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**DEMAND FOR WOOD HOUSES**

**Market research in Poland**

**Thesis**

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**ABSTRACT**

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<p>The aim of this thesis was to test and analyze the demand for log and wood houses on the Polish market. This kind of architecture is popular within Scandinavian countries, as well as Finland. Polish construction market is strongly devoted to the tradition of building out from bricks and concrete. The research was conducted for Finlandia SPOT project. Free market research provided by students was supposed to be an encouraging factor for companies interested in entering the Polish market.</p> <p>This research brought information about Polish customers' expectations, which were surveyed with an on-line distributed questionnaire. A Chi-squared test was used for the result analysis.</p> <p>This thesis includes offer examples proposed by producers operating on the Polish market.</p>		

<p><b>Key words</b> Log house, wood house, market research, questionnaire</p>
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## **CONCEPT DEFINITIONS**

Lasy Państwowe- Polish State Forests

Hypothesis- unproven statement

Null hypothesis- declares no dependencies between given variables

Alternative hypothesis- states the dependency between given variables

Quantitative market research – its objective is to provide measurable, numerical data; a large number of respondents is necessary. Data collection methods: surveys (on-line and paper), interviews, observation

Qualitative market research- its objective is to provide data which explain motivations, reasons and opinions. Data collection methods: focus groups, interviews, observation

Univariate techniques- the analysis of one variable, the objective is to describe variable

Multivariate techniques- data analysis methods, which uses multiple variables

Chi-square- a result analysis tool

Google Forms- a free service for data collection provided by Google

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## 1 INTRODUCTION

Since I am living in Finland, I have been intrigued by the timber constructions here. For me it was very interesting and new, because in my country, Poland, people are committed to the tradition of building houses out of bricks. According to research made by oferteo.pl in 2017, only 12% of Poles would like to build a timber house (Szafrńska, 2017).

In 2016, I had the opportunity to take part in Finlandia SPOT project. Its objective was to create a real Polish-Finnish collaboration center in Czerwonak (Poland). In order to encourage Finnish enterprises to enter Polish market, companies could use the opportunity of a market research made by Centria students. On Katarzyna Jämsä's request (project coordinator representative), I prepared a survey to find out about the wood houses demand on Polish market and its result is presented in this work.

The traditional construction material in Finland is timber. It is mostly because of the amount of wood resources (80% of the country's area is forest) and specific climate condition. The forest sector is the core of the Finnish economy. In Finland, timber construction trend developed in the 1930s. Finnish architects were influenced by the American style of building and developed their own way of uprising houses. The growing cost of employment encouraged entrepreneurs to search for solutions of industrial scale building out of the most popular and easily accessible raw material: wood. The design and methodology obviously have changed during the years. The Year 2011 and the modifications in Finnish building law, such as the permission for uprising timber constructions up to eight floors, brought wooden buildings to cities and developed this sector of industry. (Nordic Timber Council, 2012).

As mentioned above, the Polish market of timber construction is not developed yet. The most popular purpose of the existing wooden buildings is summer cottage. Poles mistakenly do not consider such constructions as sustainable and long lasting. In order to encourage citizens to take all advantages of wood as building material, Polish government and State Forests (pol. Lasy Państwowe) under Ministry of Environment auspice, introduced on September 2017 a project called "Polish wood houses- live in harmony with nature". The General Director of State Forests Konrad Tomaszewski highlighted that the idea was born according to flats and houses deficit on the market (number of available flats and houses is smaller than the demand), the high level of air pollutions and the low usage of renewable materials. The project follows the governmental strategy of responsible development. The government is planning to prepare a financial help program for revitalization of old, and construction of new timber buildings.

Jerzy Drabarczyk mentioned in the article on the official website of State Forests that the director declared that with the beginning of 2018, all invests of State Forests will be realized in wooden technology (Drabarczyk, 2017).

Currently over 100 wooden houses prefabricators and assemblers operate on the Polish market. There are also 10 factories able to produce 60 to 1000 timber houses annually, and around 100 middle-sized and small-sized manufacturers producing 10 to 20 houses yearly. However, most of production is exported. In 2016, only 600 all year wood constructions were built in Poland. We can realize the scope of the problem, when comparing the Polish results to the efficiency of the closest neighbors: the Czech Republic produces 2000 and Germany over 20 000 of such buildings annually. Artur Michalski, the vice director of National Fund of Environmental Protection and Water Management and Dariusz Grylak, the vice director of Bank of Environmental Protection, described the idea of financial support for wooden invests: not only special loan offers from banks, but also financial refunds will be possible to get, on condition that building have a certain energy efficiency standard. (Drabarczyk, 2017).

Log houses are a very interesting alternative for the traditional ones made of metal and concrete. In addition to the visual and esthetic advantages, wooden constructions are characterized by functionality and mobility and are environmentally friendly. The time and cost of the construction process are lower than when building out of brick. Wood is the greatest natural isolator, so a timber house can provide warmth in winter and is pleasantly cool in summer. The forecasted demand for houses made of round or rectangular logs in Poland is slowly, but constantly increasing. One of the key drivers for this phenomenon is popularization of bioeconomy- the modern concept of economy development focused on more responsible, more effective, and fuller utilization of renewable resources.

The increasing awareness and actions undertaken by the Polish government inspired me to study what kinds of expectations and preferences concerning wooden constructions Polish potential customers have. My goal was to create questions, which could possibly apply to all three market research purposes mentioned by Paul N. Hauge and Peter Jackson in *“Do your own market research”*:

- in objectives determination (f. ex. customers targeting, marketing and advertising goals)
- problem solving (like inability to answer for customers' expectations)
- company's development (f. ex. expanding offer) (Hague&Jackson 1987).

At the beginning of the thesis, a short description and an existing competitors' offer can be found. This thesis includes information about market research and its objectives as well as the methodology used



when preparing and analyzing the survey. The reader can find all questions had a place in questionnaire as well as results presented in graph form.

The most important sources used in this thesis were Ian Brace's book, "Questionnaire design- how to plan, structure and write survey material for effective market research" and Paul Hague's "A practical guide to market research" and "Do your own market research". The literature mentioned above helped me mainly at the beginning of my work, when gaining knowledge about effective questionnaire preparation and market research. When analyzing the results of the survey, I used John N. Taylor's book, "An introduction to error analysis", specifically chapter 12 "The Chi-squared test for a distribution".

## 2 MARKET RESEARCH

### 2.1 How to understand customers?

The best way to answer for customers' needs is to determine what are those and to understand them. Market research is the tool which helps enterprises to collect and analyze several types of data. The need for market research should and can appear at any moment of a firm's life, for example:

- when necessity for information appears
- when setting up the enterprise's objectives
- when looking for problem solutions
- when determining the ways and directions of company's development

Gathering and analyzing of data help to expedite professional decision-making processes and to reduce related risk. Paul N. Hauge and Peter Jackson have distinguished three types of market research application:

- a) objectives determination:
  - working out on sales goals through knowledge about the market size as well as the main existing and potential customers
  - determining the sales volume and profitability target
  - setting up the marketing goals
  - determining the long-term goals
- b) problems solving, f. ex.:
  - the inability to meet customers' expectations
  - low profitability
  - demand satisfaction ineptness
- c) company's development (Hague&Jackson, 1987, 11-23).

The figure presented below shows the classification of marketing research according to Naresh K. Malhotra (2014):

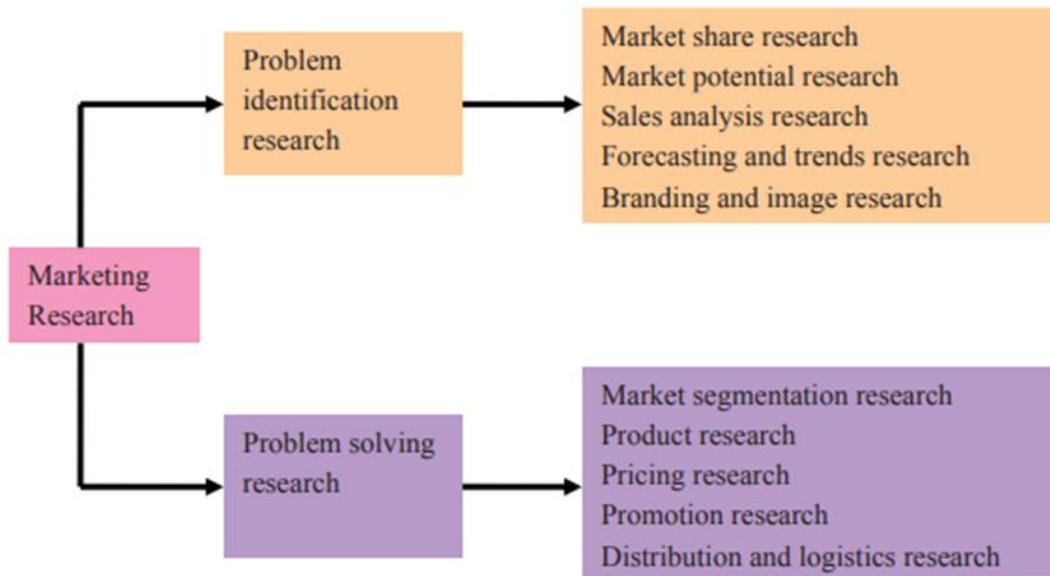


FIGURE 1. Classification of marketing research (adapted from Malhotra 2014)

Paurav Shukla (2008), referring to different scientific definitions, formulated the steps of marketing research process, which is presented in the figure below:

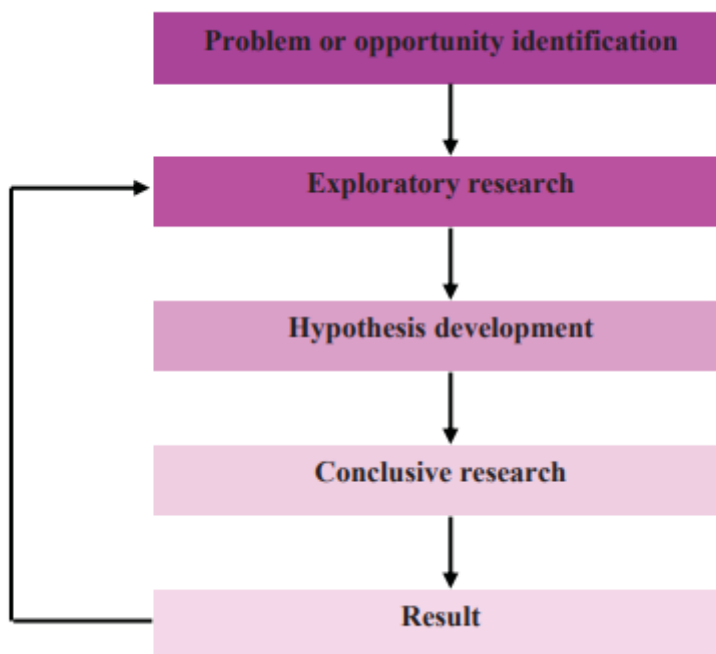


FIGURE 2. The marketing research process (adapted from Shukla 2008, 19)

The Skulka's steps of marketing process can be described as:

- Problem or opportunity identification: it is the initiation step, when the researcher should undertake the activities which allow to explore the chances or difficulties waiting for a company. The problem or opportunity must be defined to direct research and set up its objective: it helps to get knowledge about a specific area problem, to select team members and allocate their tasks.
- Exploratory research: it is classified as qualitative. Its' aim is to provide knowledge about the earlier defined problem or opportunity.
- Hypothesis development: It is the result of the previous stage, intensified by quantitative research, so a large sample is required.
- The conclusive research: Leads to the final results through analysis and data collation. (Shukla, 2008).

## 2.2 Need for clear market research objectives

It is necessary to define market research objectives because of one reason: to find out why market research is needed and what kind of knowledge is crucial to make test efficient and simply useful in latter decision making.

To check the correctness of the goals, the researcher should refer to George T. Doran's S.M.A.R.T. objectives theory:

- **S:** are the goals specific, clearly explained? Is the target area for improvement defined and understood? Can we name and describe what kind of information we want to achieve through market research?
- **M:** are our goals measurable? Will we be able to measure and execute accomplishment of the goals? What is the indicator of progress?
- **A:** "A" stands for assignable. Did we specify single persons and team tasks and responsibilities in order to achieve the goal?
- **R:** are the defined goals realistic to achieve?
- **T:** is the goal possible to achieve in given time limits? (Doran, 1981).

### 2.3 Quantitative and qualitative market research

Paul N. Hague (2006) discusses and compares the key issues of quantitative and qualitative research. Researcher should rethink and choose what kinds of tools will be satisfying for the needs of our market research:

TABLE 1. Comparison of quantitative and qualitative research on key issues (adapted from Hague 2006, 44)

QUANTITATIVE	ISSUES	QUALITATIVE
Relatively large (more than 200)	SAMPLE SIZE	Relatively small (less than 50)
Structured and standardized; mostly closed with some open ended	QUESTIONS	Unstructured or semi-structures; mostly open ended with some closed
Team often involved; re-search executive, data processing executive, fieldwork executives, field force	ADMINISTRATION	The design and the fieldwork and analysis are usually all handled by the re-search executive
Questionnaire, computer generated tables, statistical analyses	DATA CONVERSION TOOLS	Interview or discussion guide, audio or/and videotapes, notes, content/narrative analysis
Relatively high	REPLICABILITY/RELIABILITY	Relatively low
Relatively high	ACCURACY	Relatively low

Based on needs of the case of this thesis, I decided to use the quantitative method in the form of a questionnaire.

## 2.4 Market research tool: on-line questionnaire

The most important distinguished goal in this thesis was to achieve high reliability, which meant the largest possible number of answers. During the market research preparation, I was in Finland, so the question was how to reach Polish respondents while being abroad. The best solution was to distribute survey on the Internet.

The questionnaire was prepared In Google Forms because of its multiple advantages. Google Forms makes the questionnaire clear and easy to answer for respondents. Features, which make this survey a tool useful for the researcher are the ease of modification, distribution, data collection and the simple way of its transition into Excel, which helps in data compilation, analysis and presentation in the graphical form.

## 2.5 What is a questionnaire?

A questionnaire is one of the most common tools of customer survey. Quoting Ian Brace (2004) (*“Questionnaire design- how to plan, structure and write survey material for effective market research”*), questionnaire can be defined as *“A structured interview (...) in which each subject or respondent is asked a series of questions according to a prepared and fixed interviewing schedule”*. A questionnaire is prepared to gather specific information through its standardized form. Brace (2004, 4) conceptualized it as a “medium” between researcher and respondent. The major difference between a questionnaire and an interview is that during real, face-to-face interview the researcher can modify the questions according to the previously received answer. The fixed form of a questionnaire does not give such an opportunity. Therefore, it is extremely important to plan carefully the content of the and order as well as the form of answering which must provide the information the researcher is looking for.

## 2.6 How to prepare a good questionnaire?

### 2.6.1 Objectives

As mentioned before, the objective of a questionnaire is to gather information about the respondent. To make a questionnaire successful, we should analyze what exactly is the objective from each stakeholder's point of view and one must remember that a questionnaire is not only interaction between the researcher and the respondent. According to Brace (2004, 9), survey stakeholders are:

- The clients: people who commission the survey to achieve their business objectives
- The interviewers: people whose task is to perform a questionnaire in a way that allows to collect and analyze data
- Respondents: people, who are the source of information. They expect questionnaire to be clear, easy and fast to answer
- The data processors: responsible for processing data which must be extensive and clear enough to make its successful analyzes. (Brace, 2004).

I decided to focus on issues important from the potential producer's point of view. The existing and operating manufacturers should first understand who the customer is, hence the questions concerning the respondent's sex, age, employment and marital status, current housing conditions and preferable amount of invest.

At the time of designing the study, first the most important categories of timber houses interest examination were distinguished as well as possible aspects which will affect the desire to buy a home.

Then research on the construction technology, types of materials, wood and the style of building was carried out. Each category was expanded to several questions, and questions were added to facilitate the characteristics of the respondents, such as gender, age, the number of children, etc.

The distinguished categories are:

- Assessment of the overall impression, design
- Functionality
- Price
- Location
- Security
- Health, ecology
- Willingness to buy a home

One of the factors contributing to the choice of a wooden house is surely the visual aspect. Timber constructions designers and architects can present many different styles of house projects, so it is important to understand which type is the most attractive for Polish purchaser what the “average” Polish taste is. It is necessary to determine the purpose of a wooden house: is it going to be a summer cottage or a permanent residence?

The next meaningful factor is the preferable kind of material used in the process, as well as all dimensions (such as surface and the number of floors). It is also crucial to investigate where and in what kind of surroundings the client’s dream house would be constructed. Such knowledge about environmental and climate conditions helps to predict what kind of material quality will be necessary to make the useful life of a house as long as possible.

### **2.6.2 Types of questions**

According to Brace (2004,55-66), we can distinguish three groups of questions:

- open and closed: the respondent can answer in his/her own words or he/she must choose one or more from the suggested answers
- spontaneous and prompted: the respondents are asked to answer in their own words or with some options from which to choose the answer;
- open-ended and pre-coded: the respondent’s answer is recorded verbatim, or closed “pre-question” leads to an open, more detailed answer.

Due to the specification of the survey, only closed questions, partially with scale usage were chosen.

### **2.7 Market research analysis: hypothesis**

Hypothesis testing is one of the most popular forms of data interpretation used by market researchers. Quoting P. Shukla (2008, 102) “*hypothesis is empirically testable though, yet unproven statement developed in order to explain a phenomena*”. Hypothesis assumes that there is a possibility of existing correlation between two variables. A test proves whether the hypothesis is right or wrong.



Researchers should formulate two hypotheses. The first one is the so called null hypothesis, which declares that there is no relationship between the given variables. The second one, alternative hypothesis, states that a correlation between the factors exists: the objective of the hypothesis test is to prove that this dependency is not only a statistical error.

After the hypothesis formulation, the researcher must choose the proper testing technique, which serves best the needs of specific research. The figure shown below presents classification of univariate and multivariate techniques.

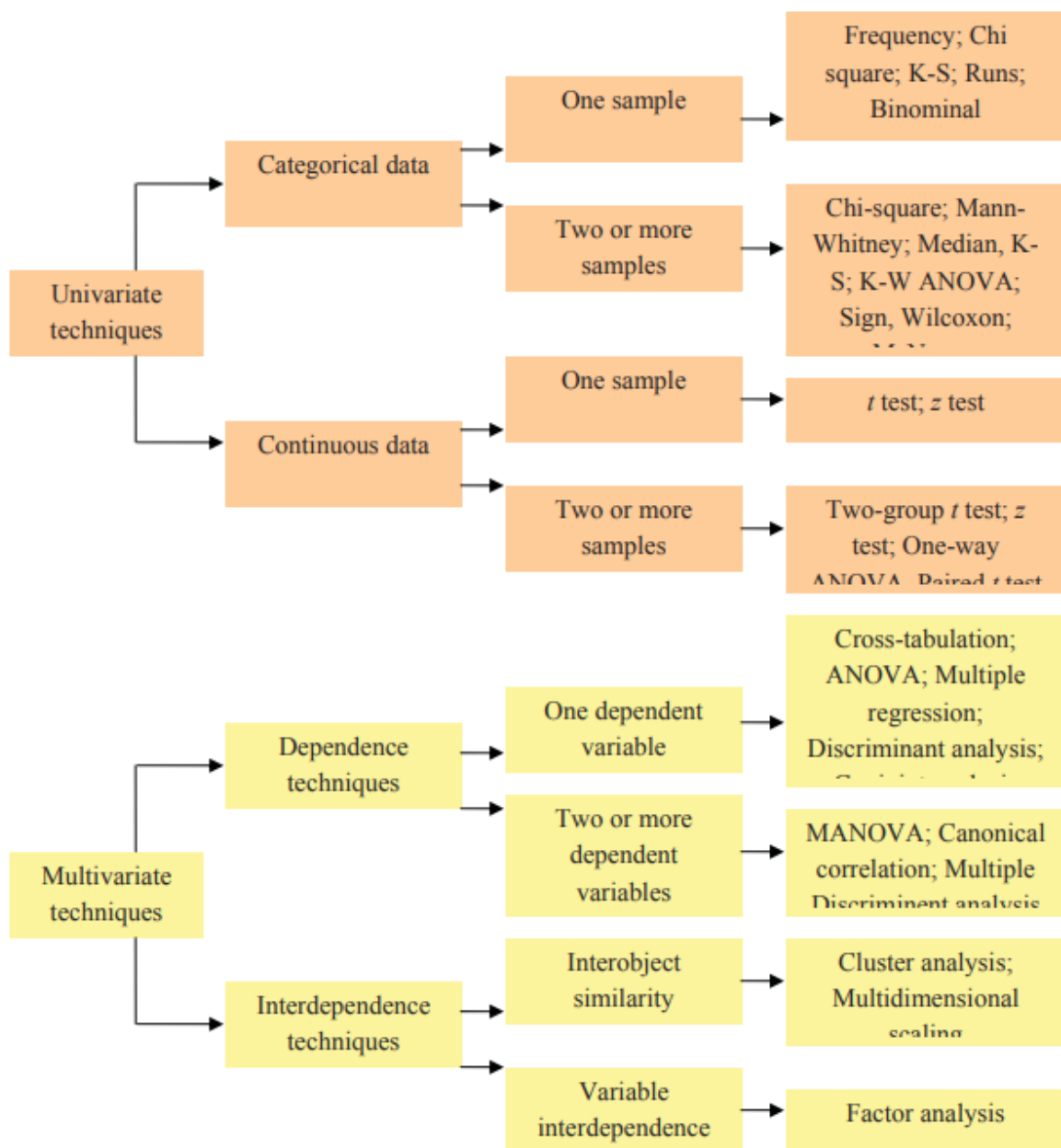


FIGURE 3. Classification of univariate and multivariate techniques (adapted from Shukla, 2008, 104)

The tool used in the analysis in this study is Chi-square, which tests the independency/dependency between variables. The Chi-squared test is commonly used to:

- measure dependencies between criteria
- test the relationship between variables (contingency tables)
- The study of sample variance Website: ([statisticshowto.com/probability-and-statistics/chi-square](http://statisticshowto.com/probability-and-statistics/chi-square), 2018.)

### **3 ABOUT SURVEY**

In this study, the potential customers' expectations and impressions about timber houses were surveyed. Attention was paid to aspects such as functionality, security, visual experience and price.

An on-line questionnaire was posted through social media such as Facebook and Twitter as well as e-mail. The goal was to receive the minimum of 400 answers. Due to fact that I was interested in Poles' answers, the questionnaire was made in the Polish language. The respondents were Polish men and women older than 18 years old.

The survey was published on the Internet in April 2016. The period of gathering answers was 2 months. The questionnaire was made in Google Forms and mailed on-line to respondents. It contained eighteen questions: six closed questions concerning information about respondents and twelve concerning their expectations about timber houses. Four out of them contained scale (in order to achieve the judgement of visual expression) and eight had closed form. After the collecting period, the answers were exported to Excel sheet. The final number of answers was 508. The answers' dispersion is presented in graph-forms.

## 4 SURVEY RESULTS

### 4.1 The main questions concerning the topic

The first part of questions considers physical aspects of a wood houses such as type of material (in this case round logs, even-cut down logs, timber logs), architectural style (traditional or modern), wood species, type of heating system and general purpose of such a construction. Questions considering dimensions also can be found. Answers given by the respondents are indicator and suggestion for potential producer about Poles' preferences and expectations which should be possibly applied to the projects.

#### 4.1.1 Question 1: How do you like the visual aspects of a house made of round logs?



PICTURE 1. A house made of round logs. Website: ([forest-comfort.com](http://forest-comfort.com), 2016.)

The scale for answers 1-5, where 1 meant 'I do not like it' and 5 meant 'I like it a lot'

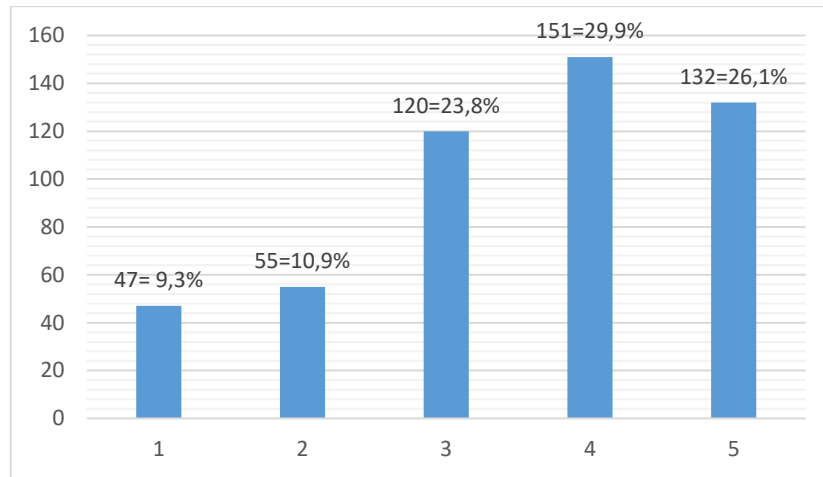


FIGURE 4 . Evaluation of visual impression of round log houses

From the chart we can see that 56% of respondents liked the design of a house made of rounded logs. Around 20% of respondents said that they do not like the visual aspects of the presented house. The design showed on the picture is very similar to Polish highland style, which is very popular in the southern part of the country. For Poles it is sentimental reminiscent of coziness and folklore that is why it causes big amount of positive answers.

#### 4.1.2 Question 2: How do you like the visual aspects of even-cut down and wood log houses?



PICTURE 2. House made out of even-cut down logs. Website: (ownwoodenhouse.com, 2017.)



PICTURE 3. House made of even-cut down logs. Website: (nerospost.wordpress.com, 2017.)

The scale for answers 1-5, where 1 meant 'I do not like it' and 5 meant 'I like it a lot'

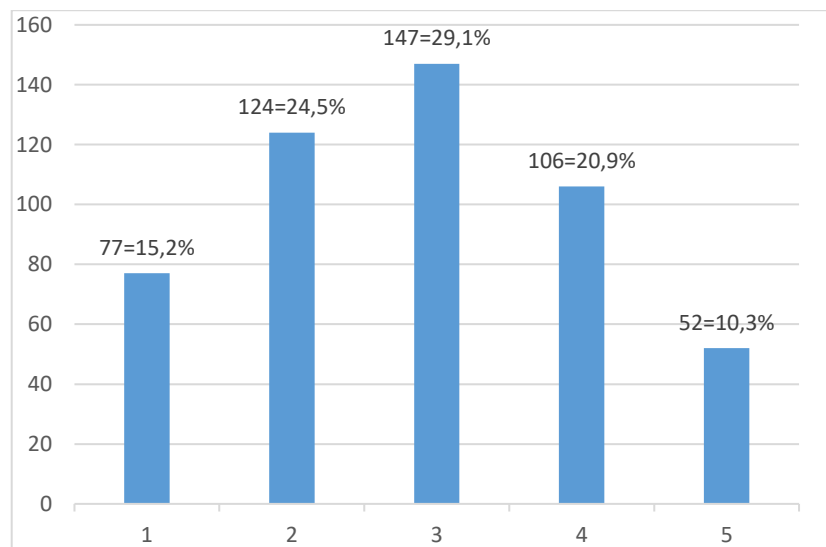


FIGURE 5. Evaluation of the visual impression of even-cut down houses

In the figure above, we can see that Poles were not as enthusiastic about even-cut down logs as they were about rounded logs. Only a little more than 30% of the respondents truly liked this design, and 40% of them do not appreciate such a look.

#### 4.1.3 Question 3: How do you like the modern style of log and timber houses?



PICTURE 4. A modern style timber house. Website: (adapted from: dluxeinternacional.com, 2017.)



PICTURE 5. A Modern style timber house. Website: (trendir.com, 2018.)

The scale for answers 1-5, where 1 meant 'I do not like it' and 5 meant 'I like it a lot'

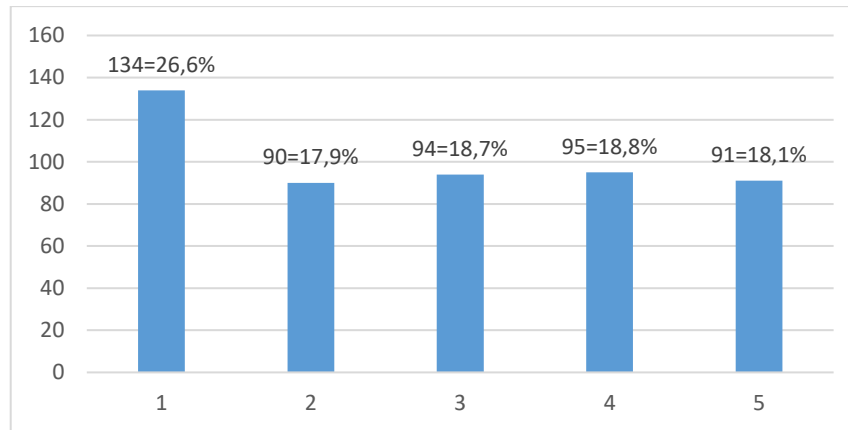


FIGURE 6. Evaluation of the visual impression of modern-style timber houses

In the figure we can observe that number of each answer is similar (18-19%), but number 1 was selected by the highest number of respondents. It means that potential Polish customers are not honestly convinced by the composite of timber and modern architecture. We can predict a growing interest in modern style during the coming years, according to world-wide trends on the market.

#### 4.1.4 Question 4: How do you like the visual aspects of traditional style log and wooden houses?



PICTURE 6. A traditional style timber house. Website: (allegro.pl, 2017.)





PICTURE 7. A traditional style timber house. Website: ([aledomydrewniane.pl](http://aledomydrewniane.pl), 2017.)



PICTURE 8. A traditional style timber house.. Website: ([domywstylu.pl](http://domywstylu.pl), 2017.)

The scale for answers 1-5, where 1 meant 'I do not like it' and 5 meant 'I like it a lot'

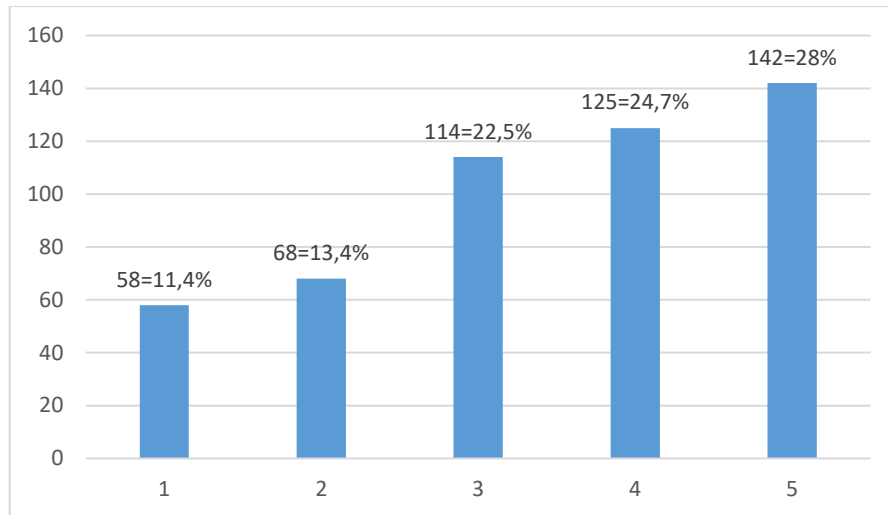


FIGURE 7: Evaluation of visual impression of traditional style timber houses

The Polish fondness to the traditional design of the house is clearly visible in the results. Answers 3, 4 and 5 were chosen by around 75% of the respondents.

#### 4.1.5 Question 5: Preferred number of floors

The figure shows the respondents' answers for the question about the preferred number of floors. The vast majority of the respondents selected "2 decks" as the most satisfying. Surprisingly only 9% of the potential customers were interested in 1 floor house. It is the opposite of the Finnish style of constructing earthbound houses.

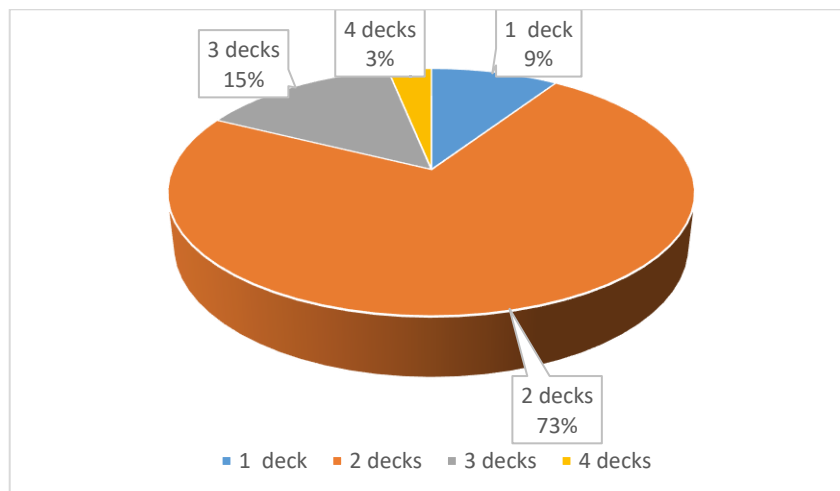


FIGURE 8. Preferred number of floors

#### 4.1.6 Question 6: Size of the house

Half of the respondents liked better 121-200 square meter house. The alternative “61-120 square meters” was chosen by 36%. It means that Poles prefer cozy and spatial surfaces, but they do not have the tendency to build residences, which would be too expensive to maintain.

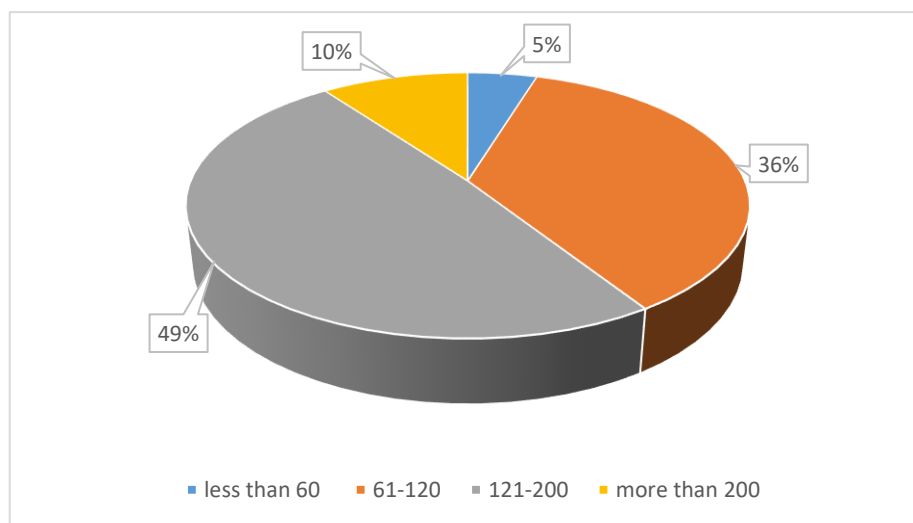


FIGURE 9. Preferred size of the house in square meters

#### 4.1.7 Question 7: Preferred wood species

We can see in the figure that 34% of the respondents would like to build house out of pine. Pine is the most popular and the cheapest kind of wood from all those mentioned in the question. Altogether 22% of the respondents selected larch, which is the most expensive but also the longest lasting construction material. Those people are ready to pay more in order to achieve the highest quality and the ease of maintenance, which is minimal in this case. Equally, 17% chose fir and spruce as the favored kind of wood. The remaining 10% would be interested in other kind of wood.

Unfortunately, the reliability of given answers is questionable, because the average respondent's knowledge about differences between the given timber species is not sure.

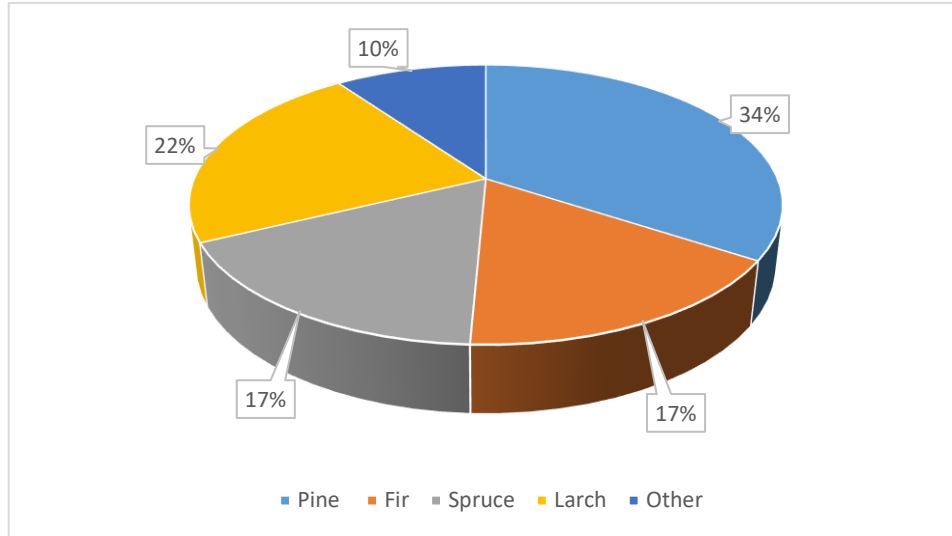


FIGURE 10. Preferred wood species

#### 4.1.8 Question 8: Purpose of the timber house

According to presented answers, we can deduce that the majority (56%) of the respondents would like to use a wooden house as their permanent residence. A total of 20% of the respondents would like to spend between 3-6 months in their timber house, and 15% of them said about less than 3 months period annually. It means that it would be typically a summer/holiday house, or for example the second house for people who live and work in two different cities.

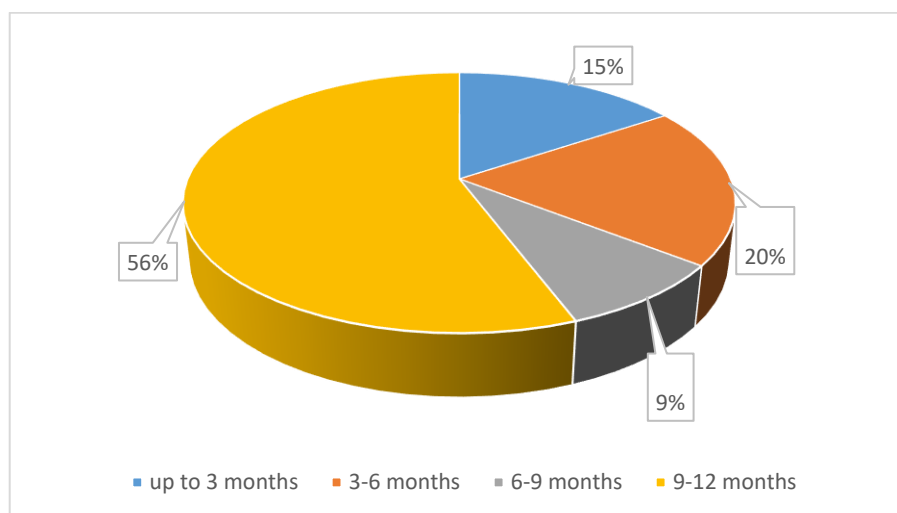


FIGURE 11. Purpose of the timber house

#### 4.1.9 Question 9: Environment nearby the house

The figure shows the respondent's answers about the preferred environment around the house. Forest, village and suburbia are the most often selected alternatives (all together 89%). The result concerns the nature of the house ownership. It is normal that the prices of the ground in the city areas are very high and that quiet, sometimes even wild environment around house increases the general comfort of living. From the listed environments, forest was the most popular.

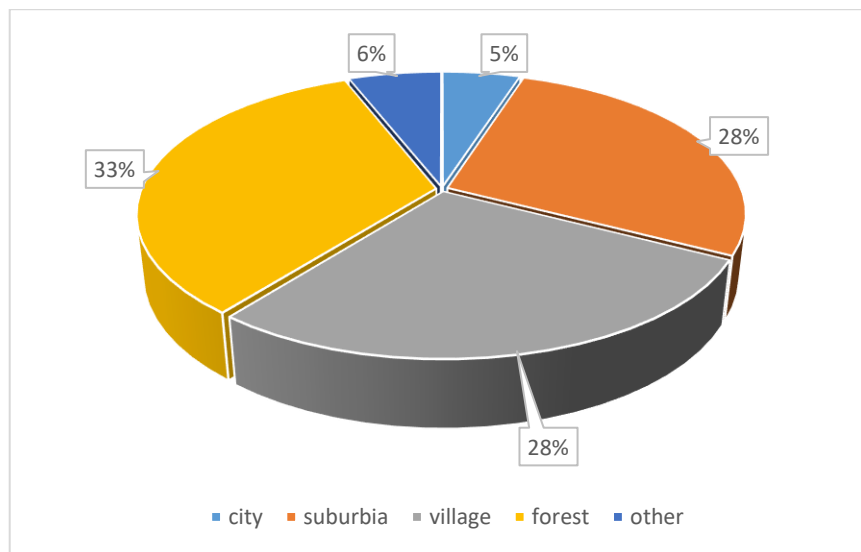


FIGURE 12. Environment nearby the house

#### 4.1.10 Question 10: Preferred region of Poland

As shown in the figure, 40% of respondents considered southern part of Poland to be the best for having A wood house. As mentioned before, timber constructions are in the Polish culture highly associated with high-land culture and folklore. Lake region was the second choice of the respondents.

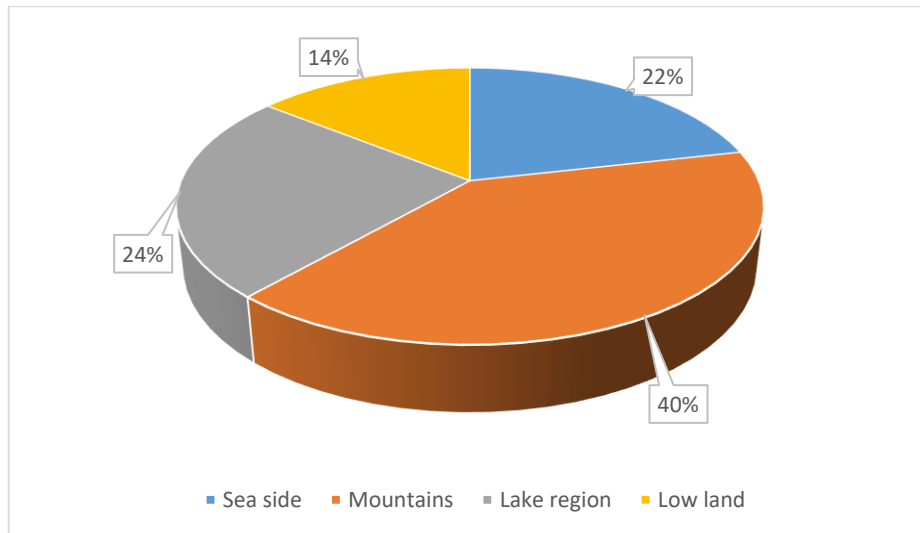


FIGURE 13. Chosen region of Poland

#### 4.1.11 Question 11. The type of heating system

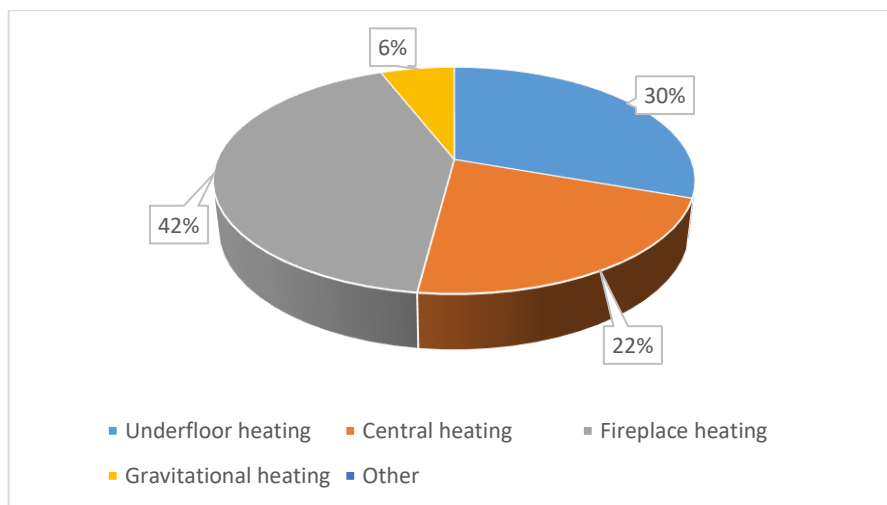


FIGURE 14. Preferred type of heating system

The figure shows respondents' answers about the preferred type of heating system. As we can see in the figure, 42% of the respondents prefer fireplace heating. The second choice was underfloor heating and the third central heating system. Gravitational heating system does not interest people.

#### 4.1.12 Question 12: Price of a timber house

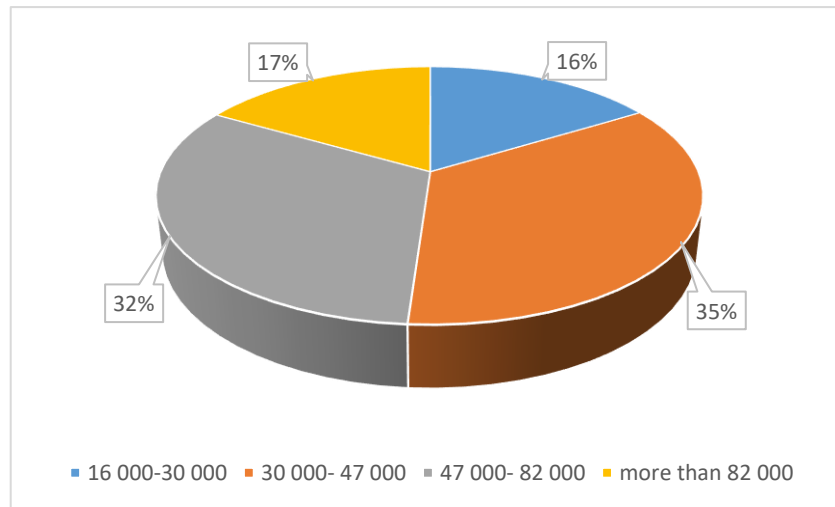


FIGURE 15. Preferred amount of investment

Figure shows respondents' answers about the preferred price of a wood/log house (currency-euro). As presented in the figure, the majority of potential customers (35%) would be ready to pay 30-47 thousand Euros for a wood house. A similar number of respondents (32%) is prepared to invest more: 47 000-82 000 euros. Only 17% of respondents could pay for a timber house more than 82 000 euro.

## 4.2 Background questions

In this part of questionnaire, I was asking questions about data directly considering respondents: about their sex, age, marital status etc. Answers provide the knowledge about who is the respondent.

### 4.2.1 Question 13: Respondents' sex

Of the respondents 6% were women and 40% were men.

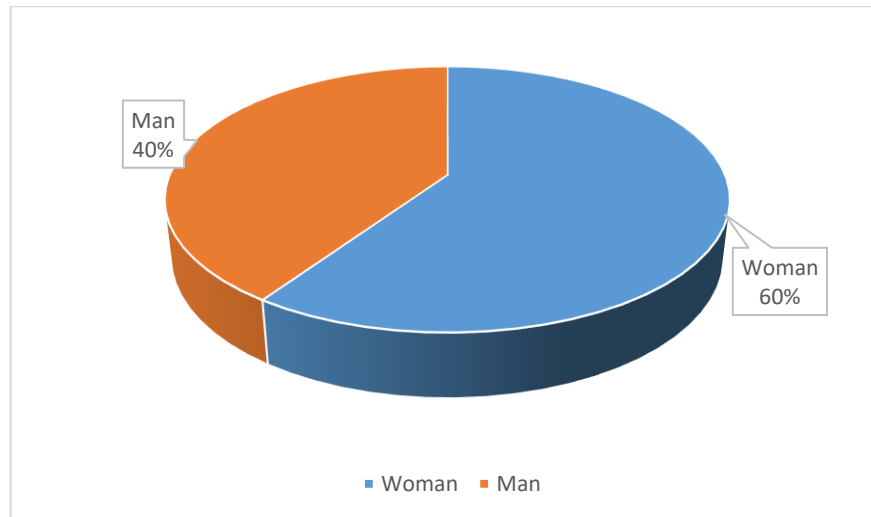


FIGURE 16. Respondents' sex

#### 4.2.2 Question 14: Respondents' age

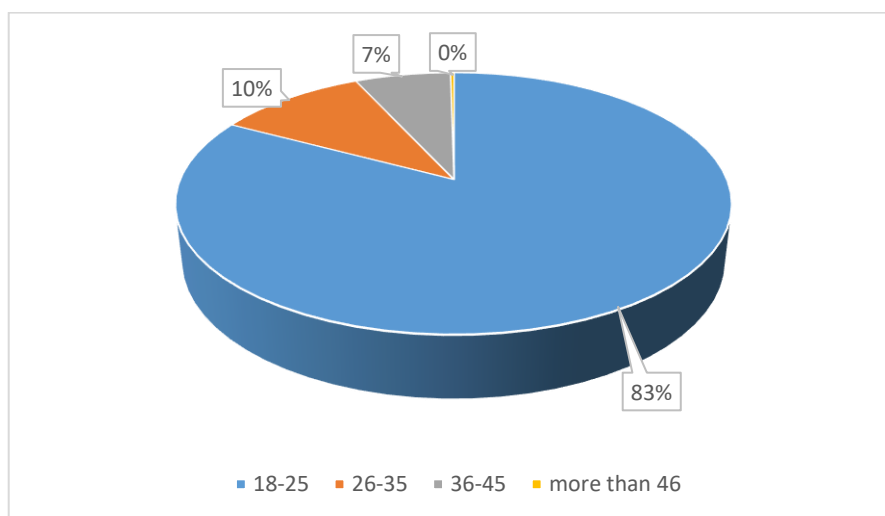


FIGURE 17. Age of the respondents

The figure shows the age of the respondents. Altogether 83% of them were between 18 and 25 years old. Such a result is explained by the distribution channels that were used, when conducting the survey. I believe that the high representation of young respondents was good for the survey from the producer point of view. The young generation is the one who will be building houses and starting families during the coming 10 years, so it is good to know their needs, expectations, preferences and possibilities.



### 4.2.3 Question 15: Employment conditions

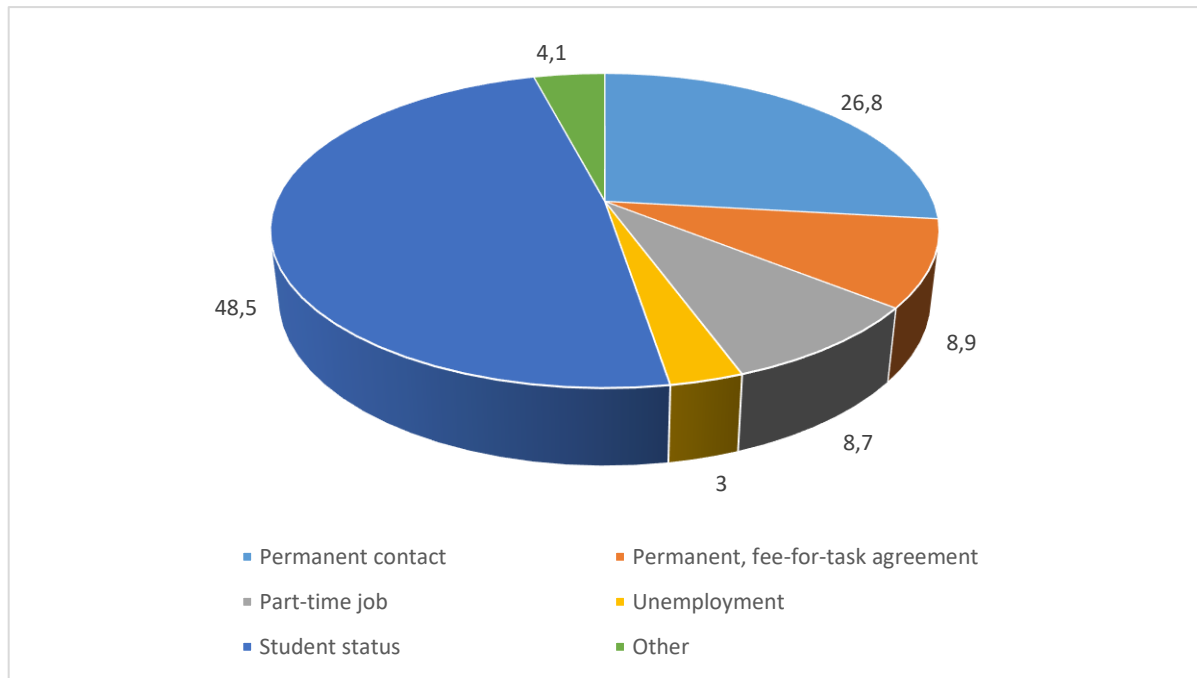


FIGURE 18. Employment conditions

According to the figure above, almost half of respondents were students. Altogether 26,8% of respondents had a permanent employment contract, 8,9% fee-for-task agreement and another 8,7% a part-time job. Only 3% of the respondents were unemployed.

**4.2.4 Question 16: Number of children**

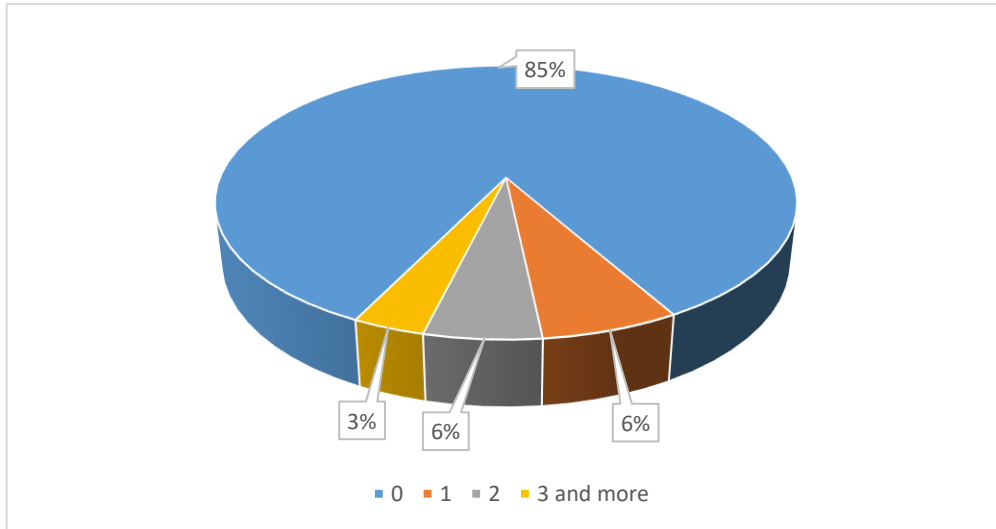


FIGURE 19. Number of children

Figure represents the number of respondents’ children. Due to young age of respondents 85% of them does not have children. Only 15% of respondents has one or more children.

**4.2.5 Question 17: Relationship status**

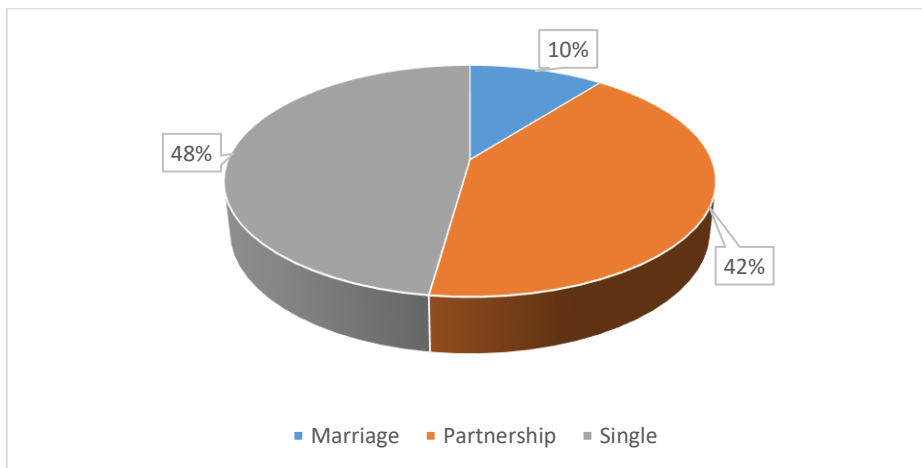


FIGURE 20. Relationship status

Figure presents the status of respondents’ relationship. Almost half, 48% of the respondents were in non-official relationship, 42% of them were single, and just 10% were married.

#### 4.2.6 Question 18. Current place of living

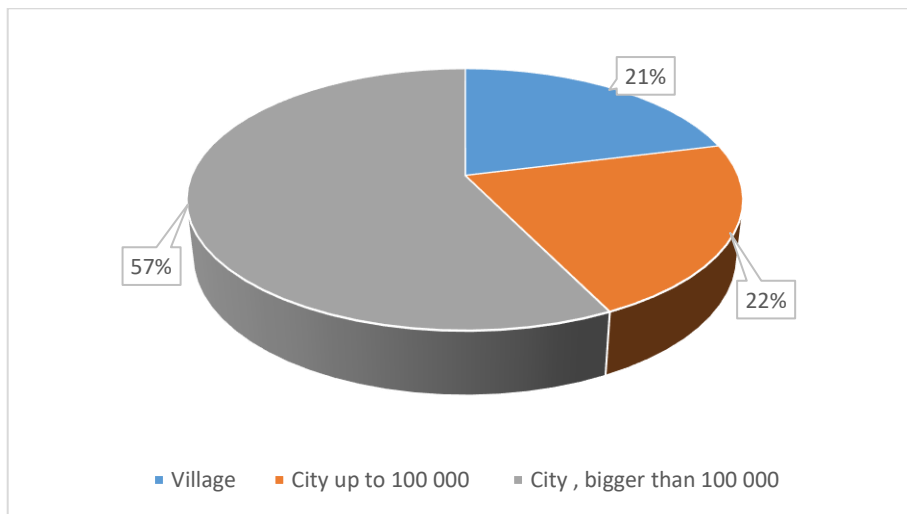


FIGURE 21. Current place of living

As we can see in figure above, 57% of respondents live currently in a city bigger than 100 000 inhabitants, 22% of them live in a city with up to 100 000 citizens and 21% live in village areas.

## 5 CONCLUSIONS

To sum up, all together 508 respondents took a part in the questionnaire, which was shared on the Internet (prepared in Google Forms, distributed through social media and e-mail).

The majority of respondents were women (59,5%), by contrast of 40,5% men. The greater number of respondents were 18-26 years old (78,9%). The reason of this result was the fact that questionnaire was shared through the Internet and it reached mostly students. The smallest number of respondents was of the age 46 and more (4,9%). Similar situation is in occupation field: the majority declare, that they are still studying (48,5%). The second biggest group of the respondents were people with full-time work contracts (26,8%). Almost 85% of respondents do not have any children. Only 15% of them has one or more children. More than 57% of respondents live in a big city (more than 100 000 residents), 21,1% live in a village and 21,7% live in a city with up to 100 000 residents.

Respondents prefer round log houses over cut-even log constructions: more than 55% chose the alternative 4 or 5, which means that such a house looks very attractive for them. Modern style of wooden houses does not seem to for Polish people. Only around 18% of respondents chose 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> or 5<sup>th</sup> degree of visual satisfaction (according to the scale given in the question). The alternative number 1 (I do not like it) was chosen by more than 26,6% of the respondents. The traditional style seems like be very attractive for the Polish respondents. Around 75% chose the alternatives 3, 4 and 5 which means that they are very interested in this kind of architecture.

The majority (75%) would like to have two floors in their houses. It is the most popular kind of a house, because it includes the basement and ground floor or the ground floor and first floor. In the question concerning the house size, the majority of respondents chose 121-200 square meters (49%) and 61-120 square meters (36,2%). When it comes to the question concerning preferred wood species, the answers were very equal. The most popular was pine (34,2%). More than 55% the respondents would like to spend 9-12 months per year in their dream wooden house. Around 20% would like to live there 3-6 months a year.

The surroundings of house are a very important element. The dream environment for the respondents was forest (33,4%), village (28%) and suburbia (27,6%). Only 5% chose the alternative "in the city". The Respondents were asked to choose region of Poland, where they would like to have their house. Altogether 40,1% of them preferred to place it in the mountains, and 24,2% in the lake region. A total

of 21,4% of the respondents wished to have such a house on the sea side and 14,3% on lowland. The heating system is very important part of house: the majority of the respondents chose fireplace heating (40,7%). The second popular was the floor-heating system (29,4%). A very interesting element was the question about the preferred price of the dream timber house. The answers were very diversified, and they depended on the respondent's age, economy and employment situation. The majority chose the ranges of **30 000- 47 000** (34,8%) and **47 000-82 000** euro (32,2%).

## 6 ANALYSIS: CHI-SQUARE TEST

Chi-square statistic (the full name “Pearson’s Chi-Square Test for Independence”) is the tool commonly used to analyze questionnaires. Discovering the dependencies between variables is important, if we want to find and understand correlation between some factor or condition and decision (in this case, the answer in the questionnaire). Hence, I decided to test three relationships: between the status of relationship and the preferred location of a wooden house, between the age and the preferred price of a timber construction and between the age and the house location.

The first step in the Chi-square test is to state two hypothesis, so called null hypothesis and alternative hypothesis. Null hypothesis always says that there is no relationship between variables and alternative hypothesis states that dependency between given variables exists. The second step is to create contingency table, where the number of answers in two correlated factors can be found. This type of collation of frequency distribution does not present yet the actual dependencies between factors. The third step is to create table of values in statistical test.

In order to confirm the right of the Chi-square test statements, C-Pearson’s coefficient was used. It is reliable when working with large sample of responds. It is a coefficient of association that tells whether two factors are independent or dependent on each other. It is based on Chi-squared statistics, so it does not exist without knowledge about Chi-square value. If the result is close or equal to zero, the researcher can state that there is no dependency between variables. If the result number is higher, then researcher can assume that such a dependency exists. The third test used in this thesis is ”Cramer’s V Correlation”, which is similar to the C-Pearson’s coefficient. the result of the test is always located between 0 and 1, where following results means:

TABLE 2. Meaning of the Cramer’s V Correlation results

0,25-1	very strong relationship
0,15-0,24	strong relationship
0,11-0,14	moderate relationship
0,06-0,10	weak relationship
0,01-0,05	no existing relationship

## 6.1 First test: the connection between the kind of relationship and the preferred house location

Hypothesis and assumptions:

- a) There is no dependency between the kind of relationship and the preferred house location
- b) There is dependency between the kind of relationship and the preferred house location
  - $Df = (3 - 1) * (5 - 1) = 8$  (degrees of freedom)
  - $A = 0,05$  (Alpha ratio)

1. Equations

- $$\chi^2 = \sum_{i=1}^r \sum_{j=1}^c \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$
- $$E_{ij} = R_j * \frac{C_j}{n}$$

Where:

$\chi^2$ -chi-squared

$O_{ij}$ - amount of values in specific interval

$E_{ij}$ - number of units, which should be in specific interval

$R_j$ - sum of the rows

$C_j$ - sum of columns

$n$ - number of answers

TABLE 3. Table shows the number of answers in two correlated factors for test number 1

	LOCATION PREFERENCES					RESULT
	City	Suburbs	Village	Forest	Other	
KIND OF RELATIONSHIP						
Marriage	2	17	22	12	3	<b>56</b>
Civil-partnership	10	58	58	71	12	<b>209</b>

no relationship	13	64	63	88	15	<b>243</b>
<b>RESULT</b>	<b>25</b>	<b>139</b>	<b>143</b>	<b>171</b>	<b>30</b>	<b>508</b>

TABLE 4. Table shows values in the first statistical test

	LOCATION PREFERENCES				
	City	Suburbs	Village	Forest	Other
KIND OF RELATIONSHIP					
Marriage	2,76	15,32	15,76	18,85	3,31
Civil partnership	10,29	57,19	58,83	70,35	12,34
No relationship	11,96	66,49	68,40	81,80	14,35

Results and conclusions

For:

df=8

Alpha= 0,05

critical value is 15,51

$\chi^2 = 6,533$

CONCLUSION: the value of the statistical test is 6,533 and is smallest than critical value of chi-squared for  $\alpha=0,05$  and  $df= 8$  (15,51). We can assume that hypothesis that there is no connection between the kind of relationship and the house location preferences is right.

## 2. C-Pearson's coefficient

$$C = \sqrt{\frac{\chi^2}{n + \chi^2}}$$

Where:

C= contingency coefficient

$\chi^2$ = chi-square statistic



$n$ = total number of cases or observations in our analysis/study

$$C = \sqrt{\frac{x^2}{n + x^2}} \Rightarrow C = \sqrt{\frac{6,53}{508 + 6,53}} = 0,113$$

CONCLUSION: The force of dependency between two variables is in 0-0,24 interval, so it is weak. It means that there is no significant dependencies between kind of relationship and preferred house location.

### 3. Cramer's V Correlation

$$V = \sqrt{\frac{x^2}{n(k-1)}}$$

Where:

$x^2$ = chi-square statistic

$n$ = total number of cases or observations in our analysis/study

$k$ = number of columns

$$V = \sqrt{\frac{x^2}{n(k-1)}} \Rightarrow V = \sqrt{\frac{6,53}{508(3-1)}} = 0,08$$

CONCLUSION: Ratio value is in <0;1> interval, so it is weak- value closer to 0. It means that there are no significant dependencies between kind of relationship and preferred house location

## 6.2 Second test: Connection between the age and the preferred price of a house

1. Hypothesis:

- a) there is no connection between the respondent's age and the preferred price of a log house
- b) there is connection between the respondent's age and the preferred price of a log house
  - $Df = (4 - 1) * (4 - 1) = 9$
  - $A = 0,05$  (Alpha ratio)

2. Equations:

- $$\chi^2 = \sum_{i=1}^r \sum_{j=1}^c c \cdot \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$
- $$E_{ij} = R_j * \frac{C_j}{n}$$

Where:

$\chi^2$ -chi-squared

$O_{ij}$ - amount of values in specific interval

$E_{ij}$ - number of units, which should be in specific interval

$R_j$ - sum of the rows

$C_j$ - sum of columns

$n$ - number of answers

TABLE 5. Table shows the number of answers in two correlated factors for the second test.

AGE	PRICE PREFERRATION (currency-euro)				RESULT
	16 000- 30 000	30 000- 47 000	47 000- 82 000	more than 82 000	
18-25	70	131	122	78	401
26-35	5	28	12	5	50

36-45	8	9	15	0	32
more than 46	1	8	13	3	25
RESULT	84	176	162	86	508

TABLE 6. Table shows values for the second statistical test

AGE	PRICE PREFERRED (currency- euro)			
	16 000- 30 000	30 000- 47 000	47 000- 82 000	more than 82 000
18-25	66,31	138,93	127,88	67,89
26-35	8,27	17,32	15,94	8,46
36-45	5,29	11,09	10,20	5,42
more than 46	4,13	8,66	7,79	4,23

### 3. Results and conclusions

For:

df=9

Alpha= 0,05

critical value is 16,919

$\chi^2 = 28,11$

CONCLUSION: The value of the statistical test equals 28,11 and is higher than the critical value of chi-squared for  $\alpha=0,05$  and  $df= 9$  (16,919). Based on this, the hypothesis that dependency between the age and the preferred price of timber house exists is true.

### 4. C-Pearson's coefficient

$$C = \sqrt{\frac{x^2}{n + x^2}}$$

Where:

C= contingency coefficient

$x^2$ = chi-square statistic

n= total number of cases or observations in our analysis/study

$$C = \sqrt{\frac{x^2}{n + x^2}} \Rightarrow C = \sqrt{\frac{28,11}{508 + 28,11}} = 0,229$$

CONCLUSION: The Dependency force between the two variables is in 0- 0,24 interval, which means that it is weak. In comparison to the first test, it is a little stronger.

## 5. Cramer's V Correlation

$$V = \sqrt{\frac{x^2}{n(k - 1)}}$$

Where:

$x^2$ = chi-square statistic

n= total number of cases or observations in our analysis/study

k= number of columns

$$V = \sqrt{\frac{x^2}{n(k - 1)}} \Rightarrow V = \sqrt{\frac{28,11}{508(4 - 1)}} = 0,43$$

CONCLUSION: The value of the ratio is in interval <0;1>. The dependency between the variables is median: the value is closer to 0 than to 1, but it is almost in the middle of the scale. It means that there is existing strong dependency between variables.

### 6.3 Third test: Dependency between the age and the preferred location of a wood house

#### 1. Hypothesis:

- a) there is no dependency between the age and the preferred location of a log house
- b) there is dependency between the age and the preferred location of a log house

- $Df = (4 - 1) * (7 - 1) = 18$
- $A = 0,05$  (Alpha ratio)

#### 2. Equations:

- $\chi^2 = \sum_{i=1}^r \sum_{j=1}^c \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$
- $E_{ij} = R_j * \frac{C_j}{n}$

Where:

$\chi^2$  -chi-squared

$O_{ij}$ - amount of values in specific interval

$E_{ij}$ - number of units, which should be in specific interval

$R_j$ - sum of the rows

$C_j$ - sum of columns

$n$ - number of answers

TABLE 7. Table shows the number of answers in two correlated factors

PREFERRED LOCATION	AGE				RESULT
	18-25	26-35	36-45	more than 46	
Suburbs	102	19	10	7	138
Village	106	11	8	12	137
Seaside	6	1	1	1	9
Lake-land	21	1	0	0	22
High-land	6	1	0	0	7
City	22	4	2	2	30
Forest	136	13	11	3	163
<b>RESULT</b>	<b>399</b>	<b>50</b>	<b>32</b>	<b>25</b>	<b>508</b>

TABLE 8. Table shows the values in the statistical test

PREFERRED LOCATION	AGE			
	18-25	26-35	36-45	more than 46
In the suburbs	108,81	13,63	8,72	6,81
In the village	108,02	13,53	8,66	6,76
On the seaside	7,09	0,88	0,56	0,44
Close to lake	17,34	2,17	1,39	1,08
In the mountains	5,51	0,69	0,44	0,34
In the city	23,65	2,96	1,89	1,48
In the forest	128,53	16,10	10,30	8,05

### 3. Result and conclusion

For:

df=18

Alpha= 0,05

critical value is 28,87

$\chi^2 = 18,30$

CONCLUSION: The statistical value is 18,30 and it is smaller than the critical value for  $\alpha=0,05$  and  $df=18$  (28,87). It means that there is no dependency between the age and the preferred location of the log house.

### 4. C-Pearson's coefficient

$$C = \sqrt{\frac{\chi^2}{n + \chi^2}}$$

Where:

C= contingency coefficient

$\chi^2$ = chi-square statistic

n= total number of cases or observations in our analysis/study

$$C = \sqrt{\frac{\chi^2}{n + \chi^2}} \Rightarrow C = \sqrt{\frac{18,30}{508 + 18,30}} = 0,186$$

CONCLUSION: The dependency force between the two variables falls in 0- 0,24 interval, which means that it is weak. Compared to the first test it is a little stronger.

### 5. Cramer's V Correlation

$$V = \sqrt{\frac{\chi^2}{n(k-1)}}$$

Where:

$\chi^2$  = chi-square statistic

n = total number of cases or observations in our analysis/study

k = number of columns

$$V = \sqrt{\frac{\chi^2}{n(k-1)}} \Rightarrow V = \sqrt{\frac{18,30}{508(4-1)}} = 0,0028$$

CONCLUSION: The ratio value is in <0;1> interval, so it is weak. It means that there are no dependencies between age and preferred wooden house location.



## 7 COMPETITION ON POLISH MARKET

There is a range of companies building wooden and log houses in Poland, so competition is quite hard. All of them are already competing between each other, trying to offer the best possible prices, quality and time of project realization. A major part of them has in offer ready projects to buy without possibility of customization, with defined pricing. The below chapters present the most popular wooden and log houses producers in Poland.

### 7.1 Honka

Honka is a Finnish producer of wooden and log houses, which model's projects in the Finnish style. The most competitive advantage of this firm is wood out-sourcing. Materials are imported from Finland, which means the high quality of material. Due to this fact, the prices are also relatively higher than those of Polish producers. Honka constructs projects in modern and traditional style, and each project can be developed and changed according to customer requirements and vision. Findrewno Sp. z o.o. is the executive producer in Poland.

TABLE 9. Honka's offer. Website: (honka.pl, 2017.)

TYPE	MODEL	SIZE (squared meters)	MATERIAL PRICE	REALIZATION PRICE
Classic	Kessa	90	89 373 EUR	16 495 EUR
Classic	Kessa	100	92 968 EUR	17 082 EUR
Classic	Kessa	110	98 164 EUR	17 975 EUR
Classic	Taalko	110	100 796 EUR	18 113 EUR
Classic	Taalko	120	111 622 EUR	19 874 EUR
Classic	Taalko	130	121 258 EUR	20 943 EUR
Modern	Melka	90	93 797 EUR	16 920 EUR
Modern	Melka	100	100 243 EUR	18 203 EUR
Modern	Melka	110	107 238 EUR	19 187 EUR
Modern	Jarve	110	108 460 EUR	20 427 EUR
Modern	Jarve	120	117 160 EUR	21 392 EUR

Modern	Jarve	130	122 890 EUR	22 039 EUR
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The materials that Honka offer include:

- External wall and massive interior made from log RLL 230 (round log, diameter 230mm, made of two elements (Classic type) and log MLL 182 (rectangular log: width: 182mm, height: 260mm, made of 6 elements).
- Wireframe walls fagged by g-k x2 board
- Roof truss with rafters 58\*220 mm
- Full skis above isolated part of roof, panel above eaves.
- Wind protection and counter battens.
- Roof thermal insulation Steico Flex 200 + 50 mm, damp barrier systems, interior soffit
- Internal and external woodwork
- Terraces (corrugated boards dried and impregnated by pressure; beams dried and impregnated by pressure)
- External impregnation and internal waxes
- Combining materials (screws, nails etc.)
- Transportation: Finland- Warsaw (each 100km extra= 200 EUR), according to information on [www.honka.pl](http://www.honka.pl)

## 7.2 Skibiński wood houses

Wooden houses producer, SKIBISKI, is a family company with a long, 20-years tradition and experience. It cares about the quality of service and customer's satisfaction. SKIBINSKI company works with respect for natural environment. The firm's price list for specific projects is available on its web site and it was used to present examples shown below.



PICTURE 9. Example of Skibiński's timber house project. Website: ([domyskibinski.pl](http://domyskibinski.pl), 2017.)

Project above presents 94 meters squared the wooden house, which includes living room, kitchenette, dining room with fireplace, two bathrooms, wind catcher with wardrobe, two bedrooms.

Price of this house is 29 500 euros + VAT.



PICTURE 10. Example of Skibiński's timber house project. Website: ([domyskibinski.pl](http://domyskibinski.pl), 2017.)

On the picture below, you can see 151 meters squared timber house. Interior includes six rooms (three of them with balcony), two bathrooms, kitchenette, wind catcher, boiler house, living room with fireplace. Cost of project realization is around 41 000 euros + VAT.



PICTURE 11. Example of Skibiński's timber house project. Website: ([domyskibinski.pl](http://domyskibinski.pl), 2017.)

Picture above presents big timber house (more than 321 meters squared. Living room with dining room and kitchen, pantry, wind catcher, six rooms and two bathrooms are creating area of the house.

Price is 58 411 euro + VAT.

### 7.3 Drownar

DREWNAR is a professional company in the wood industry that has been operating on the market since 1989. The experience in the field of construction in wood technology allows to execute orders from the simplest wooden structures to highly individualized designs of wooden houses and cottages. The implementation of their projects runs on time and does not exceed the set budget. All the information presented below comes from company's offer available on [www.drownar.pl](http://www.drownar.pl).



PICTURE 12. Example of Drownar's timber house project. Website: ([drownar.pl](http://drownar.pl), 2017.)

This small house is 47,5 meters squared. Interior is living room, kitchenette, wardrobe, two rooms, bathroom. Customer can decide for what kind of house condition he/she wants to pay. There are three possibilities available:

- Building shell: 22 550 EUR + VAT
- Builder's finish: 27 700 EUR + VAT
- Turnkey construction: 34 345 EUR + VAT



PICTURE 13. Example of Drewnar's timber house project. Website: (drewnar.pl, 2017.)

On the picture above, we can see 77,5 meters squared timber house. Potential customer can expect bathroom, living room with dining room, three bedrooms, kitchen inside of the house, as well as two balconies.

Estimated prices suggested by producer are:

- a) Building shell: 38 200 EUR +VAT
- b) builder's finish: 46 845 EUR + VAT
- c) turnkey construction: 58 177 EUR + VAT



PICTURE 14. Example of DREWNRAR's timber house project. Website: (drewnar.pl, 2017.)

House shown on the picture above is 136,6 meters squared big.

Interior includes small wardrobe, boiler house, toilet, living room with dining room, kitchenette, four bedrooms, big wardrobe and big bathroom

Price list offered by the company:

- a) Building shell: 63 317 EUR + VAT
- b) builder's finish: 76 518 EUR + VAT
- c) turnkey construction: 92 990 EUR + VAT

#### **7.4 Conclusion**

The prices offered by the Polish producers are much lower than those of the Finnish company. According to the answers given in the questionnaire, the approach of the Polish manufacturers is much more affordable for potential customers. The differences in the prices result from the raw material, transportation and labor costs.

## 8 SUMMARY

Timber and log houses are not popular in Poland. Nevertheless, Polish government creates supporting programs whose objective is to encourage to this kind of construction. The demand of potential customers' expectations was surveyed in this thesis. The number of responses given by interviewees was large enough to prepare their analysis.

The majority of respondents were students between 18 and 25 years old. This fact is recognized as a weakness of the research sample, especially that dependency between age and expected cost of timber house was identified in latter Chi-squared test analysis.

On the basis of the answers, an average wooden house in Poland is a place with a fireplace, where residents are living for the whole year. Expected size is between 121 and 200 square meters. A house should be designed in the traditional style and made from round logs. The dream wooden house of Polish customers has two floors and it is located in mountains, forest or village. The average expected price is 30 000-47 000 euros.

The prices of Polish producers' are very low, thus we can draw a conclusion that it would be difficult for a Finnish company to enter Polish market. One of the way for price reduction would be to supply raw materials within Poland or middle Europe countries. Such a step would decrease final cost declared by Finnish companies.



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