. The survey's objective is to generally assess the current state of awareness about sustainable building materials (SBM), the use of sustainable building materials for housing design and construction in Vietnam, and barriers (if any) if sustainable construction materials are not selected for use. The survey targeted target groups of individuals working as investors/individuals who built houses for sale/lease; design consultancy; construction contractor; state management agencies; construction education and training unit.

Although the investor and design consultant will play a decisive role in selecting materials used for housing design and construction, the survey still targets other individuals who are active in the application form. Construction contractors, state management agencies, and construction education and training units aim to have a multi-dimensional view on research issues. On the other hand, the construction industry's characteristic is that individuals can change their active role in the construction sector, so their personal experience will be the source of information exploited in the research process. Portfolios and contact information of companies working in the construction sector are gathered from Vietnam Yellow Pages. A total of 500 companies were contacted via e-mail to invite the survey. Also, the survey is spread through some career forums.

The survey questionnaire was developed, including questions to learn about the perception of sustainable building materials, the level of use, and the barriers (if any) for the sustainable use of building materials. for house construction. The questionnaire is divided into three sections:

Section 1: Survey participants' personal information
Section 2: Status of awareness and use of sustainable building materials for housing construction
Section 3: Find out information about the factors affecting the choice of construction materials in housing design and construction; barriers to sustainable construction materials not being used, and suggested solutions

The questions are multiple-choice and open for their own opinion. Besides, to avoid bias responses or false-positive responses, the survey is designed with clear, easy-to-understand language and has the option of "Other opinions" when needed. The authors also conducted a pilot survey to review the questions to avoid ambiguous expressions before the survey questionnaire was sent out widely.

Various scales have been developed to measure respondents' direct attitudes about a given issue, of which the Likert scale is widely used (Boone & Boone, 2012). In 1932, Likert developed a principle of measuring respondents 'attitudes through respondents' responses based on a series of states on that topic according to the degree of agreement with the questioner's opinion (Joshi, Kale, Chandel, & Pal, 2015). According to this principle, the intensity/degree of experiences is linear, meaning that from strongly agreeing to disagree completely is a continuous line, respondents' attitudes can be measured. The standard Likert scale of 5, 7, or 9 levels is used to express the level of agreeing or disagreeing with each

opinion, in which the 5-level Likert scale is commonly used (Derrick & White, 2017; Dittrich, Francis, Hatzinger, & Katzenbeisser, 2007).

The Likert scale has many different benefits. When using the Likert scale, the response from the questioner is not merely 'agree/disagree' but the level of agreement/disagreement, so it can be easily assessed, analysed, and generate a visualisation of respondents' attitudes about a given issue, even if users do not have any concept of the question asked, they can choose a neutral opinion (Harpe, 2015). On the other hand, this scale can be quickly done by online surveys by sharing social networks, e-mails, even text messages; thereby, more responses can be obtained in a significantly shorter time than in interviews (Nemoto & Beglar, 2014). However, like other formats, the Likert scale also has its disadvantages. The Likert scale responses may be affected in terms of accuracy due to the effects of social and/or political pressure, meaning that respondents may be more inclined to choose flattering responses (Maurer & Pierce, 1998; Su, Zheng, Liang, & Tsai, 2018). In this study, the author selected the 5-level Likert scale based on its advantages such as shortness, ease of measurement, visual analysis, and accessible synthesis of results. It is worth noting that bringing the 5-point Likert scale into play as an interval scale presumes that the difference between strongly agree and agree has the same relative difference between neutral and agree.

RESULTS AND DISCUSSION

The survey obtained a total of 140 completed responses, of which 130 were valid. Their roles in the housing development sector and years of experience in construction industry are shown in Figure 1 and Figure 2. The distribution of the role and number of years of experience of the respondents appear diverse, making the findings avoid the one-sided picture to some extent.
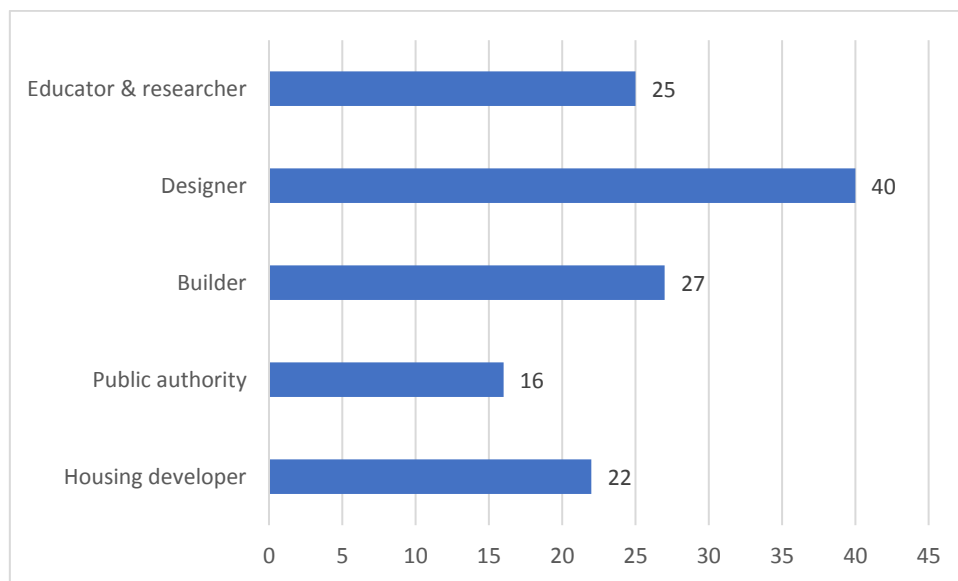

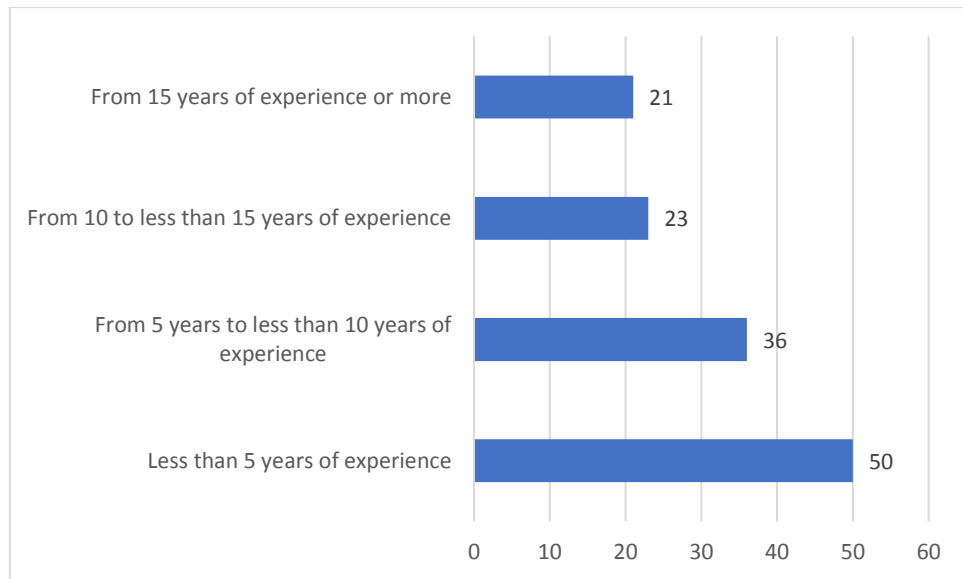**Figure 1:** Respondents' position distribution

Figure 2: Respondents' experience in construction industry

Figure 3 shows descriptive statistics for awareness, trust, and readiness towards sustainable materials. Specifically, each dimension is as follows: awareness is attached to 1 if "Never heard of", 2 if "Heard but not understood", 3 if "Know well"; trust is attached to 1 if "Absolutely do not trust", 2 if "Low level of belief", 3 if "Neutral", 4 if "Trust" and 5 if "High level of trust"; readiness is attached to 1 if "Very not ready", 2 if "Case by case", 3 if "Ready"; adjusted readiness is attached to 1 if "Not very ready" and 5 if "Very ready". As for the mean, awareness's is 2.21/3 (73.7%), belief's 3.46/5 (69.2%), readiness's 3.92/5 (78.4%). Our results share a number of similarities with Son, Kim, Chong, and Chou (2011) 's findings that US and Korean practitioners have a relatively strong awareness and preparedness (60-70%) to deliver sustainable construction, including sustainable materials.
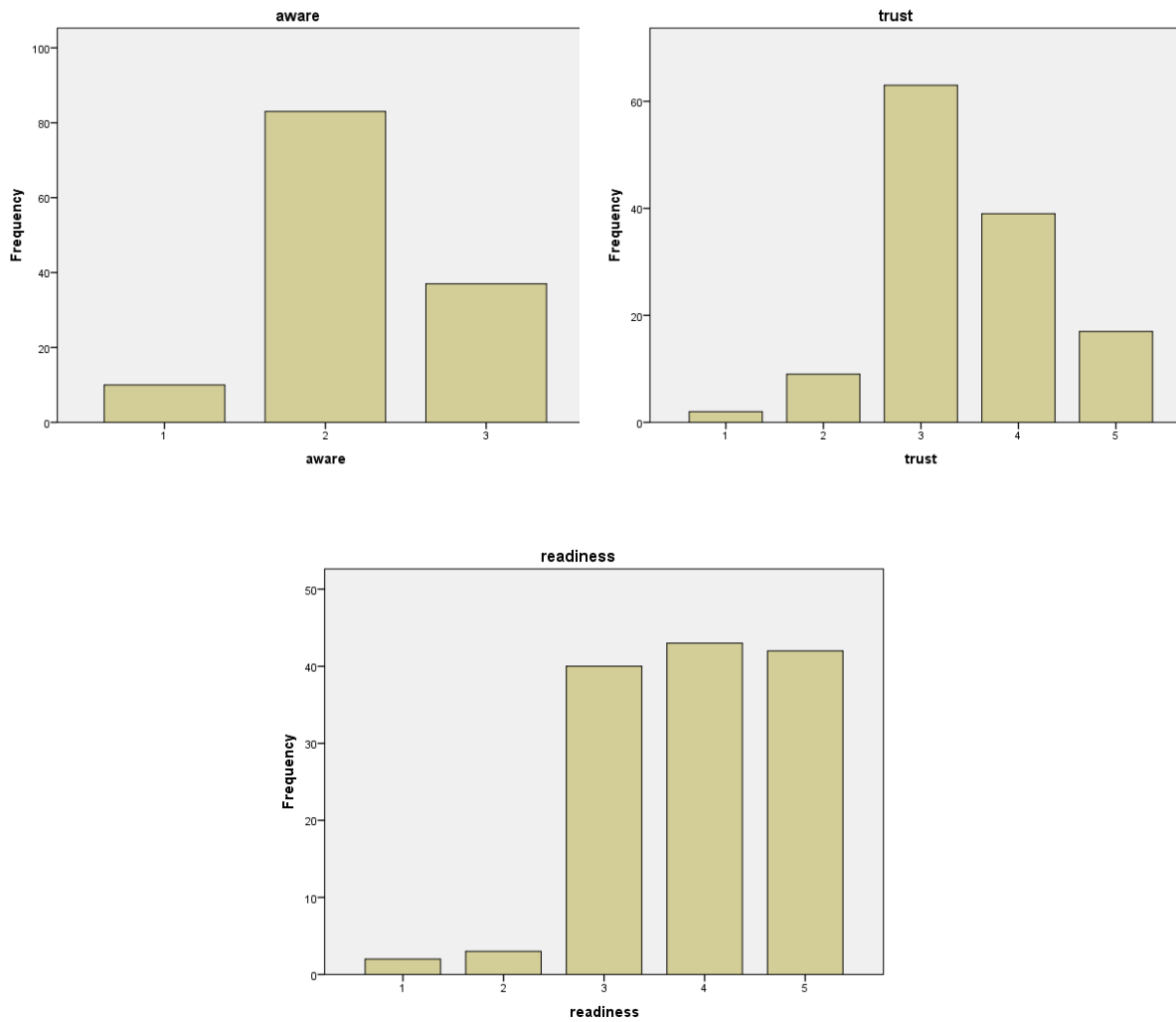
Figure 3: Descriptive statistics for awareness, belief and readiness towards sustainable materials

This paper uses the t-test to see if there are differences in perception between groups. Educators, Builders, and Public authorities are grouped into Group 1, temporarily called the group that has an indirect impact on the decision to use SBM. Housing developers and Designers are grouped into Group 2, temporarily called the group that directly impacts the decision to use SBM. The t-test method is used to test whether or not the difference of the mean value of a single variable from a specific value is given, with an initial hypothesis that the mean to be tested is equal to with a specific number. The Independent-Samples T-Test is a hypothesis test of the population mean, used in case we want to compare the means of two independent groups to determine whether there is statistical evidence that the associated population means are significantly different. As shown in Table 1, the results indicate no significant difference between the two groups in awareness, belief, and readiness towards sustainable materials.

Table 1: Result of Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
									Lower	Upper	
aware	Equal variances assumed	4.657	.033	.891	128	.375	.089	.100	-.108	.286	
	Equal variances not assumed			.898	127.448	.371	.089	.099	-.107	.284	
trust	Equal variances assumed	1.364	.245	.733	128	.465	.111	.152	-.189	.412	
	Equal variances not assumed			.737	127.992	.463	.111	.151	-.188	.411	
ready	Equal variances assumed	.560	.456	.989	128	.324	.161	.163	-.161	.484	
	Equal variances not assumed			.988	126.020	.325	.161	.163	-.162	.484	

Considering experience, an interesting question is whether years of experience correlate with awareness, trust and readiness towards sustainable materials? There are many correlation coefficients; the most common is the Pearson correlation coefficient r. Pearson correlation coefficient (symbol r) measures the linear correlation between two variables. In principle, the Pearson correlation analysis will find a line that best matches the two variables' linear relationship. Pearson's correlation coefficient (r) will take a value from +1 to -1. The condition for correlation has a significant meaning in the sig value <0.05.

Table 2: Result of the Pearson correlation analysis

		exp	aware	trust	readiness
exp	Pearson Correlation	1	.326[**]	.170	.230[**]
	Sig. (2-tailed)		.000	.052	.009
	N	130	130	130	130
aware	Pearson Correlation	.326[**]	1	.341[**]	.266[**]
	Sig. (2-tailed)	.000		.000	.002
	N	130	130	130	130
trust	Pearson Correlation	.170	.341[**]	1	.499[**]
	Sig. (2-tailed)	.052	.000		.000
	N	130	130	130	130
readiness	Pearson Correlation	.230[**]	.266[**]	.499[**]	1
	Sig. (2-tailed)	.009	.002	.000	
	N	130	130	130	130

[**]. Correlation is significant at the 0.01 level (2-tailed).

Table 2 shows a significant correlation between respondents' experience and their awareness and readiness to adopt SBM. In a sense, the more experienced a respondent is, the better their awareness of and willingness to use SBM are. This confirms previous findings in Son et al. (2011) and further supports the idea that awareness and readiness levels are higher among experienced construction practitioners. The correlation between awareness and readiness is worth noting and in line with Son et

al. (2011) findings. The results point to the likelihood that awareness is the key to advance to the diffusion of SBM. This study has gone some way towards enhancing our understanding of awareness, belief and readiness for sustainable materials and a positive outlook for sustainable construction in Vietnam.

CONCLUSION AND RECOMMENDATION

The construction industry in Vietnam is one of the industries with a large GDP share and one of the least sustainable industries. One of the leading resources for constructing sustainable buildings has not yet been widely used in the construction industry in general and housing construction, particularly in Vietnam. In the contents mentioned earlier, we have raised the theoretical basis of using sustainable building materials for the construction industry. The article has also assessed the status of awareness and sustainable building materials for housing design and construction in Vietnam. The present findings might suggest several courses of action to solve the problem of overlooking sustainable materials. Our research suggests that it is essential for policymakers to encourage stakeholders to take sustainability into consideration. The research findings have profound managerial implications that experienced practitioners might significantly impact the decision-making process in the realm of sustainable orientation. Further studies, which take factors affecting stakeholder choice of sustainable materials into account, will need to be performed. Research is also needed to determine the strategy that integrates sustainable building materials into innovative and transformative construction practices.

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