Consumer attitudes towards timber frame houses in China
Qinian Hu a, Bart Dewancker a*, Tao Zhang a, Tanaphoom Wongbumru a

*Faculty of Environmental Engineering, The University of Kitakyushu, Kitakyushu 808-0135, Japan

Abstract

Timber framed architecture owns thousands of years’ history in China. However, with the rapid industrialization and urbanization, timber frame houses have substantially deceased. In order to reduce the concentration of the greenhouses gas CO2 in the atmosphere and establish a low carbon society, the promotion of green building materials and energy saving buildings has been put in a prominent place by Chinese government. However, both of the number of timber frame houses and the potential of using timber, the green and sustainable architectural materials, are still very low in China. This paper presents findings from a questionnaire, shows the Chinese consumers’ attitudes to timber frame houses. The semi-structured questionnaire method was chosen to explore common consumers’ attitudes. It is found that prejudice regarding the deficiency of timber houses, in terms of fire resistance, durability and stability, persists in the minds of consumers. The aim of this paper is better understanding the challenges and difficulties that timber frame houses market facing from the view of consumers, thus figure out better ways for the future development.

© 2016 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Keywords: timber framed houses; consumer; consumer attitudes;

1. Introduction

Today, buildings are responsible for more than 40 percent of global energy used, and as much as one third of global greenhouse gas emissions, both in developed and developing countries. As global environmental problems come more and more serious, how to decrease the negative effects of architecture has aroused extensive attention. “Green design”, “green architectures” become popular all over the world; countries try to explore new ways to meet green, ecological and low carbon equipments. China, as the largest developing country in the world, is experiencing unprecedented development, 1.13 millions of square meters building are under construction and 0.39 million are

* Bart Dewancker. Tel.: +81-93-695-3245; fax: +81-93-695-3345.
E-mail address: traceyian@163.com
complete in 2013 (Nation bureau of statistics of China). It means there are huge potential for China to improve their architectural industry, thus to alleviate environmental problems. Timber as a building material is seen to have low impacts from the perspective of low water pollution, low greenhouse gas (GHG) emissions, low air pollution and low solid waste compared with concrete and steel with positive implications for living conditions (Liu, Y., Zhang, J.X., Zhou, B.G., Huang, Z.Z., 2005). What is more, the widely utilization of timber as construction material is considered especially beneficial, due to its long term conservation effects. The Chinese government has already realized about this, and promulgated the National Plan for Responding to Climate Change (2014-2020), and issued the China-U.S. Joint Announcement on Climate Change, stating that China aims to achieve the peaking of carbon dioxide emissions around 2030 and to increase the share of non-fossil fuels in primary energy consumption to around 20% by 2030 (U.S.-China Joint Announcement on Climate Change and Clean Energy Cooperation, 2014).

2. Literature review

Timber framed architecture owns thousands of years’ history in China. However, with the rapid industrialization and urbanization, timber frame houses have substantially deceased. Timber is widely used as beams, poles, columns in Chinese ancient architectures, such as temples, towers and residence. Moreover, the ancient timber joint technology is very advanced, there are still some ancient architectures can show it, such as the wooden tower in Yingxian county, Shanxi Province (built in 1056) and the Palace Museum located in Beijing (built in 1420). But what we called timber frame architectures are different from those ancient ones, which a modern method of construction (MMC) – using standardized, prefabricated timber wall panels and floors commonly in use in many developed countries – which bears no relation to its Tudor ‘post and beam’ namesake. Nor does it bear much relation to the form of softwood framing common in the 19th and first half of the 20th centuries.

In the first two “Five year’s development plans” after the establishment of People’s Republic of China, timber was widely used as construction materials and took about 46%. Since the Reform and Opening Up policy in 1976, China entered a rapid developing process, and concrete and steel gradually became the main building materials. Especially, the “National Forest Protection Program” took into action in 1989, and timber was controlled to be used in construction industry. Timber frame houses were gradually took place by concrete and steel buildings. Nowadays, timber frame houses just take small proportion in the whole market. In 2006, there were only a total of 2000 wooden houses in Beijing and Shanghai. Out of the 10 million sets of residential flats that are built in China each year, and only about 500 timber frame houses, which are mainly built by imported wood and construction technology (Wang, G.R., 2009). It is predicted that there will be around 140 billion m^2 houses completed during 2003 to 2020, which means 32 m^2 for each person and 2.2 billion m^2 houses are needed each year.

Both the Agenda 21 and the UN 10 Year Frame work of Programs on Sustainable Consumption and Production highlight the necessity for substantially changing consumption and production patterns in order to ensure present needs are met, without compromising the ability of future generations and other world regions to meet their own needs, as defined in the Brundtland report (World Commission on Environment and Development, 1987). China, as the largest developing country in the world, is facing serious resources shortage, only for cement in 2012, Chinese consumption is more 1600 kg/person/year compare with 300kg of U.S.A, 410kg of Russia, and 8 times higher than the world average consumption (Nation bureau of statistics of China). Globally, concrete accounts for two-thirds of total energy use in the production of non-metallic minerals and its production contributes globally to at least 5-7% of CO2 emission (Taylor, M., Tam, C., Gielen, D., 2006). Along with this the serious environmental problems, in China, one-eighth of CO2 emissions are generated by the cement industry (Hao, L.X., Zhao, F.Q., Zhao, P.X., 2011), thus how to improve timber frame houses in China has already aroused much attention from domestic architecture field and also other international companies and organizations. In 2001, Canada forestry delegation visited China for the first time and communicated related materials and technology of timber houses. At the same year, American Forestry and Paper Associate and Canada Timber Export Bureau hold seminar in China. In 2002, The Nordic Timber Association starts their market promotion in China, and helped China to enact Structure Design Specification Manual. Since 2004, Standard for Methods Testing of Timber Structures; Code for Design of Timber Structure; National Building Standard Design Drawing for Wood Buildings are completed one by one. However, the market proportion of timber frame houses in China is still very low. There must be lots of reasons considering economic, social, psychological and anthropological fields, such as 1. Lack of public awareness about wooden
framed houses; 2. Lack of related education; 3. Lack of supportive policy from the government; 4. Lack of fiscal incentives; 5. Lack of coordination and consistency in rating tools and standards, and the gap between the government directives and the market development (Mei Qu, Paavo Pelkonen, Liisa Tahvanainen, Javier Arevalo, David Gritten, 2011). But for this paper the first reason: lack of public awareness about wooden framed houses will be discussed.

For these reasons, there are many literatures research on from the opinions of related experts, such as architects and engineers, or property developers, merchants, while studies regarding attitudes from consumers’ viewpoints are scarce.

On this basis, the following research questions are formulated: 1. Do Chinese consumers familiar with timber frame houses? 2. What are their attitudes when timber used as main construction material? 3. What elements will influence their decision when to buy houses? 4. What are their opinions about the relationship between timber frame houses and Chinese environmental protection? And the aim of this paper is better understanding the challenges and difficulties that timber frame houses market facing from the view of consumers, thus figure out better ways for the future development.

3. Methodology

2.1. Principles of consumers’ attitudes

Attitudes are a complex definition, which is an expression of feelings about the object whether consumers like it or not and also describes the attitude of consumer confidence in the various attributes and benefits of such objects (Abdullah Ramdhani, Dini Turpanam Alamanda, Hendri Sudrajat, 2012). Simply, attitude has been defined by Alport “a mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual’s response to all objects and situations with which is related”. Attitude is shaped selectively to compromise consumers’ needs and could be changed by external effects like; joining a new community, gaining more knowledge and environment of a person (Chisnall, P.M., 1995). Attitudes towards any object are determined by beliefs about that object, and beliefs about the object are formed by associating that object with various characteristics, qualities, and attributes (Ajzen, I. and M. Fishbein, 1980). Attitudes towards timber frame houses will be directly influenced by consumers’ beliefs. Then customers’ demographics also can influence customers’ attitude. What’s more, the current purchase patterns, knowledge and consumers’ environmental awareness are the important factors that will influence consumers’ attitudes towards timber frame houses.

Therefore, the following factors are determined and showed. Figure 2.1 depicts the causal paths leading to formation of overall attitude toward timber frame houses, in which the factors such as knowledge and information that the customers have, the current houses purchase patterns, beliefs about timber frame houses, environmental awareness, personal background as demographics and socio-economic factors. This model is an extension of the multi-attribute and mediation models of Moon and Ajzen and Fishbein (Moon, W. and S.K. Balasubramanian, 2004).

3.2 Questionnaire survey

![Figure 1 Causal relationships between the factors proposed to determine the attitudes](image-url)
In order to better understanding the attitudes of Chinese consumers’ attitude, questionnaire survey is adopted as the main method of the paper, and distributed by e-mails and a Chinese data collection website, named Jing ShuJu. The respondents in this study should be over 18 years old. Because every 18 years old citizens in China means they are mature, and socially defined as “adult”, no longer enjoy care not of the law on protection of minors, but can enjoy any of the rights enjoyed by adults, began to have right to vote and the right to be elected. A total of 587 responses were received after the follow-up mailing and from the data collection website.

3.2. Contents of the survey

The survey was carried out by mails in April and May 2015 to the common Chinese consumers who are over 18 years old. In order to better understand Chinese consumers’ attitude towards timber frame houses, a semi-structured written questionnaire is designed, all the questions are designed to summarize information of consumers attitudes, which including five sections: (1) social demographic data, which including age, genders, education levels, occupations and income; (2) Questions about respondents’ experience about timber frame houses, whether they have the experience of living in timber frame houses before and their evaluation about timber frame houses; (3) Questions about respondents’ houses purchase habits, there are 15 influence factors are chose and four evaluation scales: very important 1, rather important 2, less important 3, and not important at all 4, for respondents to choose. (4) The measure of consumer knowledge of timber as construction materials and there are three evaluation scales: agree fully 1, agree somewhat 2, and fully disagree3. (5) Last part of the questionnaire is about respondents’ environmental awareness and opinion on the future construction materials. The preponderant part of the interview was designed from closed-ended questions with pre-defined response categories. In order not to overstrain the interviewees, questions were kept short and response categories limited.

3.3. Data analyze

After the data collection and coding, data was ready for statistical analyses. For analyzing SPSS 13 statistical package for Windows is used. Firstly variables are taken from excel sheets and then series of analysis are applied. In this paper, the basic analyses methods are used mainly the descriptive statistic methods, and the further analysis are mainly use T-test to analyze the difference attitudes among different genders, personal experience, and one-way ANOVA to analyze the difference among different ages, education background, occupation and incomes, thus to make the attitudes towards timber frame houses much more clear.

4. Results

Three Tables with detailed data are present: table 1 show the frequency distribution of the demographic characteristics of survey respondents. Table 2 evaluates the factors that have influence on consumers’ choice when they decide to purchase a house. Table 3 shows consumers attitude to the different aspects of timber as construction material.

The demographic characteristic of survey is showed in Table 1. Approximately 36.5% of the respondents were male and 62.9% were female. The age rage are mainly within 20-30, which takes about 44.3% of the whole number of respondents, and then 30-40, about 31.5%. For the location, most of respondents are living in the urban area. Education, as an important factor for consumers’ attitudes, there are 58.4% of respondents are bachelor degree, 31.9% are master degree, and 7.3% are high school, which means the average education level is high among these 587 respondents. For occupation, there are mainly five occupations are showed in the questionnaire, and income is divided into 7 different rages, and from the result it is found that there are 38.3% of respondents are office staff, 14.1% are civil servant, 13.6% are students, and so on. Table 2 show consumers’ evaluation of aspects when they purchase a house, the aim of which sought to evaluate consumers’ current consumption habits and purchasing patterns, thus to evaluate the importance of certain criteria. Actually, making the decision to buy a house is a multi-dimensional process that many important factors can influence it. Here, 15 factors were chose as the most essentially
perceived characteristics of timber to measure the attitudes of private consumers towards timber as a construction material, and these factors are put forward to interviewees for grading. There are four grades for them to choose, very important, rather important, less important, and not important at all.

Table 1 Frequency distribution of the demographic characteristics of survey respondents

| Characteristic (N=587) | Gender | Number of respondents | % Respondents |
|------------------------|--------|-----------------------|---------------|
|                        | Male   | 214                   | 36.5          |
|                        | Female | 369                   | 62.9          |
|                        | Unknown| 4                     | 0.6           |
| Age                    |        |                       |               |
| 20-30                  |        | 260                   | 44.3          |
| 30-40                  |        | 185                   | 31.5          |
| 40-50                  |        | 65                    | 11.1          |
| Over 50                |        | 73                    | 12.5          |
| Unknown                |        | 4                     | 0.6           |
| Location               |        |                       |               |
| Urban area             |        | 505                   | 86            |
| Rural area             |        | 18                    | 3.1           |
| Unknown                |        | 64                    | 10.9          |
| Education              |        |                       |               |
| Middle school          |        | 3                     | 0.5           |
| High school            |        | 43                    | 7.3           |
| Bachelor               |        | 343                   | 58.4          |
| Master                 |        | 187                   | 31.9          |
| Unknown                |        | 7                     | 1.2           |
| Occupation             |        |                       |               |
| Civil servant          |        | 83                    | 14.1          |
| Students               |        | 80                    | 13.6          |
| Office staff           |        | 225                   | 38.3          |
| Freelancer             |        | 60                    | 10.2          |
| Self-employed          |        | 32                    | 5.5           |
| Unknown                |        | 103                   | 17.5          |
| Income                 |        |                       |               |
| Below 6000             |        | 150                   | 25.6          |
| 6000-10,000            |        | 127                   | 21.6          |
| 10,000-13,000          |        | 80                    | 13.6          |
| 13,000-16,000          |        | 79                    | 13.5          |
| 16,000-24,000          |        | 68                    | 11.6          |
| 24,000-32,000          |        | 57                    | 9.7           |
| Unknown                |        | 18                    | 3.1           |

Through analysis of data, findings are showed as following: (1) it is found that health and cozy living are the most important two criteria for consideration when the consumers make decision. (2) Safety criteria is the second influence factors, such as safety against thief, fire protection, flood safety and acoustic insulation, these four influence factors are put on the top of all the factors. (3) Further issues are considered slightly less important, that are surrounding areas, environmental friendly materials, cost. (4) Maintenance, energy saving, personal contribution, aesthetic seems less important. (5) Finally, the least influential for making the purchase decision are closing to work places and short construction period. Among the advantages of timber frame houses, short construction period actually is one of the prominent one. A typical 2 storey semi-detached houses can be constructed in approximately 1 week, but for masonry structure will be 6-8 weeks and steel structure will be 2 weeks. This characteristic is put in the least influential position, which is understandable for the unclosed relationship with them, but it own closed relationship with cost and environmental protection.

All of these findings show that consumers pay more attention on quality, security as their evaluation standards for purchase houses, while aesthetics, eco-friendly, short construction period and some other prominent characteristics of timber houses are often put in unimportant standard for housing purchase. However, the strongest advantages of
timber frame houses are often showed as these characteristics. Therefore, how to improve consumers’ attention on these advantages and how to let consumers to renew their knowledge of timber frame houses, especially improve their beliefs of timber houses is very important for the policy makers and market developers.

Table 2 Evaluation of aspects decisive for timber frame houses when doing the housing purchase (n=587)

| Aspect                      | Very important % | Rather important % | Less important % | Not important at all % | Mean | Std. Deviation | Rank |
|-----------------------------|------------------|--------------------|------------------|------------------------|------|----------------|------|
| Health                      | 86.5             | 11.4               | 0.9              | 0.2                    | 1.14 | 0.383          | 1    |
| Cozy living                 | 80.2             | 17.7               | 0.9              | 0.2                    | 1.2  | 0.434          | 2    |
| Safety against theft        | 75.8             | 20.4               | 2.4              | 0.3                    | 1.27 | 0.514          | 3    |
| Fire protection             | 73.4             | 20.6               | 4.4              | 0.5                    | 1.31 | 0.58           | 4    |
| Flood safety                | 70.2             | 26.2               | 2                | 0.3                    | 1.32 | 0.528          | 5    |
| Acoustic insulation         | 69               | 28.1               | 1.9              | 0.2                    | 1.33 | 0.518          | 6    |
| Surrounding areas           | 63.9             | 33.7               | 1                | 0.2                    | 1.37 | 0.514          | 7    |
| Environmentally friendly materials | 56.6       | 36.8               | 5.1              | 0.7                    | 1.49 | 0.628          | 8    |
| Cost                        | 52.6             | 40.9               | 4.9              | 0.7                    | 1.51 | 0.571          | 9    |
| Maintenance                 | 52.3             | 43.6               | 2.7              | 0.3                    | 1.53 | 0.625          | 10   |
| Energy saving               | 37.6             | 53.2               | 7.3              | 0.7                    | 1.71 | 0.631          | 11   |
| Easy personal contribution  | 28.4             | 53.5               | 16.2             | 1                      | 1.91 | 0.694          | 12   |
| Aesthetic                   | 25.7             | 55.2               | 17.2             | 0.7                    | 1.93 | 0.676          | 13   |
| Close to working place      | 25.2             | 51.6               | 20.8             | 1.2                    | 1.978| 0.717          | 14   |
| Short construction period   | 18.4             | 49.6               | 29               | 1.7                    | 2.14 | 0.728          | 15   |

**Question:** How important do you consider the following issues when you decide on the building construction model?

Source: own illustration.

1 represents positive attitude and 4 represents negative attitude.

a Figures are rounded. Therefore, percentages within one row may not add up to 100.

b Mean of all evaluations for one item (codes 1 to 4): the smallest the average, the more important the aspect with regard to the decision for a certain building construction mode.

Table 3 shows consumers’ belief and knowledge about timber as construction materials, which reveals that consumers own positive views on the characteristics of natural, healthy, and aesthetics, but lots of consumers hold doubts about the environmental protection, cozy living and modern characteristics. What is more, the durability, acoustic insulation and fire protection are widely rejected.

Comparing Table 2 and Table 3, the most important standards, health for consumers to make decision of purchase houses are satisfied by their attitude, but for the cozy living, the second standard is doubted by the consumers. For the safety consideration, especially the fire protection, consumers show pronounced doubts. Fire protection is long time doubted by consumers even by experts, such as architects, property developers. However, as the development of modern technology, the fire protection ability of timber frame houses is largely improved. Thus the long rooted impression should be changed and improved.

Therefore, the characteristics of natural, healthy, cozy living and environmental friendly can be as starting points for property developer to broadcast in China. For the misunderstanding about the fire protection, acoustic insulation, durability, it seems to be the deeply root conception about the timber frame houses for consumers for a long time. Nowadays even timber frame houses have already improved a lot for its durability, combustibility and insulation; consumers are still unfamiliar with these improvements, especially for the Chinese consumers who do not have lots of chance to know the modern timber frame houses. The development of a better understanding of the
timber properties would help ensure the wide use of timber as construction material and promote the future development of timber frame houses in China. The results of this paper thus can be used as a reference for the future policy making, and guide for the future market direction.

Table 3 Evaluation of aspects decisive for timber frame houses (n=587)

|                      | Agree fully % | Agree somewhat % | Fully disagree % | Mean   | Std. Deviation | Rank |
|----------------------|---------------|------------------|------------------|--------|----------------|------|
| Natural              | 83.8          | 14               | 0.9              | 1.16   | 0.389          | 1    |
| Healthy              | 77.7          | 19.6             | 1                | 1.22   | 0.139          | 2    |
| Aesthetics           | 72.9          | 24.5             | 1                | 1.27   | 0.467          | 3    |
| Environmental protection | 69           | 23.9             | 5.6              | 1.36   | 0.587          | 4    |
| Cozy living          | 64.4          | 32.5             | 1.7              | 1.36   | 0.516          | 5    |
| Modern               | 37.6          | 54.2             | 6.8              | 1.69   | 0.595          | 6    |
| Durability           | 33.9          | 51.1             | 13.5             | 1.79   | 0.662          | 7    |
| Acoustic insulation  | 32.9          | 49.6             | 16.4             | 1.83   | 0.686          | 8    |
| Fire protection      | 28.1          | 39.9             | 30               | 2.03   | 0.773          | 9    |

From the data analysis, 45.7% of the respondents have experience of living in timber frame houses, but 53.8% of them do not have, which is very low from the world average level. It is estimated that across all the developed countries, timber frame accounts for around 70% of all housing stock, representing some 150 million homes (SustainableHomes: Timber Frame Housing). In Australia, Canada, Norway, US, the timber frame houses takes the market share more than 90% ( Advantages and Disadvantages of Timber Frame Construction), which means most of the population has the experience to live in timber frame houses. What is more, when asked between concrete houses and wooden houses, which one you will choose to live? There are 66.1% of respondents choose yes to show they have the willingness to live the timber frame house. For the question are you interested in timber frame houses, there are just 50.6% of respondents own positive opinion about it. Although the development of timber frame houses is not the only way to improve and speed up Chinese low carbon society, the renewable and recyclable characteristic of timber as construction material have the potential to improve environment. In recent year, due to the serious environmental problems, more and more Chinese people start have environmental awareness is also one of important factor that influence their attitudes. There are 436 respondents out of 579, 74.3%, who know the information about low carbon society and climate change. However, the answer for the question do you think wood timber house can improve and speed up the Chinese low carbon society developing process, there are just 50.6% of respondents own positive opinion about it. Although the development of timber frame houses is not the only way to improve and speed up Chinese low carbon society, the renewable and recyclable characteristic of timber as construction material have the potential to improve environment.
awareness, and from the data they own positive attitudes for timber as construction material, but there are still 49.4% respondents doubts it, thus there are a long way to go for environmental protection.

![Figure 2 Consumers’ attitude on the future construction materials in China](image)

**5. Discussion**

In China, for every 10,000 USD GDP, the water consumption is 4749 m³, while just 500 m³ in developed countries, the water utilization rate is 25 times higher than Japan and 4 times than the world average level (Yu Yang, 2011). The over use of water in Chinese architecture market can be changed by importing more renewable and recyclable construction materials, such as timber frame houses. Generally, environmental pollution caused by architecture can be divided into two processes, one is the process of construction, and the other is the usage. In China, the standard life span for houses is 50-60 years, but the reality average life span in just 30 years, which is far less than developed countries. As the findings of questionnaire, timber is not the main construction material in the future, but consumers still believe it can be combined with concrete and brick. Thus, for the consideration of environmental protection, reducing CO2 emission have already come to be a standard of policy making, and timber, as an environmental friendly construction material will be a trend in the short future.

From the findings of questionnaire, consumers’ knowledge for timber frame houses is still very limited. They hold negative attitudes to the modernity, durability, sounds insulation and combustibility. Actually, these negative attitudes come from their prejudice and shortage of modern timber frame houses’ knowledge. It is stated that the development of a better understanding of the wood property would help ensure the wide use of wood as building material (Morrell, J.J., 2002). Take fire protection as an example, it shows the most pronounced prejudice comparing with other aspects of timber, and such kind of expression is long time rooted in consumers’ mind. For the property developer, they should pay much attention to this and the only way for consumers to change their long time rooted expression is through education. The Chinese timber frame market is very different from others, the market share is very low and consumer can not like other consumers in other countries have lots of chances to experience and get the knowledge. In Japan, in order to promote the spread of modern timber frame houses, the property developer supply the service, called trial living for consumers and also some lessons, such as visiting factory or technology education, all of these can be used as a reference in China for the future development.

For education, to change consumers’ prejudice is the first step and the more important thing is spread the knowledge of timber frame houses. At the same time, it is clear that there are some characteristics are widely agreed by consumers, such as health, natural, aesthetics, and eco-friendly. In the findings, it finds that consumers own high environmental awareness, which is accordance with the high eco-friendly characteristics of timber frame houses. Therefore, changing consumers’ prejudice should be done at the same time with improve consumers’ knowledge about the advantages of timber, as construction material.

Timber frame houses can be constructed in any seasons and any temperate. In the modern timber frame houses, all elements are fully prefabricated in the workshop in dry conditions and comply with the highest quality standards (High Tech Timber, Ingenious Switzerland). High speed construction process and maximum elements are
prefabricated is the basis for timber frame houses development in urban areas, and intergraded manufacture road is the developing road of timber frame houses for the future development in China (Chen Fenxia, Chen Lin, 2007).

6. Conclusion

Comparing with the great achievements for the development of timber frame houses in other countries, Chinese timber frame houses take just few market shares without advanced and systemic integrated and industrialized design, manufacture and construction system. However, Chinese consumers show huge interesting in timber frame houses and positive attitudes towards some typical characteristics of it, such natural, cozy living, aesthetics, and environmental friendly. At the same time, there are still some long time rooted prejudice among consumers, for example the durability, combustibility and acoustic insulation, which actually is one of barriers for the future development. Due to environmental protection pressure of China in recent years, especially when China aims to achieve the peaking of carbon dioxide emissions around 2030 and to increase the share of non-fossil fuels in primary energy consumption to around 20% by 2030, timber as an eco-friendly material start to get the attention from the government, property developers and consumers, all of these are good start for the future development of timber frame houses in China.

This study figures out Chinese consumers positive and negative attitudes towards timber frame house and discussion the solutions. In order to improve the acceptance degree of timber frame houses, knowledge education and related information spread are crucial, which also need the cooperation of several fields, such as government, school, and property developer and so on. The study confirms these attitudes of Chinese consumers and supply reference for making policy and market promotion strategy by government and property developers. There are some limitations of the study, for the demographic factors including locations, incomes and age choice, and some question design. It is better to figure out the criteria for the future data collection. Future research will focused on evaluating the factors that lead to formation of particular attitudes and how to further enhance consumers’ attitudes.

References

Liu, Y., Zhang, J.X., Zhou, B.G., Huang, Z.Z., (2005). Modern wood constructionarchitecture and its possibilities in China. Jiangsu Architecture 3, 5e8.
U.S.-China Joint Announcement on Climate Change and Clean Energy Cooperation.(2014). https://www.whitehouse.gov/the-press-office/2014/11/11/fact-sheet-us-china-joint-announcement-climate-change-and-clean-energy-c
Wang, G.R., (2009). The present situation and prospects of timberwork house in China. Wood Processing Machinery 2, 35e36.
World Commission on Environment and Development, editor. Our common future. Oxford: Oxford University Press; (1987)
Nation bureau of statistics of China, http://www.stats.gov.cn/english/
Taylor, M., Tam, C., Gielen, D., (2006). Energy Efficiency and CO2 Emissions from the Global Cement Industry. Energy Technology Policy Division, International Energy Agency, Energy Efficiency and CO2 Emission Reduction Potentials and Policies in the Cement Industry, Hao, L.X., Zhao, F.Q., Zhao, P.X., (2011). Measures to reduce carbon dioxide emission of China cement industry. Advanced Materials Research 233e235, 412e415.
Mei Qu, Paavo Pelkonen, Liisa Tahvanainen, Javier Arevalo, David Gritten, (2011). Experts’ assessment of the development of wood framed houses in China. Journal of Cleaner Production
Abdullah Ramdhani, Dini Turpanam Alamanda, Hendri Sudrajat. (2012). Analysis of Consumer Attitude Using Fishbein Multi-Attributes Approach. InsanAkademika Publications
Chisnall, P.M.(1995) Consumer Behaviour, 3rd edition. Mc Graw-Hill Book Company, England
Ajzen, LandM. Fishbein, 1980. Understanding Attitudes and Predicting Social Behavior. Prentice-Hall, Inc., Englewood Cliffs, N.J.
Moon, W. and S.K. Balasubramanian. (2004). “Public Attitudes toward Agrobiotechnology: The Mediating Role of Risk Perceptions on the Impact of Trust, Awareness and Outrage.” Review of Agricultural Economics, 26(2): 186-208
Sustainable Homes: Timber Frame Housing. http://cdn2.hubspot.net/hub/63188/file-15203851-pdf/docs/timber_frame_housing.pdf
Advantages and Disadvantages of Timber Frame Construction
http://www.environ.ie/en/Publications/DevelopmentandHousing/BuildingStandards/FileDownload,1677,en.pdf
Mei Qu, Paavo Pelkonen, Liisa Tahvanainen, Javier Arevalo, David Gritten, (2011). Experts’ assessment of the development of wood framed houses in China. Journal of Cleaner Production
Yu Yang, (2011). Study on the Four Processes of Housing Industrialization between Japan and China
Morrell, J.J., (2002). Wood-based building components: what have we learned? International Biodeterioration& Biodegradation
High Tech Timber, Ingenious Switzerland, http://www.iht-rafz.ch/PDF%20Dateien/Broschuere_Hightech_Timber.pdf
Chen Fenxia, Chen Lin, (2007). Development path of wooden-structure residence in China” Housing Science
Timber frame houses are the ultimate in durability and open space; but, since they are unlike standard construction homes in many ways, it pays to spend time learning as much as possible about the structure that may become your family home for decades. Timber Frame HQ. 8. This attitude colors all your decisions and will have a great influence on the final cost for your home, (more on this later). 7. As prices of fuel, labor and materials continue to rise, building as soon as you are able will probably be less costly than delaying your construction. Timber Frame HQ. 14. 8. A timber frame house can mean many things when it comes to building a custom home. Spend time learning about this creative and comfortable living space to determine what it really represents to you. Timber frame house made using glued laminated beams has special properties that favourably differ it from whole-wood framing. It is high strength, durability, absence of warpage and cracking, aesthetics. Structured glued wood up to 40 feet long allows you to design houses with complex architecture and design, opens up wide opportunities for designing large-span rooms and implementing the most daring design ideas. 8. Timber-framing is great for building not only individual houses but for public and commercial buildings as well. Special attention of architects has recently been paid to the so-called ‘glass fachwerk’. In this kind of houses double-glazed windows are used as the filling of walls.