

MOTIVATION OF LOCAL WOODEN HOUSE PURCHASE FOR REVITALIZING JAPANESE

WOOD PRODUCTION

-CASE STUDY IN KOCHI PREFECTURE, JAPAN

A Thesis

by

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in Partial Fulfillment of the Requirements for the Degree

Master of Sustainability Science

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Graduate School of Frontier Sciences

The University of Tokyo

March 2013

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ABSTRACT

Facing with growing demand for wood in the global market and limited availability of forest resources in the earth, Japan is expected to increase its wood supply from own planted forests rather than depending on foreign forests. To improve Japanese forestry sector, this research focused on increase of demand for domestic wood, especially demand for local wooden house (LWH) from the end purchasers. Previously this field was studied from builders' viewpoint; yet purchaser, another key player of the market, had been left unidentified. For further promotion of LWH, this research aimed to fulfill this gap by identifying the purchasers' motivation in terms of their environmental awareness, passion for house building and intention towards house building. The data were collected in Kochi Prefecture by postal and web-based questionnaire survey in August to October 2012. The target groups were: LWH purchasers who bought from a mediation group, LWH purchasers by other means, and purchasers of other types of house (non-LWH). Series of statistical analyses detected the significant differences between mediated LWH purchasers and other two groups in many aspects. The mediated LWH purchasers can be called as intended purchases, since they had higher passion and were motivated to purchase a LWH by house's material, and the latter group can be called as by-chance purchasers, since their characteristics were similar to non-LWH purchasers and probably they were recommended to purchase a LWH by their builders/designers. The analyses also revealed that environmental awareness was irrelevant to purchase behavior and that access to LWH information correlated with the interests in wooden-structured house. From

these results, three ways are possible towards increase the demand for LWH: to spread the attractiveness of wood as a house material, to enlighten more builders/designers, and to promote wooden-structured house in a broader sense.

(293 words)

ACNOWLEDGMENTS

This thesis would not be completed without thousands of cooperation.

First of all, I would like to convey my gratitude to Mr. Kazumasa YAMAMURA, the head of Yamamura Mokuzai Co. Ltd., for his overall supports for my field work at Kochi Pref., by organizing interviews, introducing me to many key persons, and sharing interesting information on various kinds of topics. I am also grateful for Mr. Masaoki SHIOTA, the representative of Ki to Hito Deai Kan, for his support for data collection by sending and collecting the questionnaire sheets to his customers. Mr. Hitoshi TANAKA at Kochi Mokuzai (wood) Center also introduced me to many important people and shared his idea for the wooden house market. Mr. Ippei HAMAGUCHI kindly gave me an idea how designers perceived LWH and the housing market, and introduced his customers to me for an interview. I am also grateful for interviewees, such as purchasers of local wooden house, and Mr. Jyunji INOUE and Mr. Hiroshi OSAWA at Nishikawa Forest Market.

Besides, I am very thankful to those who kindly shared their experiences and perceptions by interviews; such as Mr. Takanobu SUWA, Ms. Michiyo HIRAOKA, and Mr. Takashi TAKAMIYA at Forest Products Department of Kochi Pref. Government, Mr. Takahisa HIROSE and Ms. Yoko HORI at Kochi Wooden House Network, and Mr. Kazumasa YAMAMOTO at Department of Forest Policy of Yusuhara Town Government. Staff of Mokuzai Kyokai (Wood Association) at Kochi Pref., such as Mr. Mizuho TAKEICHI, Mr. Keiichi IWAGUCHI, and Mr. Masamitsu SHIMAZAKI gave

me a permission to conduct research through Kito Hito Deai Kan and guided me to Yusuhara town. Additionally, I am also thankful for Mr. Kiichi ONODA at Onoda Building Firm, Mr. Takahisa SUMI and Mr. Ruishi MATSUMOTO at Sumi Sawmilling, and Ms. Tamae FUJINO by deepening my understanding of this field in practice. In terms of data collection, Ms. Nozomi HORIKAWA and Ms. Kuki MATSUI at Macromill Inc. supported web-based questionnaire.

In terms of academic skills, I would also like to show my gratitude to staff of my program GPSS. Professor Hirokazu YAMAMOTO supervised me for the two years of my master research. He helped me from deciding topic to writing up the thesis and always took time for me maturing ideas. Associate Professor Masaru YARIME gave me constructive advice and comments from the different perspectives, and inspired me by different disciplines that sustainability concerns on. Dr. Makiko SEKIYAMA shared her knowledge on statistics and gave advice on whole logic based on the data analyses. I am also particularly thankful to the members of the laboratory seminar; Professor Makoto YOKOHARI, Assistant Professor Toru TERADA, Dr. Mariko MIYAMOTO and Dr. Yosuke WATANABE. Outside of school, I was helped by some of my friends; Mr. Akihisa KURIYAMA at IGES gave advice on data collection based on his experiences, and Erika Hsu at Pennsylvania University revised my English mistakes.

Lastly, writing up this thesis based on precious data and comments would not be completed without my colleagues at the program, especially those in the same batch. Their hard works and passion always motivated my for stepping forward through the toughest but the loveliest two years.

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LIST OF TERMINOLOGY

ANOVA	Analysis of Variance
df	degree of freedom
FAO	Food and Agriculture Organization, United Nations
IGES	Institute for Global Environmental Strategies
KH	Ki to Hito Deai Kan
K-W test	Kruskal-Wallis one way analysis of variance by ranks test
LWH	Local Wooden House
MAFF	Ministry of Agriculture, Forestry and Fishery, Government of Japan
MIAC	Ministry of Internal Affairs and Communication, Government of Japan
MoE	Ministry of Environment, Government of Japan
MLIT	Ministry of Land, Infrastructure, Transport and Tourism, Government of Japan
Non-LWH	All types of houses except LWH
US, EPA	United States, Environmental Protection Agency

Chapter 1 Introduction

1. Background

1-1 Sustainability and the Position of the Study

Industrialization and subsequent changes of our lifestyle (Adams & Jeanrenaud 2008) have accelerated the capacity of human society to influence the Earth's biological and geological processes over the years. These changes resulted in many environmental problems such as climate change, loss of biodiversity, air and water pollution and numerous other environmental problems.

The concept of 'Sustainable Development' was developed and was published in 1987 by the Brundtland Commission to confront these issues without compromising human needs of today and those of future generations. This concept was originally based on a rather simple principle: 'Everything that we need for our survival and well-being depends on our natural environment' (US, EPA¹). Thus, sustainable development implies that human activities should avoid exceeding the capacity of natural resources' regeneration for sustaining the life that we have. We are required to transform our understanding and practice for sustainability (Blackstone et al. 2007) in many fields, but the transforming process should also be continuous because drastic alteration of our lifestyle is not acceptable for most of people.

Recently, the term '*sustainability*' has become popular in various fields in slightly different meaning, such as in corporate management (e.g. Lee & Saen 2012), in governance (e.g. Agrawal

¹ US, EPA: <http://www.epa.gov/sustainability/index.htm> (retrieved at 29th January, 2013)

2001), and in social management (e.g. Dumreicher & Kolb 2008) all of which are also facing serious problems.

This research discussed on altering the society's consumption patterns for 'sustainability' in the original purpose, particularly on wooden house consumption pattern because it has direct relationship with global forest degradation and natural resource management. This research intended to figure out that giving positive effect to the environment is compatible with maintaining our quality of life, for meeting both needs of today and of future generation. This first chapter describes the problems of global and Japanese wood market, followed by overview of academic discussion and the objective of this study.

1-2 Expansion of Global Wood Market

The renewability and energy efficiency of wood over other materials have attracted more and more attention in recent years. Wood products are renewable materials that can be relatively easily recycled in forests, as forest resources can be reproduced within several decades if they are properly managed according to local conditions. What is more, wood products can be processed and produced with relatively little use of energy in contrast to other materials such as aluminum and steel that require higher amounts of energy (Freguson et al. 1996) (Figure 1-1).

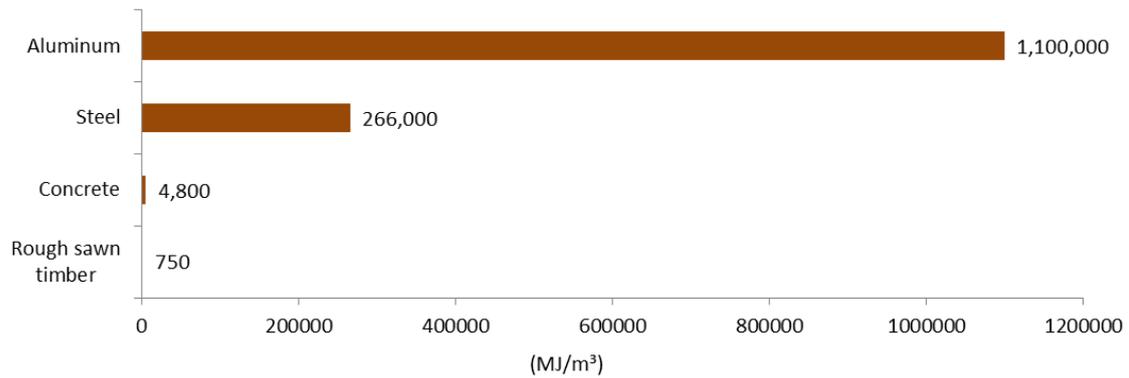


Figure 1-1 Fossil fuel energy used in the manufacture of building materials

Source: Ferguson et al. (1996)

Global wood market has been expanding and it is expected to become even more and more competitive in the future. FAO (2010^a) stated following four major driven factors that were accelerating wood market's expansion: 1) *Demographic changes*: overall demand will be expanding together with population increasing, 2) *Continued economic growth*: more countries with economic power will be coming into wood market, 3) *Energy policies*: the use of wood and woody biomass is and will be increasingly promoted, and 4) *'Wood is Good' campaigns*: worldwide campaigns strive to advance the value of wood and encouraging using it. Because of these worldwide transitions, the demand for wood will continue to increase and the scale of the wood market will also continue to expand in the long term.

In response to this growing demand, wood suppliers have regarded planted forest as wood product's sources because indigenous forests have continued to be converted to other land uses or to be designated as protected areas (FAO 2010^b). In 2010, the area of planted forests was estimated at

6.6% of the total forest area² of the earth (FAO 2010^b), and the production from planted forests accounts for two-thirds of the total wood production³ (FAO 2010^a). The area of planted forests is increasing rapidly, and as a consequence, 80% of wood demand is estimated to be produced from planted forests by 2030 (FAO 2010^a). From a global perspective, planted forests are a crucial source of wood material and their roles are anticipated to become even more significant in the future.

1-3 Shrinkage of Japanese Forestry

In Japan, most of the wood resources in planted forests have matured and are ready to be harvested. The accumulated stock of wood in the planted forests increased to 2.65 billion m³ in 2007, which was 59.8% of the total Japanese wood stock (Forestry Agency 2011; Figure 1-2). These resources are in the about 10.35 million hectares of planted forest area, which accounts for 27.3% of the country's total land area (Forestry Agency 2011). Most of these forests have planted after World War II when Japan was in need of wood resources for its reconstruction, and after decades have passed, these forests recently have grown enough.

² 264 million hectares (planted forests) / more than 4 billion hectares (total forests)

³ Production from planted forests is estimated at 1.8 billion m³

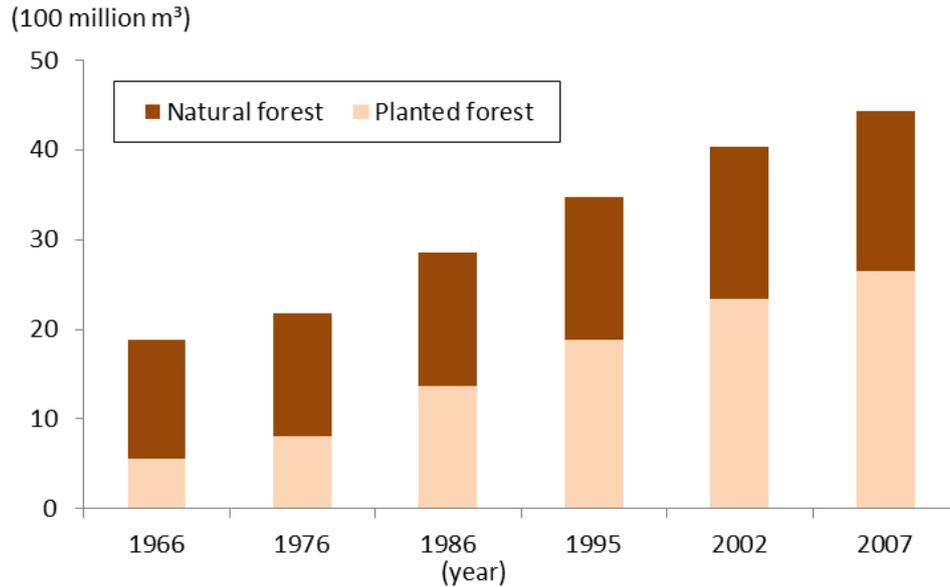


Figure 1-2 Increase of forest stock

Source: Forestry Agency (2011)

Despite the sufficient amount of domestic wood resources, Japanese wood market has relied on imported wood for a long time (Figure1-3). After the consumption of imported wood exceeded that of domestic wood in 1970 (MAFF unspecified year^a), the self-sufficiency rate continued to gradually decrease. In 2011, out of 74.4 million m³ of wood consumed, 20.1 million m³ (27.0%) were provided from domestic forests and the remainder from forests abroad; that is, imported wood. Although the self-sufficiency rate of wood has improved somewhat since 2002 (18.2%), considering the area of planted forest and amount of stock of wood resources, Japan should be able to produce more wood from its own forests.

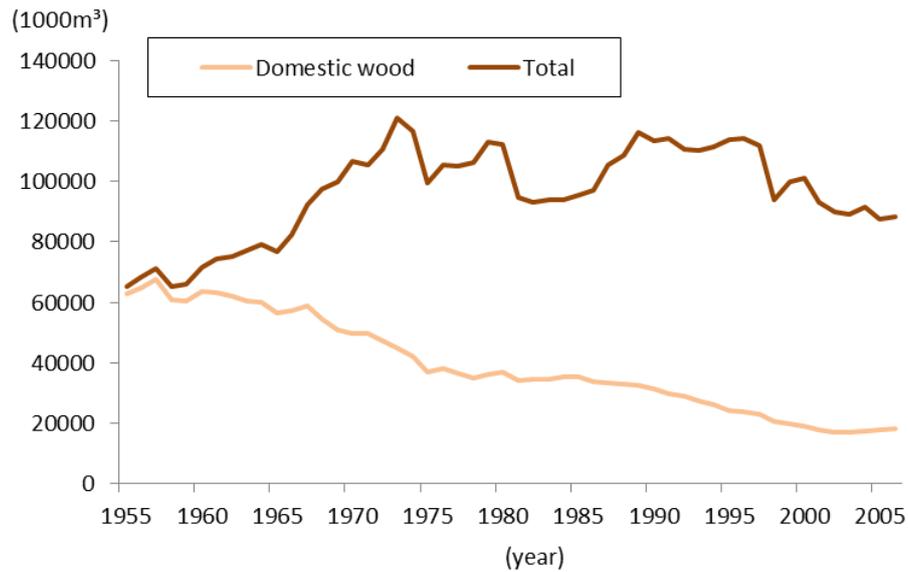


Figure 1-3 Transition domestic and total wood consumption

Source: Forestry Agency (unspecified year^a)

There were many reasons for Japan’s heavy dependence on imported wood other than immaturity of domestic wood resources until recent days (Kajiyama 2009; Narasaki et al. 2007). Most of these reasons were based on lack of appropriate system for wood production and related industries, such as narrow and unmaintained forest work roads (Forestry Agency 2011), non-integrated landownership of planted forest zones (Narasaki et al. 2007), lack of human resources such as young workers and professions of forest management (Kajiyama 2009; Forestry Agency 2011), and undeveloped and dispersed sawmilling industries and retailers (Akiyama 2010). External factors such as currency exchange rates have also affected the wood market (Akiyama 2010). These weaknesses raised the cost and limited the amount of wood production and distribution, thus prevented Japanese planted forests from being appropriately utilized. As a result, Japanese wood

market has highly depended on imported wood from Europe, Northern America, and Southeast Asian countries.

1-4 Desirable Direction of Japanese Forestry

Even though there are many obstacles, Japan is still expected to increase self-sufficiency in wood rather than continuing to import foreign wood products. The one reason is the competitiveness of global wood market driven by emerging countries' economic growth as mentioned in the previous section. Indeed, in China, the amount of import of industrial round wood increased from 15.7 million m³ in 2000 to 35.2 million m³ in 2010 (Forestry Agency 2011), as well as its share among imported wood of all countries jumped from 14% in 2000 to 32% in 2010. Japan will possibly be unable to secure a sufficient amount of wood from the global market unless it successfully recovers the economic power in the future.

In addition to the competitiveness of wood market, uncertain legality of the imported wood encourages Japan to be independent from the global wood market. Various methodologies developed by different researchers and organizations concluded that it was no doubt that considerable volumes of illegally logged wood⁴ must entered the Japanese wood markets (IGES 2007). The Japanese wood market is desired to replace this illegally logged wood with domestic wood from planted forests to contribute to maintain the forest quality and quantity in exporting

⁴ Illegal logging takes place when timber is harvested, transported, bought or sold in violation of national laws (*snip*). (IGES 2007)

countries.

Another purpose for improving self-sufficiency in wood is to keep the quality of Japanese planted forests. Planted forest should be taken care of appropriately by humans after being planted, with thinning, mowing and harvesting. These management processes are indispensable to maintain their productivity and to protect the land in planted forest areas. Planted forests should be harvested when they become matured.

Japan needs to revitalize the forestry sector by these backgrounds reasons, and improve wood supply ability from domestic planted forests to fully utilize its wood resources. It is both for declining forest degradation all over the world and for maintaining Japan's wood materials.

1-5 Revitalizing Forestry by Increasing Demand

To revitalize Japan's forestry sector, the demand for domestic wood products needs to be increased as well as its supply does. The wood supply will certainly be raised if the obstacles of supply side are eliminated by e.g. installing high-spec machines and establishing robust forestry systems. However, increasing of supply solely will affect the healthiness of forestry basis, because the price of wood will decline unless the demand for wood simultaneously increases (Endo 2007). In Miyazaki Prefecture, sudden increase of wood supply and subsequent price decline resulted in insufficient budget for maintaining planted forests, so that more and more logged areas were deserted without replanted (Fujikake 2007). Demand plays an important role in keeping wood's

price stable. It should also be considered for development of Japanese forestry sector in a sustainable scheme.

The best possibility to increase the demand for domestic wood is in the housing sector, which consumes the largest amount of wood per one product. Up to date, wood consumption by the housing market is about 32% of total wood consumption, and 44% of domestic wood consumption⁵ (Figure 1-4). Even so, there is still room that domestic wood can boost its share, because almost 70% of wood materials were supplemented with imported wood in the timber frame house⁶ sector. Imported wood are particularly dominant in basement, beam and inner decoration parts (Forestry Agency 2011; Figure 1-5) and they are replaceable with domestic wood in most of the cases.

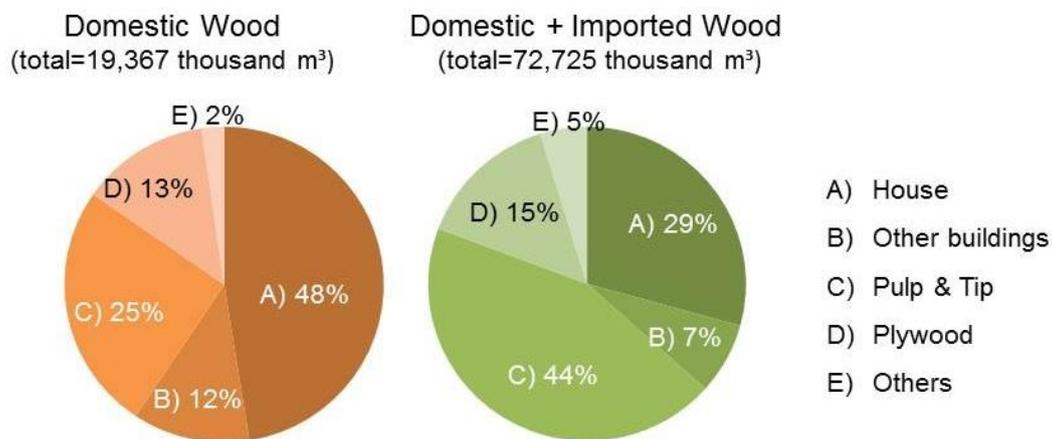


Figure 1-4 Distribution of wood

Source: Forestry Agency (2011)

⁵ Calculated by the author with referring to Forestry Agency (2011)

⁶ Timber frame house is a type of house structure. The whole load of a building is supported with jointed timber poles, beams and basements. Timber frame house dominates 76% of Japanese detached housing market.



Figure 1-5 Share of domestic wood in housing market

Source: Forestry Agency (2011)

The ratio of wooden house in Japan has been increasing in recent years, because the demand for wooden house has kept stable while housing starts in total have gradually declined (Figure 1-6). The spread of wooden houses are also encouraged due to the technological development that improves wooden-structured houses to be fire and earthquake resistant and following restructuring of legal systems (e.g. Timber Frame Housing 2002 Consortium unspecified year; Forestry Agency 2011). However, the ratio of wooded house in Japan can still be raised, considering that the ratio of wooden house in most of European countries was more than 90% (Palmer 2010).



Figure 1-6 Transition of share of wooden house among newly built house

Source: MLIT (2012^b)

Globally, wooden houses have been paid more attention for their less environmental burden by the usage of wood materials. Though some architects are suspicious about the durability of wood material, they are also interested in using wooden material because of less energy use and ease of recycle (Bysheim & Nyruud 2009; Hemström et al. 2011). European countries especially have addressed to spread wooden buildings by policy as well as by individual building firm level (Tykkä et al. 2010). Wooden buildings are considered to contribute to reduce carbon emission from building sector and promote recycling, which are the important aspect of sustainable society in Japanese context (MoE 2007).

These years, in Japan, more and more house customers have been interested in using domestic wood, rather than imported wood. According to the questionnaire for opinion survey, those who

answered that ‘When I buy a wooden product, I will choose a product if all other conditions are the same’ increased from 78.0% in 2001 to 87.1% in 2011 (MAFF 2001; MAFF 2011^b). The survey also identified that what those who wanted to live in wooden house required for the wood material were quality, durability, beneficial for health, and domestically produced (MAFF 2011^b). These results implied the potential demand for domestic wood in the housing market.

Even though the housing market is thought to be shrinking along with the population, it is still possible to increase the wood demand from this sector by increasing the share of domestic wood in wooden house and by increasing the share of wooden house in the housing market. In the future, the target of the strategies will extend to the ‘residential place’, in addition to current ‘detached house’.

1-6 Administration’s Leading to Change in Housing Market

From the administrative side, Japan’s forestry policies have shown two directions towards increase the penetration of domestic wood in the housing market: encouraging close communication between forestry sectors and house builders/designers in a local scale to produce what end consumers demand for; and integrating production lands and related industries to produce uniformed and competitive products for mass housing markets (Ito 2008). However, the latter ‘integration’ approach does not suit to the context of local communities which prefer stability and continuity, rather than taking a risk of failure and a responsibility of new system and making efforts to adapt to it (Ito 2008). Hata (2011) also pointed out that only a few regions will be adaptable to

this integration approach because it requires drastic changes in many related sectors.

In contrast, the first ‘collaboration’ approach has spread all over the country by involving house builders/designers, forestry sectors, sawmilling factories, retailers and end customers in local scale⁷ from 1990s. In 1996, the importance of collaboration between wood producers and end users was first mentioned at ‘Annual Report on Forest and Forestry⁸’ and gradually this movement has been expanded afterwards. From purchasers’ perspectives, involved into a collaboration group is also beneficial; close communication with professions of wood material is helpful to collect relevant information about their requirements, such as quality of material and its effects for health.

In practice, administrations have also supported these movements. From 2001, Forestry Agency has promoted the collaboration groups’ house building by calling this movement as ‘Housing with Familiar Faces and Wood’. Forestry Agency launched the website⁹ for purchasers to search and find a suitable group easily, and published pamphlets of advanced cases for groups to share the successful examples. MLIT have also given financial support to the builders’ group using wood grown in a local area. This project is called ‘The Branding Project of Area-Based Residence’¹⁰, and 363 housing groups were subsidized in 2012. What is more, the best-known support is considered to be provided from prefectures; 43 prefectures support the house built with wood which are produced/processed inside the prefecture. Close communication might be

⁷ The scale of ‘local’ is discussed in the next section.

⁸ ‘Annual Report on Trends in Forests and Forestry, Fiscal year 1996’ (retrieved at 1st February, 2013) : <http://www.maff.go.jp/hakusyo/rin/h06/html/index.htm>

⁹ Website of ‘Housing with Familiar Faces and Wood’ (retrieved at 29th January 2013): <http://kaomiedb.jp/>

¹⁰ Website of ‘the Branding Project of Area-Based Residence’ (retrieved at 29th January 2013): <http://www.chiiki-brd.jp/>

decreased by extending the unit to prefectural level, but certification from Prefectural Government might attract and involve in more purchasers into this movement for compensation.

Due to these social circumstances, more and more collaboration groups have been formed all over the country. However, the purchasers of these houses have not increased as rapidly as the groups have. The number of group registered in 'Housing with Familiar Faces and Wood' increased from 117 in 2001 to 321 in 2009 and the number of house built with these groups increased from 4,870 to 6,681 (Figure 1-7). This means that the number of house built by one group in average dropped from 41.6 to 20.8; though this movement has spread to house providers, house purchasers have not increased as rapidly as providers.

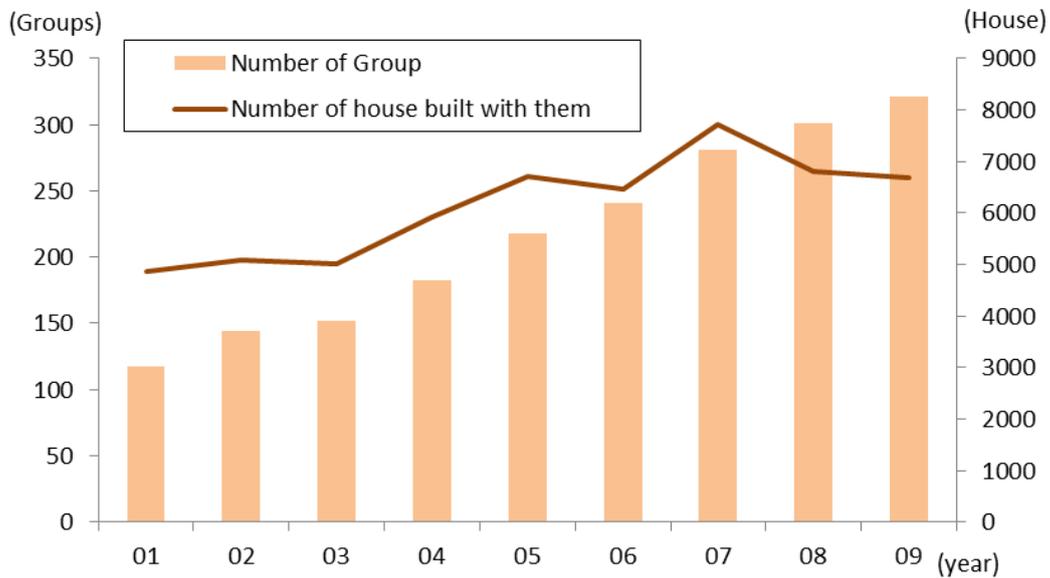


Figure 1-7 Transition of groups of 'Housing with Familiar Faces and Wood'

Source: Forestry Agency (2011)

According to the discussion above, collaboration among housing related industries in local scale suit in current forestry and local communities' scheme. Thus, this is considered to contribute to revitalize Japanese wood production. Thanks to the municipal supports, more and more builders and forestry sectors have formed collaboration group applying local wood to their house. However, the number of actual purchasers has slowly increased and further promotion is expected. Certainly purchasers' interest in domestic wood has been increased, so that it should be possible to increase the actual usage of domestic wood in the housing industry.

2. Defining Local Wooden House

From the previous discussion, it is considered that the share of domestic wood in the housing market can be increased by collaborations between forestry and housing industries in local scale; but in practice, the scale of ‘local’ collaboration has not been standardized. In many cases, the term ‘local’ (*chiiki* in Japanese) is applied without clear definitions of its scale. The MLIT’s project did not strictly limit the extent of ‘local’ area¹¹, so it could be either within a small town or crossing prefectural borders. ‘Housing with Familiar Face and Wood’ project also simply stated the scale as ‘local area’. Academic discussion has neither succeeded to determine the scale of ‘local’; it may be ‘specific area’ (Yasumura 2006), ‘river basin’ (Shirai 2006), or just ‘local’ without any particular references (Takakamo et al. 2006).

Neither have some of other definitions been standardized. For instance, the amount of local wood to be applied depends on project; some projects defined the minimum percentage of targeting wood, whereas others required full application. Processes for certifying the production area have neither been integrated due to complicated wood distribution system. Each project has their own criteria for certifying the distribution channels.

To include as many possibilities occurring in practices as possible, this research targets on the potential of ‘detached houses that applied local wood in their structure’. In the following discussion,

¹¹ Though the scale is not strictly defined, wood and wood products must satisfy at least one of followings:

- Whose production area can be proved by the prefectural or equivalent institution
- Harvested from forests which are certified its sustainability of forest management and concern of environmental conservation by private independent organizations
- Whose legality is certified according to the Forestry Agency’s guideline

‘local wood’ corresponds with ‘the wood produced inside the same prefecture as that of house’, because of the wide accessibility by prefectural residents and the ease to understand by house purchasers. This research does neither matter the share of local wood nor the form of supply systems to involve more purchasers in the future market.

This thesis calls the target house as ‘Local Wooden House’ (LWH) unless it specified in other ways. For comparison, all the other types of houses are called ‘non-Local Wooden House’ (non-LWH) and it includes any types of house, such as concrete-structured, and steel-structured and foreign-wooden-structured houses.

3. Specific Literature on LWH

Along with the spread of LWH and 'local' (in other scale) wooden houses, many researchers have studied this and related issues. However, mostly their main subjects focused on house providers such as builders and forestry sector, rather than purchasers of these houses.

The processes of forming collaboration groups were investigated in some case studies. Okuda et al. (2004) identified that the key factors of successful case of Kanayama town, Yamagata Prefecture were the residents' positive evaluation of traditional landscapes composed with regional houses and the local network (among builders, sawmilling factories and forestry union)'s promotion. Kakizawa (2007)'s study was about Tokachi region in Hokkaido, describing how the leadership of builders and designers, response of sawmilling industries, and support of local municipalities formed their collaborative relationships.

Other well-studied topics are the aims and the impacts of application of locally grown wood to house industry. According to Yamagami & Kondo (2003)'s questionnaire survey to the builders, builders' main purposes for LWH building were revitalization of regional industries and development of attached feeling to the houses. Takakamo et al. (2006) also investigated that builders' motivations of addressing LWH were to maintain regional natural environment and to build up face-to-face relationships among related sectors and house purchasers. The positive effect of these movements to forestry was revealed by Yasumura (2006): it raised a price of timber by satisfying purchasers' various and unique demand which were not fulfilled with large housing

companies supplying uniformed houses. Tanaka (1998) investigated these groups' significant roles in local economy by motivating local industries to continue their business.

All these studies discussed on suppliers of houses, whereas purchasers, another key player of the market, have not yet been clearly identified. Miyamoto et al. (2009) mentioned that the hidden demand for LWH were larger than actual market demand, according to their questionnaires towards house purchasers. Shimase (2002) interviewed to three purchasers of LWH and revealed that they were motivated to purchase a LWH by the empathy to group's concept and recommendation from the builders they trusted in.

These two studies from purchasers' side yet did not provide the overview of LWH purchasers. Miyamoto et al. (2009)'s study was based on the data from questionnaire survey, but it did not identify the mechanism of purchasers' behavior and role of material for forming motivation. Neither the data in Shimase (2002)'s study failed to represent LWH purchasers due to the limited number of respondents and lack of comparison with purchasers of other types of houses.

In order to involve more people to purchase a LWH, it is necessary to understand the past purchasers of LWH. Their decision making process and motivation towards LWH purchase, comparing with that of non-LWH purchasers, should be investigated for developing further promotion strategies of LWH.

4. Objective of the Study

Former sections explained the significance of the LWH in revitalization of domestic forestry and thus, global forestry. Japan is expected to increase its wood production by utilizing own planted forests, so that increase in demand is also necessary for stable development of this sector. Among all sectors, the housing market has the highest potential to increase domestic wood use by increasing the share of wooden houses among the housing market and the share of domestic wood in wooden houses. This study specifically discussed the LWH addressed with prefectural scale because of ease of spread to many forestry regions. Academic literature have identified the provider of LWH, however, it is necessary to understand actual purchasers' behavior and motivation by comparison with that of purchasers of non-LWH for further promotion of LWH.

Therefore, the objective of this research is to identify the characteristics of past purchasers of LWH by comparison with those of purchasers of non-LWH. This objective is achieved by answering these two research questions:

1. What kind of people purchased a LWH and in what aspect they were attracted?
2. Why purchasers of non-LWH could not purchase a LWH?

First research question focuses on past purchasers of LWH, which is for figuring out the characteristics of purchasers themselves and of their house purchase. Second research question is for figuring out the past purchasers of non-LWH and why they did not purchase a LWH.

5. Working Hypotheses

As Shimase (2002) mentioned, environmental awareness might have encouraged to purchase a LWH, because builders and collaboration groups have appealed LWH by its less environmental burden and by role of LWH for forestry and regional environment.

In terms of another consciousness, purchasers of LWH were considered to have strong persistence to their house, in other words, they were 'passionate' towards house building (Vallerand et al. 2003). Close communication with related sectors should consume longer time and more energy to determine the designs, material, and the details of a house. The LWH purchasers are thought to accept spending much time and energy to build a house; thus, they should be more passionate towards house building.

Considering 'house purchase' in broader meaning, some past studies illustrated the patterns of house purchasers regardless of its material. From the results of questionnaires to those who visited a house showroom, purchasers' requirements for a house were quality, performance, structure, price, and building techniques (Iwasaki et al. 2005). Trustworthy of a builder, design and facility of a house were also important considerations (MLIT 2012^a), though what they consider depend on cultural and regional context as well; Opoku & Abdul-Muhmim (2010) mentioned regional differences of preferred structure and considerations of a house to purchase. The aspects mentioned above are thought to be weaknesses of LWH, because economics of scale strongly improves them but most of LWH firms are relatively smaller and thus disadvantageous. Therefore, LWH

purchasers' intention behind house purchase should be different from that of non-LWH purchasers such as described in Iwasaki et al. (2005) and MLIT (2012^a). To increase the share of LWH, differences of intention between past purchasers of LWH and non-LWH should also be understood.

Therefore, this research investigates the differences of two groups of house purchasers (LWH and non-LWH) in terms of their

- Environmental awareness
- Passion for house building
- Intention for house purchase behavior

The following sections described the procedure of meeting the objective of this research; including methodology, results, discussion and the conclusion. Chapter Two described the study area including justification of its selection and detailed methodology. Following Chapter Three showed the result of comparative analyses and how the results should be interpreted. Then, these results were summarized and evaluated their validity with the results of other studies in the Chapter Four. This study was concluded with Chapter Five that answered the research questions and achieved the objective of the study, as well as stated the vision of the future of this field of research.

Chapter 2 Study Area and Methodology

1. Study Area

Kochi Prefecture, located in the southern part of Shikoku Island (Figure 2-1), was chosen as the study area because it has one of the most advanced LWH markets due to the amount of forest resources, wood production, and municipal support to LWH.

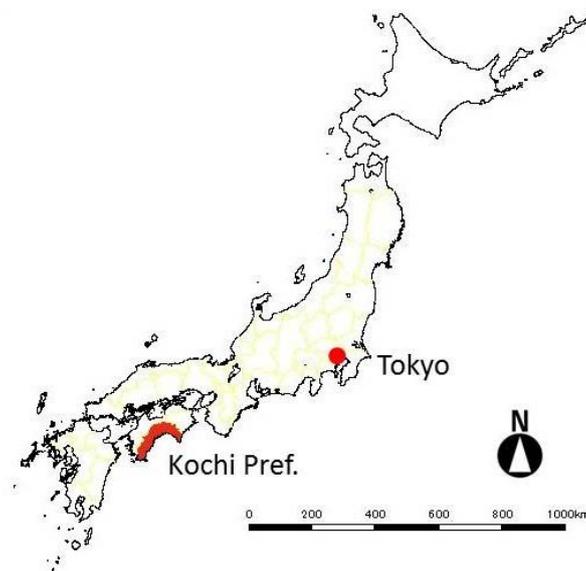


Figure 2-1 Location of Kochi Prefecture

1-1 Basic Geography and Current Forestry in Kochi Prefecture

Kochi Pref. has abundant forest resources. Forest coverage is 84% (599,180 ha/710,501 ha), which is higher than any other prefectures (Table 2-1). Among its forests, 65% (392,145ha) are planted forests (Table 2-1) composed of Cryptomeria, Japanese cypress (*Chamaecyparis obtuse*) (*Cryptomeria japonica*), and pine (*Pinus*). The remainders are natural and secondary forests, composed of several kinds of oak (such as *Quercus acutissima Carruth*).

Table 2-1 Prefectures with the highest forest ratio

	Forest coverage		Planted forest ratio	
1	Kochi	84.3%	Saga	66.6%
2	Gifu	81.5%	Kochi	65.4%
3	Shimane	78.4%	Aichi	64.4%
4	Nagano	78.1%	Fukuoka	64.2%
5	Yamanashi	78.0%	Mie	61.8%
	Japan	67.3%	Japan	41.2%

Source: Forestry Agency (unspecified year^b)

Kochi Pref. is famous for its abundant mountain ranges, and forestry has been implemented in these mountainous areas (Figure 2-2). In the north to the central part of Kochi Pref., the Ishiduchi Mountains and Shikoku Mountains compose an alpine zone of 1500-2000 meter height where Reihoku forestry is implemented. In the eastern region, with Tsurugi Mountains approximately 1300 meters high, Agei forestry is implemented. Western Kochi is a hilly region that is 700-1000 meter high, dominated by Shimanto forestry. In the middle of the prefecture, with the Pacific Ocean facing in the south, there is a flat delta where the majority of the population lives and where the prefectural capital, Kochi City, is located.

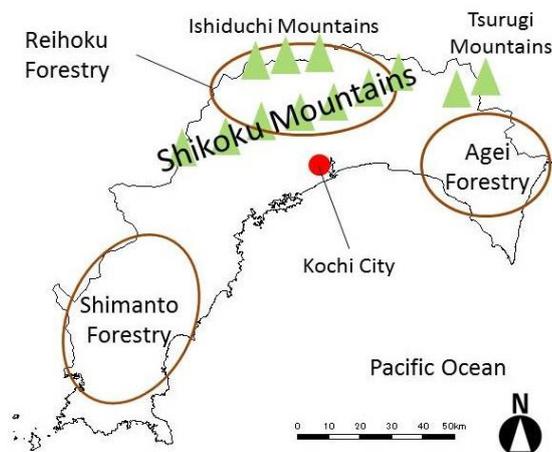


Figure 2-2 Topography of Kochi Prefecture

Forestry plays an important role in the Pref.'s economy because it is a rich and abundant local resource. Wood production by forestry makes up 0.196% of the gross income of the Prefectural economy, which is the fourth highest share among all prefectures (Table 2-2). Additionally, the forestry sector has incrementally increased the employment basis in Kochi Pref. in recent years. From 2006 to 2010, forestry employment increased from 1,508 to 1,645, while the ratio of employees over 60 decreased from 39.5% to 34.1% (Figure 2-3). The forestry sector in Kochi Pref. is gradually improving particularly in comparison to the national trend of reducing employment and aging in the workforce.

Table 2-2 Prefectures with the highest wood production share in the economy

	Prefecture	WP/GI
1	Miyazaki	0.485%
2	Iwate	0.303%
3	Oita	0.196%
4	Kochi	0.196%
5	Akita	0.193%
	Japan	0.004%

WP: wood production, GI: gross income

Source: MAFF (2011^a), Cabinet Office (2010)

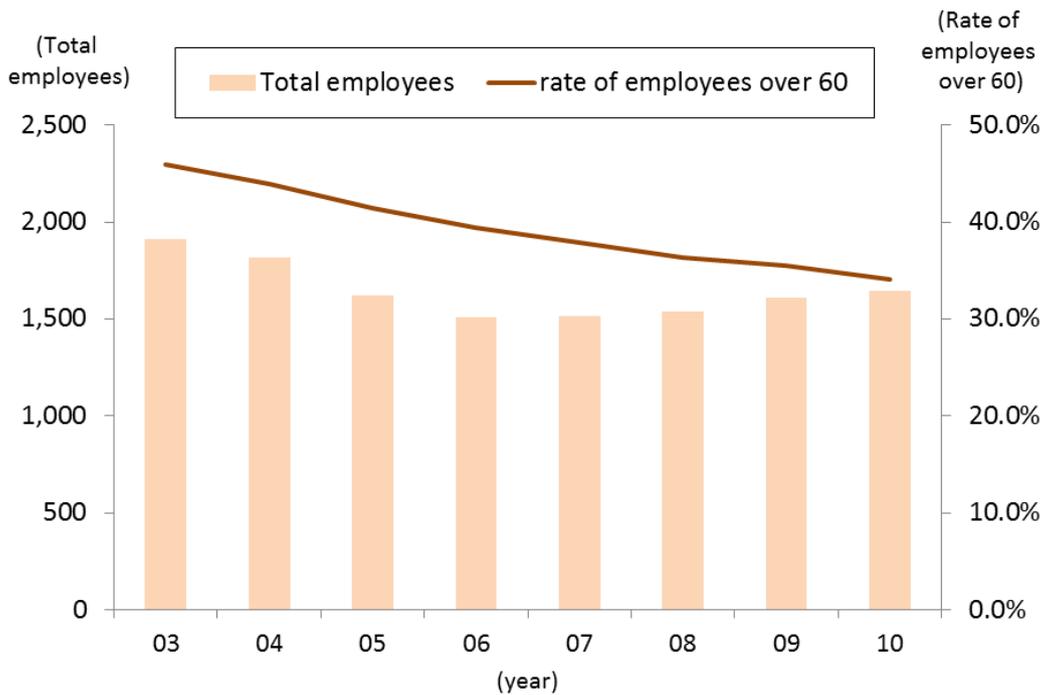


Figure 2-3 Transition of forestry employment in Kochi Pref.

Source: Kochi Prefectural Government (2012)

1-2 Housing Market in Kochi Prefecture

The housing market in Kochi Pref. is not large compared to many prefectures due to its small population (764,456 population and 321,909 households, MIAC 2010). The number of newly detached houses built in 2011 was 1,909, which was the third lowest of all prefectures (MLIT 2012^b). Therefore, it is easy for residents in Kochi Pref. to access ‘local wood’, because of a higher availability of product per capita.

Kochi Pref.’s housing market is also marked by the higher demand for the wooden-structured detached house. In Kochi in 2011, 58.6% of all newly built houses, including apartment buildings, were wooden-structured detached houses. The national percentage was of these types of houses was 44.6% (MLIT 2012^b). Since 2008, this percentage has been increasing due to the increasing demand

for wooden detached houses and the declining of demand for other types of houses.

Other options for building are readily available in the prefecture. Some large scale house builders who do not usually build LWH have established showrooms and branches¹² within Kochi Pref., enabling people in Kochi Pref. to choose a builder or house from various types of options.

In summary, the housing market in Kochi prefecture is small, but the popularity of wooden detached houses is higher than other areas of the country. Various builder choices are also available. These factors make Kochi Pref. an ideal place to study.

1-3 Municipal Support on LWH in Kochi Prefecture

The Prefectural Government also expects Kochi's rich amount of forests to be beneficial resources for economic development. Earlier than national trends, Kochi Pref. has subsidized those who purchased a LWH since 2004, and gradually the budget and the number of subsidized purchasers has increased. The first budget in 2004 started with 53 million yen which subsidized 88 purchasers. In 2010, the budget increased to as much as 133 million yen which subsidized 434 purchasers in 2010 (unpublished data; Figure 2-4).

¹² A house exhibition in Kochi city also displays some modeling houses by famous nation-wide builders (non-LWH) such as Misawa Home, Sekisui Heim, Sekisui House, Daiwa House, Mitsui Home and Sumitomo Ringyo (confirmed at 1st February 2013, from <http://www.tosasearch.com/sumai/lim/home.html>).

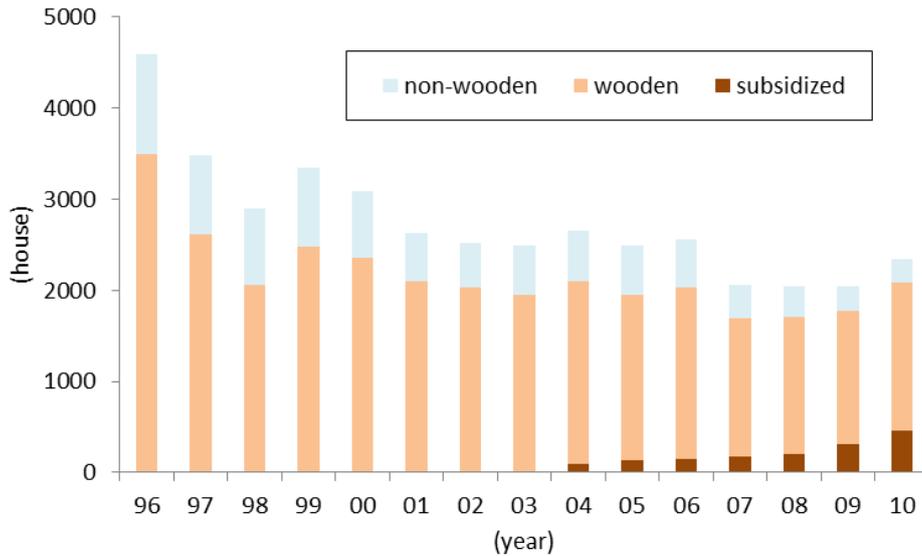


Figure 2-4 Transition of housing market in Kochi Pref.

Source: unpublished data

However, it is difficult to meet the requirements for receiving this subsidy: 70 % of the basic structure¹³ must be composed of dried local wood¹⁴. Each purchaser can receive 13,500 yen per 1 m³ use of local wood for the basic structure, as well as 2000 yen per 1 m² for the use of local wood for the floor, wall and ceiling. Besides the Prefectural government, 4 other regional municipalities (Yusuhara town, Niyodokawa town, Shimanto town and Shimanto city) have also subsidized LWH purchasers by their own criteria. One may receive subsidies from both prefecture and regional municipalities for further promotion of local wood use.

¹³ Basic structure: groundsill, girder, sleeper, beam, angle brace, purline, ridgepole, through pillar, stand column, stud, platband, windowsill and bracing.

¹⁴ Dried local wood should fulfill all the five requirements: 1) harvested from sustainably managed forests 2) legally harvested with appropriate procedures 3) harvested and primarily processed within Kochi Pref. 4) unmixed with other uncertified wood 5) is less than 20% of moisture content (defined by Wood products department of Kochi Pre. Kochi no Ki no Sumai Zukuri Josei Jigyohi Hojyokin Kofu Yoko)

2. Methodology

In order to meet the objective of this research, questionnaire surveys were conducted towards past purchasers of LWH and non-LWH. The results obtained from questionnaire were statistically analyzed with SPSS Statistics 17.0. This section describes the process of data collection and analyses to give overview of the research procedure.

2-1 Target Populations and Data Collection Procedure

2-1-1 Purchasers of LWH (Group A)

The respondents of past purchasers of LWH were recruited from the customers' list of Ki to Hito Deai Kan (Place to Meet Wood and People, represented as 'KH' in following). KH is a mediating organization which aims to connect house designer who actively using local wood¹⁵ and potential purchasers who wants to build a LWH. KH was established in 2002 by Wood Promotion Association in Kochi Prefecture (Kochi Ken Mokuzai Fukyu Suishin Kyokai) with support of house designers' group called Tosa Ha, which had been promoting local material use to their designed house since the mid-1980s. Therefore, all respondents in this group had their will for purchasing a LWH that initiated them to visit KH.

To this group, questionnaire sheets were distributed and collected by posting. In total of 168 questionnaire sheets were distributed in 23rd August 2012, with letters of request from the representative of KH, brief summary of this research including the aim of the survey, and a stamped,

¹⁵ The local wood produced in Kochi Prefecture is called Tosa Wood, taken after old name of this area.

self-addressed return envelope. Questionnaire sheets were distributed by a staff of KH and returned to the office of KH, in order for respondents not to concern on leaking of their privacy.

2-1-2 Purchasers of any types of house (Group B)

Past purchasers of any types of house were also verified for controlled comparisons. The respondents of this group were recruited with cooperation of Macromill Inc., a web-based research company and thus, web-based survey was adopted to distribute and collect questionnaire sheet. To distinguish the purchasers of LWH, this group could be divided into two subgroups: Group B-1 (non-LWH purchasers) and Group B-2 (LWH purchasers).

The target should be conditioned as similar as the other group to implement the comparative analyses, that are ‘those who have purchased a house in Kochi prefecture within the latest ten years’ and ‘those who have been involved in the decision making process of purchasing the house in practice’. To select them among the registered monitor lists, pre-questionnaires were distributed to 4,357 possible targets in October 2012. Out of them, 1,580 replies have been collected, and 188 were selected as target population after these screening processes. To these 188 past purchasers of any types of house, main questionnaire was sent via email from Macromill Inc. at 29th October.

2-2 Questionnaire Sheet

The questionnaire sheet was composed of three or four sections: 1) *attributes of respondents*, 2) *environmental awareness and passion towards house building*, and 3) *intention for house*

purchase. Questionnaire to Group B (purchasers of any types of house) includes one more section:

4) *type of purchased house*.

1) *Attributes of respondents*

This section asked the respondents' age, occupation, and place of birth.

2) *Environmental awareness and passion for house building*

- **Environmental awareness**

'General Ecological Behavior' scale developed by Kaiser et al. (1999) was applied to measure the respondents' environmental awareness. This scale is composed of 28 questions asking daily environmental behaviors, such as 'I collect and recycle used paper', and 'I bring empty bottles to a recycling bin'. Originally this scale was developed to assess people's 'General Ecological Behavior' by considering different ecological behaviors. Each item in the series of questions have different levels of difficulties to be carried out, but one's tendency to behave ecologically is estimated by considering the number of these ecological behaviors items she/he carries out (Kaiser et al. 1999). Thus, this scale was applied to estimate the tendency of considering environmental dimension in daily life, with hypothesizing that it is related with environmental concern when they purchase a house; this research calls this concern as 'environmental awareness'. In the actual questionnaire, seven questions which fit into the Japanese context were picked up (shown in Appendix 1) from 28 original ones to reduce the loads of responding.

- **Passion for house building**

Six questions to measure ‘passion’, developed by Vallerand et al. (2003) (shown in Appendix 1), were applied. In the original study, Vallerand et al. (2003) discussed two types of passion: *harmonious passion*, which results from an autonomous internalization of the activity into the person’s identity, and *obsessive passion*, which results from a controlled internalization of the activity into one’s identity. Obsessive passion may sometimes cause conflicts with other aspects of people’s life, so that this study only considered harmonious passion that motivates people to engage in house purchase in a controllable degree.

In addition to the questions detecting harmonious passion, ‘length of period from starting serious consideration till making a contract’ and ‘the number of builders visited in this period’ were also asked as objective evidences of being passionate.

3) *Intention for house purchase behavior*

This section revealed the intention of house purchase behavior by identifying the decisive factors in a house and a builder, and attractiveness of the house’s structural material. Regarding with ‘decisive factors in a house’ and ‘attractiveness of house material’, respondents were asked to pick up first to third most decisive factor/attractive point among ten/twelve choices shown in Table 2-3 and Table 2-4, respectively. The choices for ‘decisive factors in a house’ were determined by referring Yamagami & Kondo (2003) and Iwasaki et al. (2005), as well as Gold & Rubik (2009) for the choices of ‘attractive points of house material’. For ‘decisive factors in a builder’, open-ended

form was applied for respondents to describe the reasons and process of deciding on a certain builder they ordered to. In this form, the number of letters was not limited.

Table 2-3 Choices of 'Decisive factors in house'

	Choice	Represent in the text
1	Reputation of a builder/designer	Reputation
2	Room arrangement and space design	Space design
3	Appearance (exterior and interior)	Appearance
4	Facilities (such as kitchen)	Facilities
5	Performance (heat insulation, quake resistance, etc.)	Performance
6	Material (wood, concrete, steel etc.)	Material
7	Relation and matching with builder/designer	Relation
8	Price	Price
9	Environmental burden in construction and living process	Env'tal burden
10	Others	Others

Table 2-4 Choice of 'Attractiveness of house material'

	Choice	Represent in the text
1	Good smell and texture	Smell and texture
2	Good for health	Health
3	Durable	Durable
4	Good appearance	Appearance
5	Good for environment	Environment
6	Simple maintenance	Maintenance
7	Low price	Cheap
8	Regional characteristics	Regionality
9	High-class looking	High-class
10	No special attractiveness	No
11	Others	Others

4) Type of purchased house (only to Group B)

In this section, the type of house respondents purchased was asked as an output of their behavior; the type of material in the house structural and to whom they ordered (name of the builder/designer) were asked. Respondents were also asked about the relation to LWH by picking up one from following choices: *I had not heard of LWH, I had heard of LWH but I was not interested in purchasing it, I was interested in LWH but I gave up purchasing it because of cost/period of construction/builders' wood collection ability, and I applied local wood to my house.*

2-3 Data Analysis Method

Data obtained from questionnaire survey were at first processed into analyzable form, and then compared in order to detect differences among purchasers groups.

2-3-1 Data processing

Questionnaire results were processed into comparable form before the analysis. As for 'environmental awareness' and 'passion for house building', target groups were compared with means of the respondents' total score. For 'environmental awareness', respondents' total score is summed up of point of seven 'Yes/No' questions (one point for a 'Yes' answer otherwise zero), and the score of 'passion for house building' is the summed up of six four-scaled questions (four points were counted for a 'highly passionate behavior', followed by three to one according to the degree of

being passionate). As for ‘decisive factors of a house’ and ‘attractiveness of house material’, groups were compared with mean score of each choice, which are calculated from respondents’ answer; each choice gained three to zero points from one respondent according to the degree of importance for her/him, and the points gained were averaged for comparison. The answers of ‘decisive factors in a builder’, an open-ended question form, were grouped into nine items (Table 2-5) for statistical analysis. For each item, the number of respondents whose answers could be categorized into it were counted (allowing multiple-counted), and then averaged for comparison.

Table 2-5 Categories of 'Decisive factors in a builder'

Category	Example
1 Design skill	Nice space design within our budget
2 Past work	Sense of past works of a designer matched to my concept of house
3 Personality	Honest and kindness of sales person
4 Acquaintance	I order to my relative/friend/old classmate
5 Location	Builder was automatically decided when I bought the land I really liked
6 Price	Appropriate/cheap price
7 Famous	Because it was a famous builder all over Japan
8 Performance	Good earthquake resistance
9 Others	Intuition, No reason, by chance

2-3-2 Data Comparison

After data processing, the target groups were compared in order to identify the factors which differentiate their purchase behavior.

For these analyses, some statistical methods were performed. For the comparison among three groups, ANOVA¹⁶ (significance probability=0.05; for all analyses) were performed to detect if any

¹⁶ More information: Knoke, D., Bonrnstedt, G. and Mee, A. P. (2002) Statistics for Social Data Analysis. Fourth edition (p. 111)

of groups were significantly different. For the items which showed significant difference in scores, Tukey¹⁷ test was applied in post-hoc analysis to determine in which groups the scores were significantly different. For some items that ANOVA was impossible to be applied due to the scores' unequal variance, non-parametric K-W test¹⁸ was performed to detect if scores of three groups were significantly different. As post-hoc detection of K-W test, Sidak¹⁹ test was performed to determine in which groups have significant differences. For comparisons between two groups, t-test²⁰ was performed to detect the significant differences.

2-4 Complementary Interviews

Three interviews towards past purchasers of LWH were also implemented in July to August 2012 in Kochi Pref. (Table 2-6), to identify their purchase processes with detailed description. Their talks were recorded by hand and digitalized within a day after the interview. These data were utilized to interpret and support the survey result from quantitative perspective.

Table 2-6 Description of interviews

	A	B	C
Interviewee	2 persons	1 person	1 person
Age	30~39	30~39	50~59
Date	21st July, 2012	9th August, 2012	
Place	their house	her house	Café nearby

¹⁷ Tukey test: more information: http://www.stattools.net/Posthoc_Exp.php (retrieved in 23rd January 2013)

¹⁸ Kruskal-Wallis one way analysis of variance by ranks test: information: <http://www.le.ac.uk/bl/gat/virtualfc/Stats/kruskal.html> (retrieved in 23rd January 2013)

¹⁹ Sidak test: more information: <http://www.utdallas.edu/~herve/Abdi-Bonferroni2007-pretty.pdf> (retrieved in 23rd January 2013)

²⁰ More information: Knoke, D., Bonrnstedt, G. and Mee, A. P. (2002) *Statistics for Social Data Analysis*. Fourth edition (p. 95)

Chapter 3 Result

This chapter describes the result of statistical analyses of the data gained from the questionnaire surveys. In order to identify possible solutions to increase demand for LWH, the first half of this section discussed the differences between past purchasers of LWH and non-LWH, and the latter half of this section verified the purchasers of non-LWH more deeply.

1. Returnee of Questionnaire Sheet

As for the Group A (purchasers of LWH from KH), 77 questionnaire sheets out of 168 were returned (returnee rate: 45.8%) until September 2012, and 73 of them were analyzed. Four sheets were removed because their respondents reformed their house by local wood, instead of purchasing a newly built house and their behavior should be different from the purchasers of a new house.

As for the Group B (any types of house), 103 responses were collected out of 188 distributions (returnee rate: 61.3%) before the closing date, and all the answers were analyzed. Out of 103 respondents, 19 of them answered 'I applied wood produced in Kochi Prefecture', thus they were categorized into Group B-2 (n=19) and others were categorized into Group B-1 (n=84).

2. Characteristics of Purchasers of LWH

In order to characterize the purchasers of LWH, this section described the results of statistical analyses performed among three purchasers' groups: Group A (LWH purchasers from KH), Group B-1 (non-LWH purchasers) and Group B-2 (LWH purchasers not from KH). They were analyzed in terms of their environmental awareness, passion for house building and their intention for house purchase behavior. The results, in short, showed significant differences between Group A and Group B-1, and between Group A and Group B-2 in many aspects, though no aspects were significantly different between Group B-1 and Group B-2.

2-1 Attributes of Respondents

Attributes, including age, occupation and place of birth were compared among three groups (Table 3-1). From the comparison of mean age, Group A (51.3 years old) was significantly older than Group B-1 (43.3 years old) and Group B-2 (42.6 years old) (K-W test: $p=0.00$ and Sidak test: $p=0.00$ for A/B-1 and A/B-2, and $p=0.98$ for B-1/B-2). In terms of the distribution of occupation, Group A showed higher ratio in 'civil servant' and 'retired', in contrast to Group B-1 and B-2 that showed higher ratio in 'company worker'. For place of birth, three groups did not show significant differences by Pearson's chi-squared test²¹ ($\chi^2=2.74$, $df=2$, $p=0.25$).

²¹ More information: Knoke, D., Bonrnstedt, G. and Mee, A. P. (2002) Statistics for Social Data Analysis. Fourth edition (p 142)

Table 3-1 Attributes of respondents

Group	n	Pattern	Mean age	Occupation					Place of birth	
				C.S.	Comp.	Indpn't	Retired	Others	Kochi	Outside
A	73	LWH (mediated)	51.3	22	12	8	14	11	67	6
B-1	84	non-LWH	43.3	9	35	6	1	33	72	12
B-2	19	LWH (not mediated)	42.6	1	11	1	1	5	15	4

C.S.: Civil servant, Comp.: company worker, Indpn't: independent employee

2-2 Environmental Awareness and Passion for House Building

Environmental awareness and passion for house building were compared among three groups by analyzing each group's mean score with ANOVA (Table 3-2). The mean scores of environmental awareness were 3.33 (A), 2.58 (B-1), and 2.53 (B-2) out of maximum of seven point. ANOVA detected the significant differences ($p=0.00$), and Tukey test defined them between Group A and Group B-1 ($p=0.03$), and Group A and Group B-2 ($p=0.00$). From this result, those in Group A had significantly higher environmental awareness than other two groups. In terms of passion for house building, scores of each group were 20.49 (A), 17.07 (B-1), and 17.05 (B-2) respectively, out of maximum of 24 points. ANOVA detected the significant differences ($p=0.00$), and Tukey test defined them between Group A and Group B-1 ($p=0.00$), and Group A and Group B-2 ($p=0.00$). 'Length of period till contract' and 'the number of builders visited', which support the 'passion for house building', also showed higher score in Group A, but it was not significant in 'length of period till contract' (ANOVA, $p=0.19$). 'The number of builders visited' was significantly larger in Group A than Group B-2 (ANOVA, $p=0.00$ and Tukey, $p=0.00$), supporting that 'passion for house

building’ of Group A was higher than that of Group B-1. These results suggested that those in Group A had higher environmental awareness and passion for house building than those in Group B-1 and B-2.

Table 3-2 Environmental awareness and passion for house building

	Means			E.V.	ANOVA	Difference
	A	B-1	B-2	p	p	(Tukey)
Environmental awareness	3.33	2.58	2.53	0.77	0.00*	A/B-1, A/B-2
Passion for house building	20.49	17.07	17.05	0.17	0.00*	A/B-1, A/B-2
Considering ~ contract (month)	23.43	16.64	16.63	0.34	0.19	
Number of builders	4.75	2.89	3.63	0.05	0.00*	A/B-1

E.V.: Equal Variance

* Significantly different among three groups

Yellow color: significantly higher than other two groups, pink color: significantly higher than other one group

2-3 Intention for House Purchase Behavior

2-3-1 Decisive factors in a house

To test if three purchasers’ groups had different criteria for purchasing a house, the scores of ‘decisive factors in a house’ were compared and some significant differences were detected between Group A and other two groups (Table 3-3 & Figure 3-1).

Those in Group A scored the highest for ‘material’, while other two groups scored the highest for ‘price’. Besides, all groups scored relatively higher for ‘space design’ (the second highest by Group A and B-1, and the third highest by Group B-2) and relatively lower for ‘environmental burden’ (the second lowest by Group A and B-2 and the fourth lowest by Group B-1).

Statistical analyses were performed to compare each group's score by each choice. ANOVA detected no significant differences in the scores of 'space design' and 'performance'. For other choices, since their scores did not show equal variance, K-W test was performed and significant differences were detected in choices of 'material' ($p=0.00$), 'price' ($p=0.00$), 'environmental burden' ($p=0.03$) and 'others' ($p=0.00$) (Table 3-3). For these four choices, post hoc Sidak test were performed and it detected that Group A scored significantly higher in 'material' over other two groups, and Group B-1 and B-2 scored significantly higher in 'price' over Group A. Group B-1 scored significantly higher in 'environmental burden' and 'others' over Group A.

According to the data and the analyses, 'material' is the significantly important decisive factor for those in Group A, as well as 'price' for those in Group B-1 and B-2. Environmental burden is less important to all groups, but those in Group B-1 pay significantly higher attention to it than those in Group A do.

Table 3-3 Results of analyses of 'Decisive factor in a house'

	Means (rank)						E.V. p	ANOVA p	K-W test p	Difference (Sidak)
	A	B-1	B-2							
Reputation	0.42 (7)	0.25 (10)	0.53 (5)				0.03	-	0.19	
Space design	1.18 (2)	1.12 (2)	0.84 (3)				0.05	0.55	-	
Appearance	0.61 (5)	0.49 (6)	0.26 (8)				0.02	-	0.35	
Facilities	0.24 (8)	0.25 (10)	0.05 (10)				0.03	-	0.44	
Performance	0.53 (6)	0.69 (3)	0.68 (4)				0.34	0.61	-	
Material	1.47 (1)	0.25 (10)	0.32 (7)				0.00	-	0.00*	A/B-1, A/B-2
Relation	0.78 (3)	0.49 (6)	0.89 (2)				0.00	-	0.15	
Price	0.61 (5)	1.33 (1)	1.79 (1)				0.00	-	0.00*	A/B-1, A/B-2
Env'tal burden	0.01 (10)	0.25 (10)	0.11 (9)				0.00	-	0.03*	A/B-1
Others	0.08 (9)	0.60 (4)	0.42 (6)				0.00	-	0.00*	A/B-1

E.V.: Equal Variance

* Significantly different among three groups

Yellow color: significantly higher than other two groups, pink color: significantly higher than another group

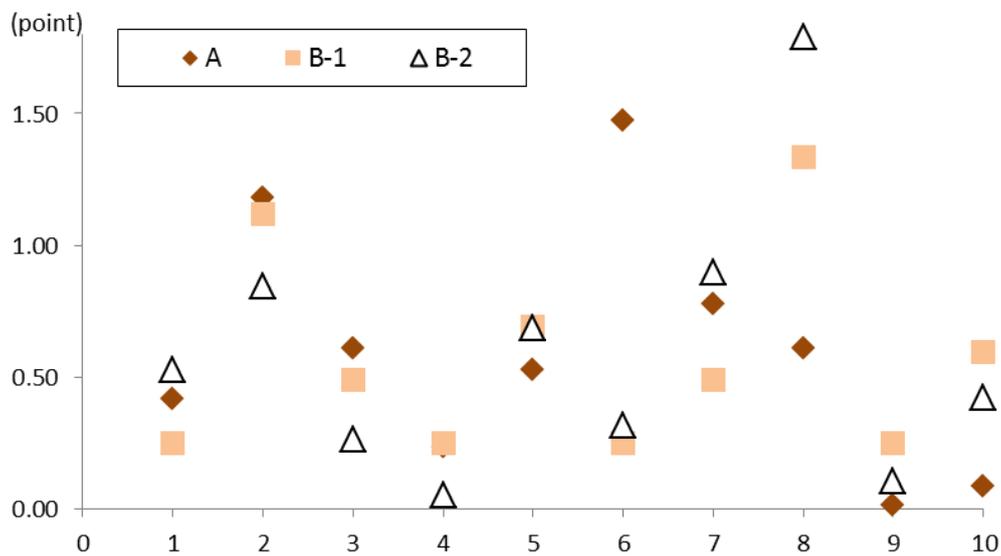


Figure 3-1 Scores of 'Decisive factors in a house'

1: Reputation, 2: Space design, 3: Appearance, 4: Facilities, 5: Performance,

6: Material, 7: Relation, 8: Price, 9: Environmental Burden, 10: Others

Point: average score of each group (maximum: 3)

2-3-2 Decisive factors in a builder

To test if three purchasers' groups decided a builder by different criteria, the scores of 'decisive factors in a builder' were compared and some significant differences were detected between Group A and other two groups (Table 3-4 & Figure 3-2).

According to the data, those in Group A found 'past work' of a builder to be the most important, while those in other two groups found it the least important. In contrast, those in Group B-1 and B-2 ordered to 'acquaintance' or those who were attached to the land they purchased ('location'), which were less of importance for those in Group A. For all respondents, the builder's 'personality' was importantly considered.

Statistical analyses were performed to compare the each group's score by each choice. ANOVA detected no significant differences in the score of 'design skill', 'personality', and 'others'. For other choices, since their scores did not show equal variance, K-W test was performed and significant differences were detected in the choices of 'past work' ($p=0.00$), 'acquaintance' ($p=0.01$), 'location' ($p=0.00$), and 'performance' ($p=0.04$) (Table 3-4). For these four choices, post hoc Sidak test detected that Group A scored significantly higher for 'past work' over other two groups, and Group B-1 scored significantly higher for 'acquaintance' and 'performance' over Group A. Sidak test did not detected any significant differences in the 'location' choice.

According to the data and the analyses, 'past work' is of significant importance for those in Group A, in contrast that significantly more people in Group B-1 order to 'acquaintance'. Those in

Group B-1 also pay significantly larger attention to ‘performance’ over those in Group A did, but it is less decisive than other points.

Table 3-4 Result of analyses 'Decisive factors in a builder'

	Means (rank)						E.V. p	ANOVA P	K-W test p	Difference (Sidak)
	A	B-1	B-2							
Design skill	0.12 (4)	0.06 (8)	0.05 (9)				0.01	0.33	-	
Past work	0.43 (1)	0.02 (9)	0.05 (9)				0.00	-	0.00*	A/B-1, A/B-2
Personality	0.22 (3)	0.19 (3)	0.21 (2)				0.72	0.92	-	
Acquaintance	0.04 (7)	0.20 (2)	0.21 (2)				0.00	-	0.01*	A/B-1
Location	0.00 (9)	0.18 (4)	0.16 (4)				0.00	-	0.00*	
Price	0.05 (5)	0.12 (5)	0.16 (4)				0.00	-	0.24	
Famous	0.04 (7)	0.11 (6)	0.05 (9)				0.00	-	0.26	
Performance	0.00 (9)	0.08 (7)	0.05 (9)				0.00	-	0.04*	A/B-1
Others	0.24 (2)	0.20 (2)	0.26 (5)				0.35	0.77	-	

E.V.: Equal Variance

* Significantly different among three groups

Yellow color: significantly higher than other two groups, pink color: significantly higher than other one group

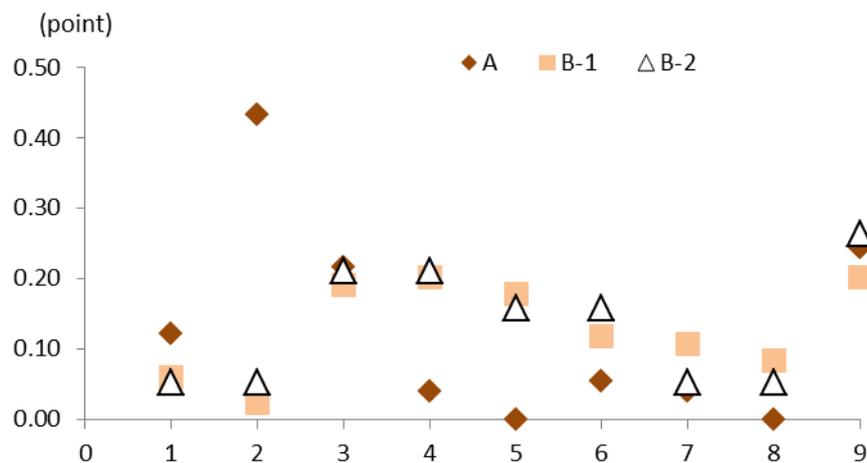


Figure 3-2 Decisive factors in a builder

1: Design skill, 2: Past work, 3: Personality, 4: Acquaintance,

5: Location, 6: Price, 7, Famous, 8: Performance, 9: Others

Point: average number of respondents of each group (maximum: 1)

2-3-3 Attractiveness of Local Wood as a House Material

To test if purchases of LWH perceive the attractiveness of local wood as a material differently, the result of 'attractiveness of house material' was compared between Group A and Group B-2, and some significant differences were detected (Table 3-5 & Figure 3-3).

The rank orders of each choice were similar between two groups; the most decisive factor for both groups were 'smell and texture', and the least decisive factor was 'high-class'. More or less, both groups perceived local wood in a similar way.

However, t-test between these two groups revealed that the degree of attractiveness that two groups perceived was significantly different in some choices. The results of t-test confirmed that Group A scored significantly higher for 'smell and texture' ($p=0.00$) and 'health' ($p=0.03$) than that of Group B-2. Figure 3-3 illustrates that attractive points which those in Group A found were concentrated on the four top-ranked items, while those in Group B-2's attracted points were more diversified. This means that most of those in Group A find local wood's 'smell and texture' attractive, and less of those in Group B-2 find it so; but still, this is the most popular aspects of local wood for both groups.

Table 3-5 Result of analyses 'Attractiveness of local wood'

	Means (rank)				t-test p
	A		B-2		
Smell and texture	2.12	(1)	1.00	(1)	0.00*
Health	1.29	(2)	0.68	(4)	0.03*
Durable	0.25	(6)	0.42	(6)	0.49
Appearance	0.25	(6)	0.74	(3)	0.08
Environment	0.95	(3)	0.84	(2)	0.75
Maintenance	0.03	(11)	0.16	(9)	0.43
Cheap	0.07	(8)	0.32	(7)	0.28
Regionality	0.73	(4)	0.58	(5)	0.57
High-class	0.03	(11)	0.11	(11)	0.48
No	0.04	(9)	0.26	(8)	0.26
Others	0.08	(7)	0.11	(11)	0.83

* Significantly different between two groups

Yellow color: significantly higher than the other group

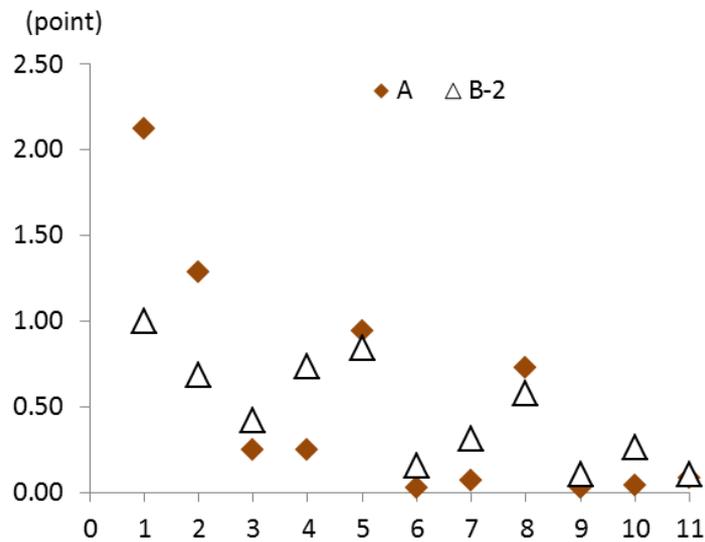


Figure 3-3 Attractiveness of local wood

1: Smell and texture, 2: Health, 3: Durable, 4: Appearance, 5: Environment,
 6: Maintenance, 7: Cheap, 8: Regionality, 9: High-class, 10: No, 11: Others
 Point: average score of each group (maximum: 3)

2-4 Summary of Comparison among Group A, B-1 and B-2

The comparative analyses among three groups implied that Group A and other two groups were significantly different in terms of the degree of environmental awareness, passion for house building and intention for house purchase behavior, whereas Group B-1 and B-2 were not significantly different in all these aspects. Those in Group A have higher environmental awareness and are more passionate for house building than other two groups. In deciding a house to purchase, those in Group A focus on 'material', while those in other two groups focus on 'price'. In deciding a house builder to order, those in Group A consider 'past work of a designer/builder' highly importantly, while those in other two groups order to an 'acquaintance', in addition to 'personality' of a designer/builder as a common concern. When people purchase a LWH, the material's 'smell and texture' and 'health' are perceived to be attractive by many purchasers. Particularly, those in Group A show greater interests in these two choices whereas those in Group B-2 show interests in more various choices.

3. Characteristics of Past Purchasers of non-LWH

In order to characterize the purchasers of non-LWH, this section discussed Group B by dividing them into smaller groups, because non-LWH purchasers and other LWH purchasers were undistinguished from the results of analyses. This section focused on non-LWH purchasers and discussed what made up their purchase behavior; concretely, this section identified the differences between those who had/had not heard of LWH when they purchased a house and between those who became/did not become interested in LWH.

3-1 Differences of Those Who Had/Had not Heard of LWH

To test if those who had/had not heard of LWH were significantly different, all respondents in Group B (purchasers of any types house, except those who purchased from KH) were divided into two subgroups: those who had heard of LWH (n=62) and had not heard of LWH (n=38). Their results of questionnaire were compared in terms of environmental awareness, passion for house building and the share of those who purchased a wooden house.

No significant differences by $p=0.05$ level were detected in all of these aspects. The mean scores of environmental awareness were 2.67 (those who had heard) and 2.41 (those who had not heard), and of the passion for house building were 17.38 (those who had heard) and 16.56 (those who had not heard). For both scores, t-test did not detect significant differences ($p=0.29$ for both score; Table 3-6). For the share of wooden house, 83.9% of those who had heard of LWH, and

69.4% of those who had not heard of LWH purchased a wooden house (Table 3-7). The percentage of wooden house of those who had heard of LWH was significantly larger in $p=0.1$ level (Pearson's chi-squared test, $\chi^2=3.28$, $df=1$, $p=0.07$).

Table 3-6 Correlation of information of LWH and environmental awareness/passion

	Means		t-test
	Heard	Not heard	p
Environmental awareness	2.67	2.41	0.29
Passion for house building	17.38	16.56	0.29
Considering ~ contract (month)	16.11	17.51	0.72
Number of builders	3.03	3.03	0.99

Table 3-7 Correlation of wooden house choice and knowledge

	Had heard of	Had not heard	n
	LWH	of LWH	
WH	52	26	78
Non-WH	10	12	22
n	62	38	100

WH: Wooden House, non-WH: non-wooden house

From these results, those who had heard of LWH cannot be distinguished from those who had not heard of LWH in terms of environmental awareness and passion for house building; however, they may have tendency to choose a wooden house rather than a non-wooden house.

3-2 Differences of Purchasers Became/Did Not Become Interested in LWH

To test if those who became/did not become interested in LWH after hearing LWH were

significantly different, two groups were picked up from respondents in Group B; those who were interested in LWH but gave up (n=17)²² and those who were not interested in LWH (n=28). They were compared in terms of their environmental awareness, passion for house building, and decisive factors in a house (a part of intention for house purchase).

The results of comparison did not detect any significant differences in $p=0.05$ level. The mean scores of environmental awareness were 3.12 (those who became interested in LWH) and 2.50 (those who did not become interested in LWH), and of passion for house building were 18.24 (those who became interested in LWH) and 17.07 (those who did not become interested in LWH). For both scores, t-test detected no significant differences in $p=0.05$ level ($p=0.08$ and $p=0.31$, respectively), but the environmental awareness was significantly different in $p=0.01$ level. For decisive factors in a house, though t-test did not detect any significant differences in means scores of each choice, two groups showed different patterns of the rank orders (Table 3-8). It is particularly seen in 'environmental burden', which ranks in fifth place for those who became interested in LWH while it ranks in the lowest place for those who did not become interested in LWH.

From these results of analyses, those who became/did not become interested in LWH were not significantly different; thus what interested them could not be defined. However, environmental awareness of those who became interested in LWH might be higher than those who did not become interested in, which indicates that they might get interested in LWH in its environmental aspects.

²² Among 17 respondents, 11 respondents gave up because of LWH's cost and 6 respondents gave up because of their builders' wood collection ability.

Table 3-8 Correlation of interest and environmental awareness, passion and decisive factors

	Means (rank)		t-test		
	interested	not interested	p		
Environmental awareness	3.12	2.50	0.08		
Passion for house building	18.24	17.07	0.31		
Considering ~ contract (month)	16.88	15.29	0.81		
Number of builders	2.88	2.71	0.79		
Decisive point					
Reputation	0.29	(8)	0.46	(6)	0.57
Space design	0.59	(5)	1.18	(2)	0.13
Appearance	0.47	(6)	0.25	(9)	0.34
Facilities	0.12	(10)	0.46	(6)	0.09
Performance	0.94	(3)	0.79	(3)	0.67
Material	0.24	(9)	0.25	(9)	0.94
Relation	0.35	(7)	0.39	(7)	0.86
Price	1.18	(1)	1.21	(1)	0.93
Env'tal burden	0.59	(5)	0.07	(10)	0.06
Others	0.94	(3)	0.64	(4)	0.41

3-3 Summary of Characteristics of non-LWH Purchasers

The statistical analyses did not detect any significant differences in following comparisons:

- Those who had heard of LWH and had not heard of LWH
- Those who became interested in LWH and did not become interested in LWH

However, the analyses implied that those who built a wooden house might have higher chance to be informed of LWH than those who built a non-wooden house might have. Also, environmental awareness could initiate to be interested in LWH for certain people who finally could not purchase a LWH.

Chapter 4 Discussion

This chapter interprets the results of analyses to extract key findings, and discusses the validity of them by comparing with the findings from previous studies. Interviews with past purchasers of LWH were also referred for interpreting questionnaire analyses.

1. Validity of Data Collection Method

Since this study applied two different data collection methods (postal survey and web-based survey), it is necessary to assess how these methods affected the results of the questionnaire. This section at first examines the possibility of sampling bias, and then, discusses two problems that sampling method might confuse the questionnaire results.

1-1 Issues to be Examined

Although web-based survey has already been applied in many fields of research, the validity of this method has still been controversial. The specific feature of web-based survey is seen in the characteristics of respondents' population. Some papers reported that the aged population have excluded from web-based survey because less aged people have the Internet access than younger people have (e.g. Mayr et al. 2012). Additionally, differences in gender, education level and income between respondents of web-based and postal surveys were reported in some studies, while other studies reported no differences in these attributes (e.g. Fleming & Bowden 2009; Linghjem &

Navrud 2009). In Japanese context, differences in attributes were also pointed out as well as respondents' attitudes towards common and classical customs (Honda 2005).

Though there might be some differences between two data collection methods, Mayr et al. (2012) and Fleming & Bowden (2009) concluded that the results of web-based and paper-based questionnaire were comparable in their study fields. In contrast, Bech & Kristensen (2009) were suspicious of comparability because of the differences in responding rate.

To sum up, these previous studies indicated that the validity of data collection method depends on cases (Table 4-1). In followings, the data obtained from the questionnaire surveys are verified by some statistical analyses to see if age difference, which is the most discussed issue, affected the actual behaviors.

Table 4-1 Issues to be examined for validity of web-based survey

	Comparison	Differences				
		Age	Gender	Education	Nationality	Income
Mayr et al. (2012)	Web / P	seen	seen	seen	no	no
Fleming & Bowden (2009)	Web / P	no	no	no	no	seen
Lundhjem & Navrud (2011)	Web/ I	no	no	seen	-	seen
Bech & Kristensen (2009)	Web / P	seen	no	seen	-	seen

Web: Web-based survey, P: Postal survey, I: Interview survey

1-2 Possibility of Sampling Bias

Looking at the Attributes of the respondents (Table 3-1), there is a significant difference in 'age' between Group A and Group B-1/B-2 (K-W and Sidak, $p=0.00$ for both) possibly caused by the uneven accessibility to the Internet. However, some previous surveys on LWH purchasers

implied that age difference could be due to the uneven age distribution of the original target groups; aged people tended to show higher interests in LWH than younger people (Miyamoto et al. 2009; Yamagami & Kondo 2003). The age difference detected in this survey needs to be examined whether it was caused by the age difference in the original target population or the differences in data collection methods.

To verify the cause of significant difference in age between Group A and B, their results were compared with the results of previous postal survey by MLIT (2012^a) that targeted to the purchasers of any types of house. From the age comparison of Group B (web-based, any types of house) and respondents of MLIT (2012^a)'s survey (postal, any types of house), it was confirmed that postal survey detected population over sixty more than web-based survey did (Table 4-2). Age comparison of Group A (postal, LWH) and respondents of MLIT (2012^a)'s survey (postal, any types of house) revealed that population over sixties accounted more in purchasers of LWH, and twenties and thirties accounted more in purchasers of any types house.

From these comparisons, both possibilities were not denied: uneven age distribution might be occurred due to either different data collection methods or differences of original target populations. It is unable to define the cause of different age distribution between Group A and Group B.

Table 4-2 Comparison of age distribution

	This research		MLIT's survey
	Postal-LWH (Group A)	Web-all (Group B)	Postal-all
~39	17.8%	36.9%	47.6%
~49	39.7%	41.7%	20.0%
~59	9.6%	15.5%	13.4%
60~	31.5%	5.8%	18.9%
n	73	103	2061

Source: MLIT (2012)

1-3 Age Differences and Passion

Suppose that uneven age distribution is occurred due to the differences in data collection methods, age difference could possibly affect the results of questionnaire survey. Especially, Group A's passion for house building could be overestimated because aged and retired people were able to spend more time and energy on house purchase than younger people were, thus it raised the score of passion for house building by Group A (older). Then, in order to confirm the independency of passion for house building from age, ANOVA among different age group was performed towards their passion for house building (Table 4-3). This test detected no significant differences among four age groups (~39, 40~49, 50~59, 60~, $p=0.30$), which means that passion for house building does not depend on purchasers' ages.

Table 4-3 Results of analyses of age difference

Age	Means				E.V.	ANOVA	K-W test
	~39	~49	~59	60~	p	p	p
Passion_house	17.68	19.04	18.46	18.32	0.50	0.30	-
~contract (month)	18.68	19.17	21.21	19.96	0.93	0.98	-
Number of builder	3.64	3.89	2.88	3.92	0.05	-	0.79
n	50	73	24	28			

E.V.: Equal Variance

Passion_house: Passion for house building

1-4 Age Differences and House Preferences

Additionally, to test if a purchaser's house deciding factors depend on their age, all respondents were divided into four groups as same as previous section (~39, 40~49, 50~59, 60~) and their score of 'decisive factors in a house' were compared by ANOVA and K-W test (Table 4-4). In terms of rank order, 'material' ranked in the second lowest in the group of age under 39, in contrast it ranked in the third and second highest in other age groups. The mean score of 'material' was also significantly different ($p=0.01$, K-W test) between groups of age under 39 and 40~49 (Sidak test, $p=0.00$) and under 30 and over 60 (Sidak test, $p=0.01$). The mean score of 'others' was also significantly different ($p=0.03$, K-W test) between groups of age under 39 and 50~59 ($p=0.02$).

Table 4-4 Result of analyses for Decisive factors in a house

	Means				E.V. p	ANOVA p	K-W test p	D (Sidak)
	~39 (a)	40~49 (b)	50~59 (c)	60~ (d)				
Reputation	0.34	0.26	0.38	0.59	0.02	-	0.51	
Space design	1.10	1.22	0.79	1.15	0.13	0.51	-	
Appearance	0.62	0.55	0.54	0.22	0.00	-	0.44	
Facilities	0.34	0.08	0.25	0.37	0.00	-	0.06	
Performance	0.46	0.53	1.08	0.78	0.01	-	0.08	
Material	0.30	0.88	0.96	1.15	0.00	-	0.01*	a/b
Relation	0.44	0.82	0.50	0.67	0.18	0.17	-	
Price	1.30	1.07	1.08	0.67	0.23	0.20	-	
Env'tal burden	0.22	0.11	0.21	0.00	0.00	-	0.41	
Others	0.62	0.36	0.08	0.19	0.00	-	0.03*	a/c, a/d

E.V.: Equal Variance, D: Difference

* Significantly different among four groups

The analyses proved that age differences do not give significant impact except concerns on ‘material’ and ‘others’. In Japanese context, the correlation of age and preferences to wood for house structure was proved (Cabinet Office 2012; Miyamoto et al. 2009), though a study in Germany showed contradicted results (Gold & Rubik 2008).

In terms of builder selection, Sumikura et al. (2005) confirmed that decisive reason of a house builder is independent from purchasers’ age. In their study, continuity of a builder, quality of carpenter and a house were of importance for any age of purchasers. This result indicates that decisive factors of a builder are not affected by purchasers’ age but by their preferences and idea. Therefore, in terms of builder deciding, age difference between Group A and B gives little impact; the differences are originated in their own concerns which correlate with house preferences.

From the analyses and discussion above, the differences in age might be caused by differences in either the data collection methods or the original target populations. However, age differences did not affect the degree of their passion for house building neither builder selection reasons. Thus, it is considered that even if there was a sampling bias because of different data collection method, it did affect no results except material choice. Even so, this research does not consider this was caused by sampling bias because the correlation of aged people and preferences to wooden material has been pointed out by previous literature with the same data collection method.

2. Key Findings of Questionnaire Results

The results of comparative analyses detected significant differences between Group A and other two groups in many aspects, indicating that those who purchased a LWH by KH had certain different preferences to house from others. They were highly aware of environment and passionate for house building; however, the most decisive factor in a house was not ‘environmental burden’ but ‘material’ as they found local wood attractive in terms of its ‘smell and texture’ and positive effect for ‘health’. When they decide a designer/builder, the important consideration was their ‘past work’. In contrast, those in Group B-2, who purchased a LWH but not from KH, did not show these characteristics; decisive factor in a house was ‘price’, and they ordered to an ‘acquaintance’ such as those in Group B-1 did. From these results, the characteristics of Group B-2 were similar to that of Group B-1 than that of Group A. Those who purchased a LWH from KH are distinguishable from other purchasers, but those who purchased a LWH without mediated are not able to be distinguished from purchasers of non-LWH.

To summarize, two types of LWH purchasers can be characterized as followings: those who purchased a LWH with recognizing positive effects of local wood using in their house (Group A), and those who purchased a LWH without special intentions (Group B-2). The first group can be referred to as ‘intended purchasers’ because it is their intention to purchase a LWH, whereas the latter group can be referred to as ‘by-chance purchasers’ because their houses do not have to be LWH according to their decisive factors and thus, LWH is purchased by-chance. The relationship

between two groups and non-LWH purchasers is shown in Figure 4-1.

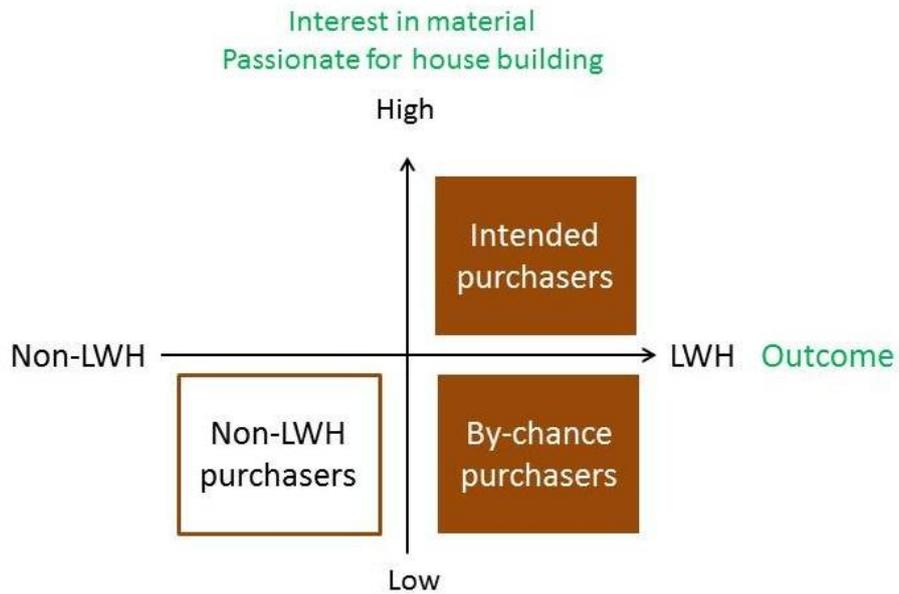


Figure 4-1 Relationship of LWH and non-LWH purchasers

For non-LWH purchasers, analyses implied the correlation between having heard of LWH and purchasing a wooden house and between becoming interested in LWH and high environmental awareness.

Following subsections highlighted each group to discuss the effect of each factor for motivating to purchase a LWH. Intended purchasers were at first analyzed from their environmental awareness, passion for house building and interest in material, followed by by-chance purchasers' motivation, non-LWH purchasers and additionally builders' viewpoint.

3. Motivation of Intended Purchasers

3-1 Environmental Awareness

According to the fact that intended purchasers showed high environmental awareness (Table 3-2) but did not decided to purchase a LWH by its environmental aspects (Table 3-3), house purchase behavior was independent from environmental awareness in this survey.

The gap between people's environmental awareness and purchase behavior in practice was identified by some previous studies (e.g. Wheale & Hinton 2007; Moisander 2007), whereas others concluded that they were related (e.g. Clark et al. 2003). In this study, the gap observed was thought to be caused by the characteristics of house as a product to be purchased. House purchase embraces difficulties to reflect purchasers' environmental awareness, because it happens a few times in a person's lifetime (Koklic & Vida 2011) and various considerations should be involved in (Kauko 2006; Wong & Li 2006; Jim & Chen 2007). For this kind of products, it is difficult to collect sufficient relevant information, budget and past experience, which are necessary to alter a purchase pattern to environmental-concerned way (Young et al. 2010). As a result, the features of 'house' as a purchasing product brought the gap between purchasers' environmental awareness and actual choice. In the case of house purchase, individual's environmental awareness does not give sufficient impact to guide or control purchasing behavior, but it just adds an extra sense of purchasing it afterwards (Loewenstein 2001) by making them realize the positive consequences of using local wood.

Therefore, it can be concluded that LWH purchase behavior is independent from environmental awareness of a purchaser.

3-2 Passion for House Purchase

Intended purchasers were significantly passionate than other two groups of purchasers (Table 3-2), and this passion is related with ‘persistency’ according to the original article of Vallerand et al. (2003); they were persistent as well to house building.

Their persistency was seen in the response of ‘decisive factors in a builder’ that ‘past work’ ranked in the top by those in Group A (Table 3-4). Table 4-5 summarized some of responses categorized into ‘past work’, which proved that they were looking for a builder whose past works matched to their senses.

Table 4-5 Examples of responses of 'Past work'

I was moved by his approach that pursues locality and natural material.
He had same opinion as I had about wood and wooden house.
I liked his design taste and choice of objects.
The house designed by him matched to our image of house.
He designed a house I like.
His idea towards house was close to ours.

Their comments implied that intended purchasers pursued their own image of house until they found a designer who had the same or similar images towards house and had been visualized it in their past works, rather than compromising it with cost or deciding by the existing personal

connection like other groups did (Table 3-4).

Interviewee A mentioned an example of their strong persistency to their house in their decision making process of LWH building. A's house, located in the riverside with plenty of sunshine, might generate electricity if they put a solar panel on the roof. However, they did not do so because A's family were proud of their roof tiles and wanted to show them off. What they wanted to pursue was not the eco-efficient house, but their persistency towards their 'original' house.

Therefore, the passion of intended LWH purchasers were stronger than environmental awareness, and it is spent to find a builder whose past work matches to theirs; in other words, intended purchasers were passionate for building a house close to their ideal image.

3-3 Intention (Material)

Material was the most decisive factor by intended purchasers (Table 3-2), and those who were not interested in the 'material' of LWH were not able to purchase a LWH even though they have other interests in LWH (Table 3-8). In most cases, material is of less importance than other criteria such as design skill, cost-effectiveness and reliability of a firm (Sakanoue 2010); LWH has disadvantage in these points and thus, is still unpopular.

Though intended purchasers were interested in the material of LWH, they might not be able to distinguish Kochi's wood from other regions' wood. The analyses verified that local wood attracted many purchasers by its 'smell and texture' and 'good for health' (Table 3-5), but these aspects are

applicable for 'wood' or 'wooden house' in broader sense as well. In fact, it is reported that people perceive 'domestic' wood as 'beautiful wood grain', 'favorable smelling' and 'familiar feeling' (Sumitomo Forestry Co. Ltd. 2009), which were close to the attractiveness of 'local' wood observed in this survey. A survey in Shiga Prefectural Government (2012) showed similar results about image of 'local' wood (wood grown in Shiga Prefecture), which were 'warm feeling', followed by 'effective for regional forestry and wood industries'. Looking at overseas, the image of 'wood' as a house material is associated with 'health' and 'well-being', rather than 'durable' and 'fire combusive' in German context (Gold & Rubik 2008), which also coincide with this study.

Theoretically, smell of wood comes from the essential oil's constituent, and it depends on the species of the wood. So that, favorable 'smell' is not determined by where the wood is produced but what the biological species is. Some soil or climatic conditions might be different by region to region even within Japan, but smell should not be so different among the same species. In Japan, dominant species of plantation were cedar and cypress; when people say 'smell and texture' of wood, they can be common in the cedar/cypress grown in any regions of Japan.

Previous studies and the fact of composition of smell indicate that purchasers of LWH in this survey do not clearly differentiate local wood from domestic wood. The positive perceptions seen in this study such as 'smell and texture' are common perceptions of domestic wood, as long as the species are the same regardless of where they were harvested.

Therefore, there should be some other factors encouraged them to select LWH from other

groups of ‘domestic wooden house’, which are built with wood produced in anywhere in Japan.

One possibility is an attachment to the local regions; in the survey of this study, ‘regionality’ ranked in the third place in attractiveness of material among intended purchasers (Table 3-5), and in Shiga Pref.’s survey, revitalization of regional industries ranked in the second place. Additionally, interview with A supports that ‘attachment to local place’ affects to the material choice; they wished to build with as much local material as possible, because they wanted to circulate the money they paid inside the region they knew, and they did not want to contribute the large scale builders which spend much budget on their advertisement. From their interview, purchasers’ regional attachments are thought to be possible to encourage them to choose a LWH.

Another possibility is the effect of strong promoting campaigns for LWH. KH as well as Kochi Pref. have strongly promoted LWH by providing opportunities for potential customer to visit to the forest, related factories, and past purchasers’ houses, and to learn the positive effects of using local wood. These enlightening activities establish the pathway for people to be interested in the material with ‘good smell and texture’ or positive effect for ‘health’, thus they do not even consider using wood from other regions unless s/he has strong attachment to the other place. Prefectures’ subsidy also encouraged a questionnaire’s respondents²³ and interviewee B to purchase a LWH.

To summarize the discussion on intended purchasers’ perception of ‘local wood’, they found the attractiveness of ‘wood’ by its smell and texture and additionally, they preferred to use wood from the area close to them because of their regional attachment or of accessible information.

²³ This respondent scored ‘others’ for the third ‘attractiveness of material’, and mentioned subsidy in the following free space.

4. Motivation of By-Chance Purchasers

Considering that by-chance purchasers of LWH were not significantly different from non-LWH purchasers in any analyses (Table 3-2~3-5), their purchase motivation was probably based on the external factors such as recommendation from their builders/designers. Usually, a builder decides house materials (Miyamoto et al. 2009; Iijima & Kawanabe 2005) and customers' opinions are not always prioritized. Some designers, who agreed on the purpose of LWH, also have connections with LWH builders. Therefore, builders/designers can recommend their customers to purchase a LWH without additional cost if they have actively used local wood and have already established the purchase channel of local wood.

In addition, since significant differences were neither detected in decisive factors in a builder (Table 3-4), it was incidental that by-chance LWH purchasers could have known a designer/builder who actively used local wood. They tended to order to their 'acquaintance' and those who had good 'personality' such as non-LWH purchasers did (Table 3-4). Interviewee C, who purchased from a friend of her, stressed the role of relation in trust in her purchase process. She was interested in local material and wooden house, but what was the most important to her was to purchase from a trustable firm; she was recommended to use local wood by her trustable friend working at a firm, which became the decisive factor. This example illustrates that personal relationship is also motivating people to purchase a LWH.

Interview with B implied that recommendation will encourage a purchaser if all the other

decisive factors are satisfied. In B's case, the husband would like to purchase a LWH whereas the wife did not have particular interest; she was more interested in facilities and space design. Then, they successfully found the LWH builder who can provide the well-deigned house with sufficient facilities and performance. They ordered to this builder, without compromising both requirements.

Therefore, the results indicate that recommendations from builders can involve more people in LWH purchase, including those who are not interested in. Thus, difference between by-chance purchasers and non-LWH purchasers might be whether their designer/builder recommended or not.

5. Non-LWH Purchasers

Non-LWH were divided into smaller groups according to the degree of possibility to purchase a LWH; those who had not heard of LWH, those who had heard of LWH but were not interested in, and those who were interested in LWH but gave up purchasing it. The analyses showed correlations between those who had not heard of LWH and building of non-wooden house (Table 3-7), and those who were interested in LWH and higher environmental awareness (Table 3-8).

The first correlation between those who had not heard of LWH and building of non-wooden structured house implies that involving more people in wooden structure may also contribute to promote LWH. In Kochi Pref., where 86.3% of newly detached houses are wooden-structured, those who built a non-wooden house are the minority and they are considered to have the specific reasons for choosing non-wooden house. They may concern on less durability and fire combustion of wood

structure, and may not be updated on new technological innovation (Timber Frame Housing 2002 Consortium). To spread the information of LWH as a first step of purchasing it, this population should be addressed by informing of wooden structure's current development.

The second correlation between those who became interested in LWH and environmental awareness can be interpreted in the same way as relationship between house purchase and environmental awareness did; environmental awareness gives insufficient motivation towards house purchase. The 'environmental friendly' aspects of LWH attracted certain purchasers, but it cannot be the first priority of decision making and thus, LWH purchase was given up.

6. Builders' Point of View

From builders' point of view, it is a reasonable strategy to provide houses to the niche demand, those who have special persistency to their house, rather than competing with large builders by providing uniformed houses (Tsukui 2005). Even small builders, who are disadvantageous in terms of new technology and material (Rokutan & Taniguchi 2006), can differentiate themselves from other builders by using local wood if there are certain demands. Building a house for those who have their own (possibly unique) image of house is a surviving option for builders, and also it can satisfy the purchasers who pursue their own image of a house.

7. Summary of Discussion

This chapter condensed the key findings of the questionnaire survey and discussed the validity of them. The first discussion identified that the intended purchasers' motivation for LWH purchase is based on their interests in 'wooden' material, rather than their environmental awareness. Also, even though they find local wood attractive, it is unclear if they can differentiate the local wood from other area's domestic wood; thus, regional attachment is considered to be another motivation. The intended purchasers are relatively more passionate than others, initiating them to spend their energy, time and budget on house purchase processes.

By-chance purchasers, in contrast, purchased a LWH by recommendation from the builder/designer whom they ordered to. Thus, for them, relationship in trust and personality were the main reasons for house purchase behavior.

To mention the non-LWH purchasers, two different steps of the process of purchasing a non-LWH were discussed. The first one is the lack of information of LWH, which is caused by indifference to wooden structure. The enlightening information to promote LWH targets to those who were already interested in 'wooden house', and excludes those who were unconcerned of wooden structure from the first hand. The other one is the environmental-oriented interests in local wood; environmental aspects of LWH attract certain people but finally they prioritize other criteria, thus compromise to purchase a LWH.

Chapter 5 Conclusion

1. Overview of the Research

This research aimed to identify the characteristics of past purchasers of LWH by comparing with those of purchasers of non-LWH. This objective was divided into two research questions which were answered by analyzing the results of questionnaire surveys to past purchasers of LWH and non-LWH. Here shows the two research questions and their answers based on the analyzed and verified questionnaire results.

RQ.1 What kind of people purchased a LWH and in what aspect they were attracted?

A.1 Two distinctive types of people were observed among LWH purchasers: ‘intended purchasers’ and ‘by-chance purchasers’. Intended purchasers are passionate towards visualizing their ideal image of house, thus they do not hesitate to spend any resources on house building process. They find LWH attractive in terms of the material’s smell and texture, and positive effect for health as well as the regionality that local wood particularly have. By-chance purchasers are not especially interested in purchasing a LWH, but they are possibly recommended to use local wood by house designers/builders whom they ordered from. By-chance purchasers find wooden structure attractive in the same points as intended purchasers do, although they do not decide because of specific features of LWH.

RQ.2 Why purchasers of non-LWH could not purchase a LWH?

A.2 Apart from the lack of a designer/builder recommending LWH, two reasons were considered; indifference to wooden structure itself and insufficient motivation for stick to the local wooden materials.

Additionally, for those who were had not heard of LWH, it needs to be started to let them know local wood and LWH, and it is considered to be effective to address to make them interested in wooden-structured house. For those who have insufficient motivation, their priority of local wood use was lower than other aspect.

Based on the answers of two research questions shown above, the characteristics of purchasers of LWH are described as either

- Interested in wood as a house material
- Acquainted with a designer/builder using local wood to their house

2. Future Vision

This research at first explained that the forestry all over Japan can potentially be revitalized by the collaboration with house industries and final purchaser in a local (prefectural) scale. The results of this research imply three different suggestions to achieve this by increase the demand for LWH:

- 1) Provide more opportunities for people to experience the attractiveness of wood
- 2) Involve more designers and builders to spread use of local wood
- 3) Attract more people into ‘wooden structure’

These solutions may influence house purchase patterns of Japanese people in the local scale in the forestry regions at first. They also may alter the forest management strategies in Japanese forestry and wood industries which impacts in the global levels by reducing forest degradation and unsustainable commercial logging in wood exporting countries.

In addition to the academic and objective discussion, this research reports two on-site examples related to first and second suggestions, indicating to make the vision of this research happen in the near future. These examples are based on interviews and field surveys.

2-1 Nishikawa Forest Market (Hanno City, Saitama Pref.)

Nishikawa Forest Market (NFM) is a NPO which has promoted Nishikawa wood (wood produced in Hanno City, Hidaka City, Moroyama Town and Ogose Town; Figure 5-1) to use in house building, aiming to increase the demand for Nishikawa wood. NFM was established in 2008

by forest owners, harvesters, sawmilling factories, retailers and builders in these cities. NFM has been selling Nishikawa wood, consulting house building, and transmitting information about wooden house as their main activities.

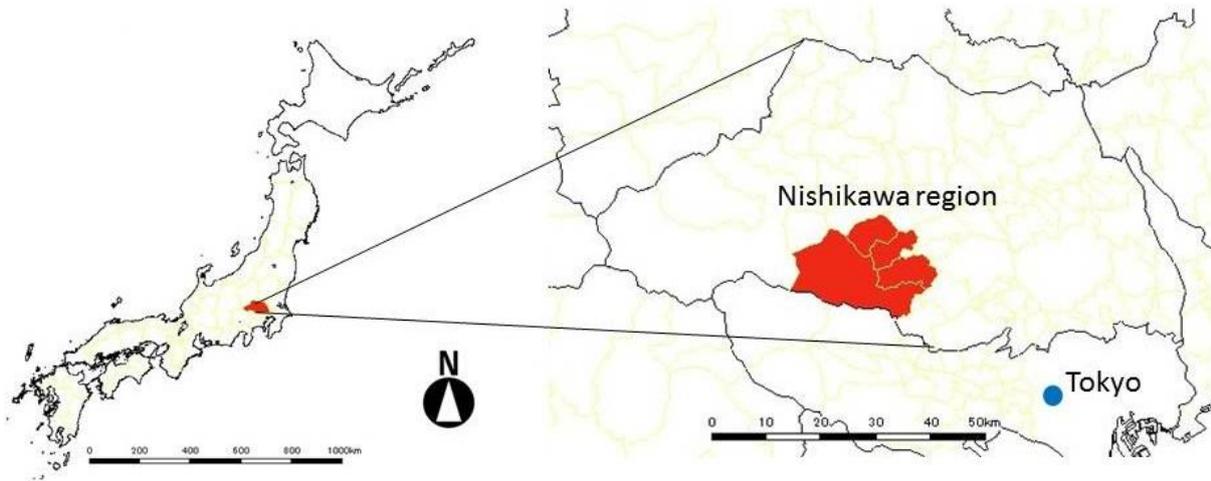


Figure 5-1 Location of Nishikawa area

One of the important activities of NFM is to hold events to provide opportunities for kids to play with wood and forests, as well as for adults to understand the positive effects of local wood use. In an event as an example, children and their parents visited the forests to experience thinning, and then made decorations from the wood, leaves and nuts they cut or collected. In another event, NFM took customers to the forests and let them watch the wood harvesting process, and opened a small talk about forest afterwards. These events do not aim at immediate increase of the demand, but to enlighten each participant including children. Participants may talk to friends or relatives about their experiences, or kids may be interested in wooden house or forest. The purposes of these events are to spread information on local wood and to give option of LWH to more people in the long-term.

Though NFM have contributed to increase the chances to feel familiar to wood for participants of their events, their activities have not yet effectively stimulated their main business. In fact, those who ordered a house through NFM were only a few, which is less than they expected. Furthermore, some of NFM members have left the group because they could not obtain any profit by keeping their memberships. This example implicates the difficulties of gaining immediate benefit by spreading information on local wood, and the necessity of having long-term perspectives.

2-2 Involving Designers

Involving designers to LWH is another difficulty; most of programs in architecture schools do not focus on or even do not include a course of wooden-structured building, thus limited number of students in architecture major afterwards would be interested in designing wooden houses.

An interview to a house designer (done in 23rd May 2012), who has actively used local wood at Kochi Pref., illustrated how he got interested in LWH building as an example. He got interested in LWH not from the study at schools, but from his first work after graduation; his first job was to manage a building site of a wooden house which reflected the purchasers' persistency in house itself and the material, wood. This experience developed his interest in wood as a material and he started learning wooden structure by himself.

His story implies that direct experiences can motivate designers to address LWH designing. Currently, many LWH groups accept their potential customers visiting the production forest and

sawmilling factories, but they better accept more designers visiting, because change of designers' attitude towards LWH can involve more than one customers to local wood use.

These on-site practices should be collected, integrated, and examined in the future researches to realize the vision of this study to increase the demand for LWH. .

3. Limitation

Though this study identified the characteristics of LWH purchasers in terms of their differences from those of non-LWH purchasers', there are some limitations left unsolved. These limitations are expected to be addressed and revealed in the future researches.

The first limitation is the geographical scale that this study concerned. This study is based on the data obtained in Kochi Pref., which has rich amount of wood resources in mountainous topography and advanced municipal support for LWH promotion. House purchase behavior in this area is supposed to be reflecting these conditions and specific features which made purchasing a LWH relatively easier. Besides, many other different features of a region would influence house purchaser behavior of local people: such as estimation of earthquake and tsunami's attacking, population density, and price of the land. The results of this study should be verified with other case studies which would show different results depending on the features of regions.

The second limitation is the target of this study, which only focused on final consumers and excluded all the other wood distribution processes. Possibly some of purchasers of non-LWH

unintentionally used local wood in their house structure indeed, but this study failed to detect them because distribution process was not considered at all. Within purchasers of wooden house (but non-LWH), only three out of sixty two respondents knew where their wood were produced (Kagawa Prefecture, somewhere in Shikoku and Northern America). It simultaneously means that the other fifty nine purchasers may use local wood without recognizing and should have been classified into Group B-2. The buyers of wood in the downstream of distribution channel may not be able to identify the exact place of wood production because wood distribution channel, especially domestic wood's one, is complicated with many middle-men and retailers (Narasaki et al. 2007). For further discussion on how to increase demand for LWH, the distribution process should also be studied and optimal channel of distributing local wood have to be investigated. It could also be combined with the optimal flow of information on producing and processing wood, from forestry side to consumer side.

Third limitation is that this study avoids discussing on the price and budget. LWH is generally considered to be more expensive than other types of houses and sometimes indeed it is (sometimes not); some of the respondents actually gave up purchasing a LWH because of its cost. Although many respondents in Group B answered that the price of house is an important decisive factor, the data failed to show the relationship of demand for LWH and its price. LWH can be accessible to more people if the price becomes lower and can be limitedly accessed if the price becomes higher, and thus, further research is expected to determine the relationship and variables of these two.

Another aspect is the negotiating process with a designer/builder: those who gave up LWH because of the price might be able purchase it if they had talked with a designer/builder with ability to convey appropriate information and to offer a plan with low cost. The actual price of a house often differs from initial price due to additional options and it is a designer/builder who suggests compromising a purchaser's requirements according to the budget-price balance. The process of negotiating with a designer/builder would be revealing another hint of involving purchasers with limited budget for house.

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Appendix 1 Questionnaire sheet (postal survey)

Questionnaire for Purchasing a House

This survey is conducted as a part of master thesis's research of the Graduate School of Frontier Sciences, the University of Tokyo.

In recent years, using domestically produced wood is increasingly required due to maturing of planted forest within Japan. In the architecture field, the largest consumer of wood, it is said that there should be still some space for expanding domestic wood use. This research focuses on Local Wooden House, built with wood grown in one particular area, and tries to find out how these houses are dealt with in house market.

This survey is conducted to examine possibility of extending share of domestic wood and locally wooden house by catching the features of past purchasers of local wooden house.

Structure of Questionnaire

It is composed of 4 pages including cover. It will take about 10 minutes to complete the survey and following is the structure of this sheet:

1. About respondent yourself
2. About purchasing a house
3. Others

Returning Period

I will appreciate if you reply with envelop enclosed within two weeks after you received.

Personal Information

Information that you answered will be statistically processed and used for research aim only. There is on possibility of being specified an individual respondent when the result is published. There is no need to notice your name and address in your reply. Responded sheet will be kept in a room with lock, and be shredded in certain period passed after research finished.

Contact

If you have some unclear points or doubts, please contact to following:

Kie KOZAWA (2nd year of Master Program)

Biosphere Informatics, Graduate School of Frontier Science, the University of Tokyo

Email: k.kozawa@sustainability.k.u-tokyo.ac.jp

2-2 To those who chose ‘very decisive’ or ‘decisive’ in ‘G) relation to a builder / designer’, please describe in which point you felt ‘good relation’ with a builder / designer.

2-3 Please pick up 3 most helpful information sources in order from followings.

- | | | |
|-----------------------------|----------------------------|--------------------------|
| A) Related magazines | relatives | J) Other website |
| B) Related books | F) Housing exhibition | K) Talks of designer |
| C) TV program | G) Showroom | L) Others () |
| D) Advertising flyer | H) Construction field tour | |
| E) Experience of friend and | I) Builder’s website | |

① _____ ② _____ ③ _____

2-4 How long did it take from start thinking about purchasing a house to actual contract?

About _____ years and _____ months

2-5 How many builders / designers did you visit in this period?

About _____

2-6 Please describe why you decided to a certain builder / designer.

2-7 Please pick up 3 most attractive points of Tosa wood in order from followings.

- | | | |
|----------------------|-------------------------|--------------------------|
| A) Smell and texture | E) Good for environment | I) High-class looking |
| B) Good for health | F) Easily maintenance | J) No attractive |
| C) Durable | G) Low price | K) Others () |
| D) Good looking | H) Region-specific | |

① _____ ② _____ ③ _____

3. Others

3-1 Do you usually act like following? Please answer yes / no (including not sure).

Items	Yes	No and not sure
I bring empty bottles to a recycling bin.	1	0
I wash dirty clothes with prewashing.	1	0
If there are insects in my apartment I kill them with a chemical insecticide.	1	0
I use phosphate-free laundry detergent.	1	0
For shopping, I prefer brining my bag to taking plastic bag.	1	0
I am a member of an environmental organization.	1	0
I use leaded gas in my automobile.	1	0
I have an attachment to the area I am living in.	1	0

3-2 Please tell us what you feel about house building process. Choose the closest one among 4.

Items	Absolutely yes	Somehow Yes	No	Not at all
House building process allowed me to appreciate this process itself more and more.	4	3	2	1
House building reflects my and my family's characteristics.	4	3	2	1
House building gave me a variety of experiences.	4	3	2	1
House building was a very important part of my life.	4	3	2	1
I spent a lot of time discussion on house.	4	3	2	1
House building was a passion for me and my family.	4	3	2	1

3-3 Please fill in your opinions on this survey, if any.

This is the end of questionnaire. I do appreciate your kind cooperation.

Appendix 2 Questionnaire sheet (web-based survey)

1. About Respondent Yourself

1-1 Please fulfill following form.

Current place	_____ Prefecture
Place of birth	_____ Prefecture / _____ city, town, village, district

1-2 Please circle the features of the house you lived in your child age.

Single-family house, Apartment, Tenement, Over 30 years old, Less than 10 years old, nuclear family, With garden, Western appearance, More than 2 Japanese style rooms, Visible Wooden poles or joints

2. About a House You Purchased within Kochi Prefecture

Please fulfill following form by circling one you are applied.

To whom ordered?	Large house builder (_____) / design office / local builder (_____)
Price per unit	_____ Ten thousand yen
Structure	Wooden, non-wooden, I don't know
(The next one is only for those who lives in wooden house)	
Production place of structural wood	Overseas (_____), Japan (_____prefecture, or _____ region) I don't know

3. About Purchasing Process of Your Current House

3-1 Please pick up three decisive factors in order when you purchased a house from followings.

- A) Reputation of a builder resistance construction and living
 B) Room arrangement and space design F) Type of material (wood, concrete, steel) J) Others
 C) Visual of a house (outside and inside) G) Relation to a builder/designer
 D) Facilities such as kitchen H) Price
 E) Performance such as I) Environmental burden in

① ② ③ _____

3-2 Please pick up 3 most helpful information sources in order from followings.

- A) Related magazines
- B) Related books
- C) TV program
- D) Advertising flyer
- E) Experience of friend and relatives
- F) Housing exhibition
- G) Showroom
- H) Construction field tour
- I) Builders' website
- J) Other website
- K) Talks of sales person
- L) Others ()

① _____ ② _____ ③ _____

3-3 How long did it take from start thinking about purchasing a house to actual contract?

About _____ years and _____ months

3-4 How many builders / designers did you visit in this period?

About _____

3-4 Please describe why you decided to a certain builder/ designer

3-7 Please pick up 3 most attractive points of house material you adapted in order from followings.

- A) Smell and texture
- B) Good for health
- C) Durable
- D) Good looking
- E) Good for environment
- F) Easily maintenance
- G) Low price
- H) Region-specific
- I) High-class looking
- J) No attractive
- K) Others ()

① _____ ② _____ ③ _____

3-7 When you purchased a house, did you know that you can use wood produced in Kochi in house's structural material?

Yes / No

For those who knew: please circle one from followings about actual usage.

	○	Reasons
Did not use		If I applied, the cost exceeded my budget.
		If I applied, construction period prolonged.
		My builder could not purchase them.
		Even though I knew, I was not interested in.
		Others ()
Used		About ____ %

4. Others

4-1 Do you usually act like following? Please answer yes / no (including not sure).

Items	Yes	No and not sure
I bring empty bottles to a recycling bin.	1	0
I wash dirty clothes with prewashing.	1	0
If there are insects in my apartment I kill them with a chemical insecticide.	1	0
I use phosphate-free laundry detergent.	1	0
For shopping, I prefer brining my bag to taking plastic bag.	1	0
I am a member of an environmental organization.	1	0
I use leaded gas in my automobile.	1	0
I have an attachment to the area I am living in.	1	0

4-2 Please tell us what you feel about house building process. Choose the closest one among 4.

Items	Absolutely yes	Somehow Yes	No	Not at all
House building process allowed me to appreciate this process itself more and more.	4	3	2	1
House building reflects my and my family's characteristics.	4	3	2	1
House building gave me a variety of experiences.	4	3	2	1
House building was a very important part of my life.	4	3	2	1
I spent a lot of time discussion on house.	4	3	2	1
House building was a passion for me and my family.	4	3	2	1