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# INVESTIGATION OF SOCIAL OPINION ON GREEN LIFESTYLE, ECO-FRIENDLY BUILDINGS AND SAVING OF RESOURCES. EMPIRICAL RESEARCH

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**Abstract.** The study examines the possibilities of eco-friendly housing development that allows developers to elaborate consistent strategies in order to promote customers' green lifestyles and achieve performance in resource savings. Using a correlation analysis, the authors identify the values of eco-friendly houses for customers and their opinion on a green lifestyle. The present paper develops decision-making criteria through empirical research to assess social opinion on green lifestyles and eco-friendly buildings. The most important attribute is eco-house functionality, raw material possibilities, manufacturing technology, the importance of using smart resources in relation to the price of the final product in the construction of eco-houses, design factors and green environment. Using certain attributes, innovative companies in eco-building can increase user value, reduce energy consumption, and advance their product development efforts. Nowadays, companies should meet customer requirements in terms of eco-innovation approach and industry's green ecosystem development, as well as remove the gaps in value preposition.

**Keywords:** sustainable development, eco-friendly house, green lifestyle awareness, eco-innovation, willingness to pay, eco-feedback.

**JEL Classification:** Q57, Q20, Q01, I31, O13, O18, O32.

## Introduction

Eco-friendly building innovation and sustainability should consider efficiency, design, manufacturing process, waste and many other aspects in order to increase the number of eco-friendly projects. However, the promotion of green lifestyles involves the investigation of users' willingness to pay for such value preposition and the development of consistent market strategies.

Any type of innovation design planning and practice must satisfy consumer needs. Without consumer acceptance, even highly organized and efficient production systems will collapse (Fletcher & Goggin, 2001). Therefore, companies are constantly trying to incorporate the dynamics of both consumers and technologies into their product design to conduct a marketing strategy. They must align the design of their products and services to fit their creativity with customers. They must also collaborate with customers on green innovation.

Customers play a significant role in defining and bargaining their needs with the product development process, which is an important task for future development. Such integrative design not only delivers core value to customers but also improves the performance of a company and helps find crucial trade-offs between a more green lifestyle value and price.

Companies are exploring new means of designing environmental technologies and products to achieve sustainability, reduce waste, and demonstrate social responsibility (Liao & Chuang, 2021). Though green building technologies are widely used, the modern development of the construction industry has slowed down due to its inability to meet customer expectations.

The aim of the study is to identify factors that influence the decision making in green lifestyle, to determine preferences in eco-building materials among customers through empirical research and to propose the

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mathematical model that will improve our understanding of customer behaviour.

In order to validate the survey instrument, a pilot test was previously conducted with the help of a small focus group to adjust and improve a questionnaire. Expert interviews and the focus group method for data validation were used previously from 6 July 2020 to 20 July 2020 (Šatrevičs et al., 2021).

The present empirical research based on pilot findings was conducted from 1 September 2020 to 20 November 2020. Willingness-to-pay (WTP), eco-friendly values and awareness factors are among the issues addressed in the present research. Respondents' priorities and awareness towards eco-friendly houses, such as design, functionality, sound insulation, and raw material possibilities, are also investigated. Based on the respondents' evaluation, the consumer behaviour model with the best performance and price fit is presented in the study for eco-friendly house developers.

## 1. The eco-friendly framework

The adoption of eco-friendly materials by individuals in the building industry is considered to be an essential solution to promote sustainable development. An eco-friendly solution basically utilises biodegradable raw materials and a manufacturing process that considerably minimises emissions and other sources of pollution.

The growing level of pollution has detrimental effects on the environment, climate, animals, plants, and human beings (Bhat et al., 2021; Kabirifar et al., 2020).

Structure production, which is amongst the greatest productions in the world, has left a considerable mark on the utilisation of raw materials and energy (Alaloul et al., 2020; Faried et al., 2021). The use of waste materials in manufacturing enhances the eco-efficiency of products (Elsheikh et al., 2022).

Several initiatives have been implemented to reduce harmful effects on the environment and ecosystems, such as improved concrete durability, the consumption of industrial waste as recycled aggregates, the function of supplemental admixtures and the conversion and reuse of components (Amin et al., 2020; Shahidan et al., 2017; Tayeh et al., 2020).

Sustainability, strength, workability, durability and engineering applicability are the most important characteristics of material for customers (Magbool, 2022).

In this paper, we assess customer awareness of sustainable materials, design, eco-building usability and maintenance. We identify and assess factors that customers find important in eco-friendly building in order to provide strategic fit opportunities for eco-friendly companies.

Currently, society is facing serious environmental degradation. With an unprecedented growth of human population and industrialization revolution, a large amount of CO emissions causes serious climate warming (Long et al., 2022). Eco-friendly advantages as the driver for the new business model and environmentally sustainable product innovation have been the focus of numerous studies recently (Zubeltzu-Jaka et al., 2018). Future perspectives for proper adaptation of modern technologies, especially in underdeveloped countries, are very important (Zhang et al., 2022). Environmental solutions in sustainable innovation are popular among researchers and practitioners worldwide (Jun et al., 2021).

Companies have realised that green innovation is an essential factor for sustainable development and competitive advantage (Gao et al., 2019; Song & Yu, 2018). Researchers demonstrate that the green lifestyle dimension has become a structural and strategic element of successful organisations (Lončar et al., 2019). Considering environmentally sustainable product innovation, studies indicate that developing green values is a key element of environmentally sustainable success and business performance (Dangelico et al., 2019).

Understanding customer feedback on green lifestyle technology and values is crucial to building companies and related industries because they drive the industry during the transition from non-renewable to renewable materials. Naturally, the industry needs to forecast whether the economic value of the products is in line with the consumers' willingness and ability to pay for eco-friendly houses. Adopting an environmentally sustainable, green lifestyle approach allows companies to align themselves with customers who are willing to care about the environment (Paparoidamis et al., 2019). It increases the awareness of the brand image among stakeholders, especially shareholders. Companies choosing competitive advantage in sustainability are among the priority groups (Gill et al., 2020; Papagiannakis et al., 2019).

The constant move towards results in the development of eco-friendly products also promotes green innovation (El-Kassar & Singh, 2019; Xie et al., 2019).

When developing green products, the main task of the eco-house developer that contributes to the success of green product innovation is to align eco-friendly factors with customer preferences. Nowadays, it is still a difficult and challenging task faced by many organisations in developing green innovations and environmentally sustainable products (Arranz et al., 2019; Yang, 2019).

Organisations must develop strategies that focus on sustainability. In particular, it is critical to incorporate a sustainability perspective as a first step in new product development. Strategic planning focused on green innovation collaborations with customers helps allocate the necessary values to green innovation buildings.

Taking into account the above-mentioned considerations, the results confirm that strategies should be flexible and responsive at the operational level. A number of studies suggest that processes need to be realigned, with attention to current customer requirements. With a variety of product alternatives and designs being introduced into the green market, it is important to build an understanding of how different segments of customers perceive the eco-friendly values in the eco-friendly industry.

Studies have found that market alignment is very important since adding the target benefits and values to specific customers is more effective during product design (Fleith de Medeiros et al., 2022). The results show that the criteria of goodness-of-fit fulfil the requirements with regard to values representing eco-friendliness (biodegradable, recycled, certified), efficiency, price, and material (Hartanto & Triastianti, 2022).

## 2. Methodology

Current *empirical research* based on pilot findings was performed from 1 September 2020 to 20 November 2020. According to the quantitative scientists' attempt to operate on the assumption of objectivity, a qualitative scientist should plan to examine the different degrees and complexities of a particular phenomenon (Leedy, 2015).

In the survey, respondents' replies were evaluated according to five-point Likert (Likert, 1932) alternatives (Hines et al., 2011; Kroth & Peutz, 2011), six-point Likert alternatives (Allen et al., 2011; Beaudreault & Miller, 2011), and seven-point Likert alternatives (Walker et al., 2011).

The aim of the questionnaire (provided in Appendix 4) was to determine the lived experiences, evaluations of executives and non-executives about eco-friendly houses. Respondents' attributes included years of working experience, current positions, and education profile.

The population of the survey consisted of the given industry customers. The survey sampling was the entire population – 1,886,198 (Worldometers, 2020). 1,399,500 of the recognised population (Central Statistical Bureau, 2020) were invited to participate in the survey (online). Information about respondents was obtained from the database of the Central Statistical Bureau.

All 1,399,500 respondents were recognised as the main population. The number of respondents surveyed online was 390 with a confidence interval of 5.00%. To determine the necessary sample, the authors used the sample selection algorithm presented online (Creative Research System, 2022). Based on the statistical calculator, it was calculated that in order to obtain a confidence level of 95% (confidence interval of 5.00), 343 respondents should be selected (some respondent answers were obsolete). Respondent selection was obtained using randomization.

## 3. Interpreting final survey results. Statistics

### 3.1. Profile of respondents

Answers about eco-friendly advantages were given by respondents whose position was directly related to the subject of the research. Most of them have a decent experience, and their answers could provide reliable information about the current situation of eco-friendly house values among Latvian inhabitants.

Table 1. Respondent Statistics (source: Research results)

| Statistics | Number |
|---|---|
| Total number of respondents | 346 |
| Male | 146 |
| Female | 199 |
| No data | 1 |
| Average age, years | 40.2 |

Survey results show the diversity in opinions of the respondents about eco-house advantages. Results confirms that *only 4% live in eco-houses*. It means that companies have a high potential to use these advantages throughout the industry and they are rare. 54.8% of respondents are not thinking about eco-houses, so the interest as an important step to willingness to buy is a significant result. Only 44.1% of the respondents are interested in eco-friendly houses.

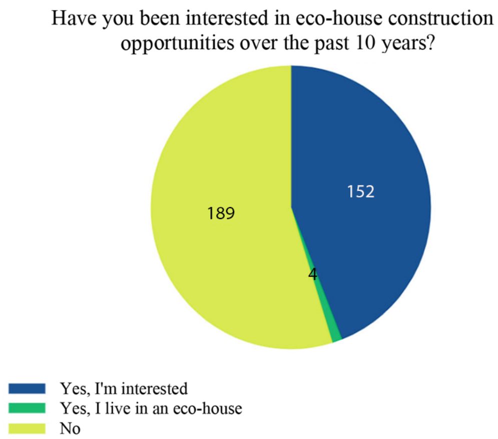


Figure 1. Respondents' awareness of eco-friendly houses (source: Research results)

The survey data (see Figure 2) show sustainable indicators. More than half (73.5%) of the respondents occupied low- to mid-level positions (such as sales managers, quality supervisors, workers etc.), 34.1% of them were specialists, 2.3% – board members, and 30.5% employees involved in the business process. To conclude, most of the respondents were workers (73.5%), and only 17.1% were executives.

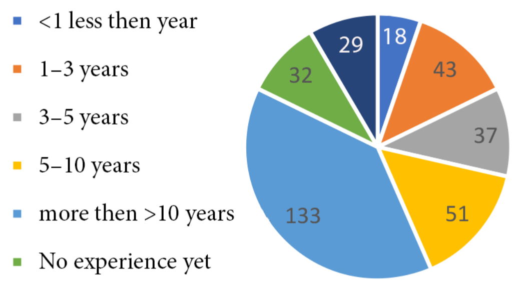


Figure 2. Respondents' work experience in the construction sector (source: Research results)

Almost 17.7% of the respondents established their business more than 5 years ago, 10.8% of respondents' companies were working in the industry for 3–5 years. 14.9% of the respondents' companies worked from 5 to 10 years and 38.8% of the respondents had work experience exceeding 10 years.

To determine whether the eco-house is related to the regions, the respondents were divided as follows: 59.2% (n = 204 from 346) were in Riga or in districts near Riga. Most of the respondents had 3–5 family members, which could affect the decision on the acquisition of an eco-friendly house (house vs. apartment) (see Figure 3).

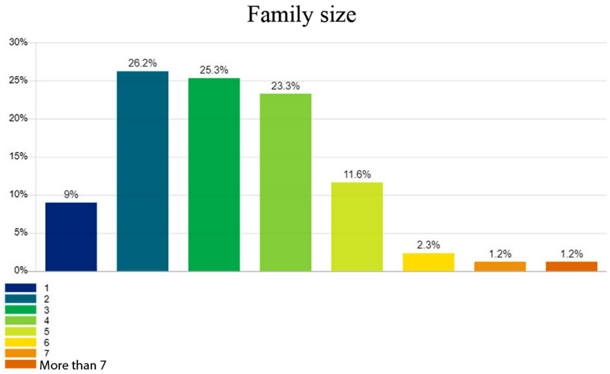


Figure 3. Respondents' family size (source: Research results)

## 3.2. Statistics on consumer behaviour and green value proposition for low-energy eco-friendly houses

Survey data show that the majority of respondents are interested in eco-friendly values (Figure 4).

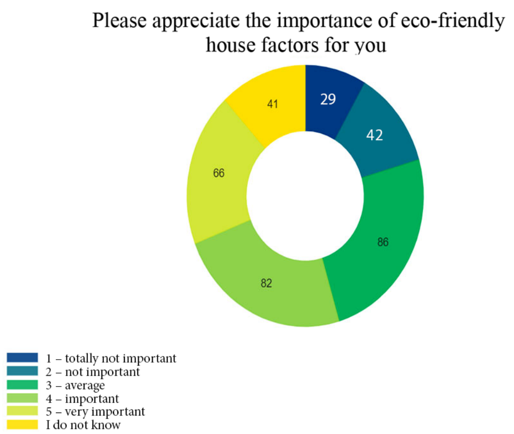


Figure 4. The importance of eco-friendly house factors for respondents (source: Research results)

Based on the data obtained, it can be concluded that the crucial aspects are price and non-price factors. To obtain relevant information and identify customer preferences with regard to environmental safety and personal benefits, we divided all factors into several categories taking into account such dimensions as functionality (efficiency, energy saving), manufacturing technology (green lifestyle values), fashion and luxury (design and quality), eco-friendly factors (e.g., biodegradable, non-toxic, waste reduction), remote possibilities, raw materials and cost factor (Figure 5). Companies need to enhance environmental innovation performance based on customer green preferences as well as provide proper value proposition for buildings.

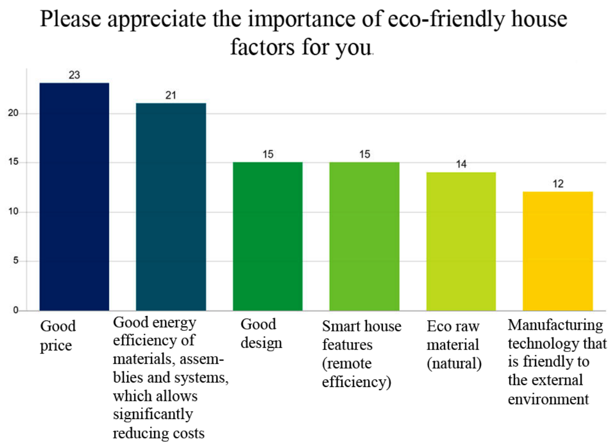


Figure 5. The priority of eco-friendly house factors versus price (source: Research results)

An effective strategy also recognises the need to enhance public awareness on the use of eco-friendly materials since this will promote eco-friendly value preference. Furthermore, incentives focused on production cost reduction will greatly and positively affect overall demand. Manufacturers also must ensure proper design for eco-friendly buildings according to customer requirements, in addition to developing remote possibilities concerning energy savings.

## 3.3. Quantitative model for the evaluation of eco-friendly values and correlation analysis

The next important phase of the research is the development of a model where the eco-friendly values are assessed through factor analysis. In order to better understand the outcome of the study as well as to measure its validity, we used a confirmatory factor analysis (CFA). As a result of the survey and factor analysis, the final correlation of the variables is presented in Appendix 1. The results of the Kaiser-Meyer-Olkin and Bartletts test are shown in Table 2.

Table 2. Respondent statistics (source: Research results)

| KMO and Bartlett's Test | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | | .952 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 7885.079 |
| | $d_f$ | 496 |
| | Sig. | .000 |

The survey was conducted using a structured questionnaire with specially designed and revised questions based on literature review and focus groups. Using the review of dependent and independent variables, the subsequent regression formula represents the level of competitiveness of eco-friendly houses. The competitiveness model was developed to evaluate the competitiveness aspects of enterprise development. Method of statistical research for inter-correlation statistical analysis was used. Its task was to discover the regularities existing in most cases of phenomena and processes. Statistical observation allows obtaining objective information where individual observations can vary; however, certain regularities can be detected owing to a large number of observations.

Eco-efficiency can be mathematically expressed as the ratio between the added value of the product and its environmental impact (Zhou et al., 2019).

Initial model of eco-friendly house value competitiveness with five influencing factor components elaborated by the authors is expressed by formula (1):

$$EcoValues = \sum_{i=1}^{n} \alpha_i C_i + \alpha_0, \tag{1}$$

where

$$\alpha_0 = 1 - \sum_{i=1}^{n} \alpha_i, \tag{2}$$

where $EcoValues$ – competitiveness of eco-friendly house values; $i$ – a respective component index, $n$ = 5; $\alpha_1, \alpha_2, \alpha_3 \ldots \alpha_5$ – significance coefficients (Appendix 1. Total Variance Explained); $\alpha_0$ – gross unrecognised component effect, %.

Determination and selection of influencing factors play an important role in the evaluation process of the enterprise competitiveness. Therefore, within the scope of the data analysis, the authors determined the most significant factors influencing the competitiveness of eco-friendly values, while identifying the minimum number of required factors.

The authors obtained the significance coefficients $(\alpha)$ for factors determining competitiveness of eco-friendly values (Formula 3). To determine the competitiveness level of building companies in a particular area, the authors used the respondents' evaluation of eco-friendly value significance (see Appendix 1). According to the function of eco-friendly value preference among customers, the authors developed a mathematical model that represents values as a score (Formula 1).

$$EcoValues = 17.87C_1 + 16.53C_2 + 11.37C_3 + 11.17C_4 + 9.52C_5 + 33.54C_n. \tag{3}$$

EcoValues is the competitiveness of eco-friendly values as a score among customers; Components $C_i$ – the factors of: $C_1$ – eco-house functionality, raw material possibilities; $C_2$ – manufacturing technology; $C_3$ – the importance of using smart resources in relation to the price of the final product in the construction of eco-houses; $C_4$ – design factors; $C_5$ – external environment, such as built-in solar control, external blinds, alternative energy, solar panels, high quality of materials and precious materials and systems (e.g., oak, etc.), $C_n$ – other unrecognised factors. (Detailed explanation of all components is provided in Appendix 3).

Evaluation of the competitiveness of eco-friendly values for building companies could be described using a formula. The objective of the survey was also to obtain information about the indicators for factor measurement.

Using the confirmatory factor analysis, the author constructed a model with the number of variables determined by the context of the research.

Figure 6 shows an overall map of the correlation of the questions (see Appendix 2 for more details).

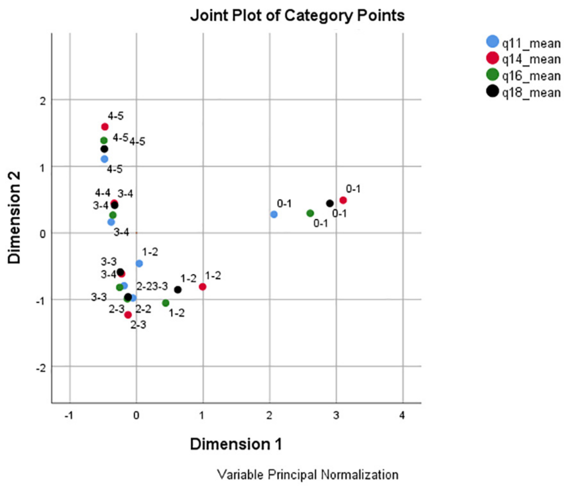


Figure 6. Variable correlation (source: Research results)

Descriptive part of the analysis is based on frequency distribution in percentage of respondents and correlation factors. A statistical method, such as Kaiser-Meyer-Olkin, was used to check the reliability of the results. Overall, the authors conclude that the reliability of information obtained is appropriate, and the survey is a suitable tool to answer the questions proposed by the research.

## Conclusions

The present paper has provided an eco-friendly framework for prioritization of factors through the empirical example in the Latvian industry.

First, the correlation of factors has been used to build a mathematical model (Formula 1, Appendix 1 for more details). Second, the authors obtained the significance coefficients (α) for factors determining the social opinion on a green lifestyle and eco-friendly buildings. According to the described function of consumer behaviour (mathematic model), eco-innovation companies could elaborate certain product design in order to meet market demand.

In Latvia, eco-friendly houses with environmentally sustainable materials are in high demand, but customers prefer energy saving solutions (individual benefit) that are not expensive (preference of price over design). Good design is more popular than luxurious and stylish houses at a high price. The quick response to the fast-changing market conditions is the most demanded issue for the developers of eco-houses. In the present research, an integrated framework for eco-innovation companies has been proposed, which complements the approach with the presented methodology to obtain criteria coefficients and prioritize alternative elements that can also be used for eco-innovation companies.

When it comes to the sustainability of competitive advantage, it is necessary to explain that focusing on eco-house functionality and raw material possibilities (efficiency) is most sufficient. Collaboration with customers is crucial when assessing the degree of strategic fit. The strategic fit depends on the competitive advantages supported by the company and on the strength of correlation among various components of the business model.

As a result, the company's performance depends on strategic fitness between internal core competence, manufacturing efficiency and the values proposed for the sustainable environment and customer individual benefits. Sustainability of competitive advantage as a strategic fit means that the company has both competitive advantages and comprehensive integration of components in its business model.

Finally, empirical results have shown how certain factors (values) affect customer behaviour. Five main components ($C_i$) with respective coefficients have been investigated: $C_1$ – eco-house functionality, raw material possibilities; $C_2$ – manufacturing technology; $C_3$ – the importance of using smart resources in relation to the price of the final product in the construction of eco-houses; $C_4$ – design factors; $C_5$ – external environment, including built-in solar control, external blinds, alternative energy, solar panels, high quality of materials and precious materials and other factors (e.g., oak, etc.).

It can be concluded that the results demonstrate respondents' awareness of the green lifestyle. Developing a better eco-innovation strategy suitable for the future of the industry is very important for the current green approach. With the help of this tool, eco-friendly house developers could adapt their eco-innovation strategies and increase overall impact of these strategies in each country (or will meet low "willingness to buy" in the application of eco-innovation strategies). Today, when a company designs a building with eco-values for customers to attain sustainable development in a dynamic environment, it is important to fully recognise the current market requirements. The limitations of the research could be attributed to the Latvian geo-political and economic position in the EU. Our future research area could be related to identifying correlations among factors in other countries and comparing them among the Baltic States.

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# APPENDIX 1

Table A1. The sum of variances of all individual principal components (source: SPSS results)

| Total Variance Explained | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 14.870 | 46.469 | 46.469 | 14.870 | 46.469 | 46.469 | 5.718 | 17.868 | 17.868 |
| 2 | 2.184 | 6.825 | 53.294 | 2.184 | 6.825 | 53.294 | 5.288 | 16.526 | 34.394 |
| 3 | 1.765 | 5.517 | 58.811 | 1.765 | 5.517 | 58.811 | 3.639 | 11.372 | 45.767 |
| 4 | 1.253 | 3.916 | 62.727 | 1.253 | 3.916 | 62.727 | 3.573 | 11.165 | 56.931 |
| 5 | 1.193 | 3.728 | 66.455 | 1.193 | 3.728 | 66.455 | 3.048 | 9.524 | 66.455 |
| 6 | .921 | 2.880 | 69.335 | | | | | | |
| 7 | .781 | 2.439 | 71.774 | | | | | | |
| 8 | .683 | 2.135 | 73.909 | | | | | | |
| 9 | .623 | 1.947 | 75.856 | | | | | | |
| 10 | .605 | 1.891 | 77.746 | | | | | | |
| 11 | .578 | 1.807 | 79.553 | | | | | | |
| 12 | .547 | 1.710 | 81.262 | | | | | | |
| 13 | .509 | 1.592 | 82.854 | | | | | | |
| 14 | .478 | 1.493 | 84.347 | | | | | | |
| 15 | .449 | 1.404 | 85.751 | | | | | | |
| 16 | .433 | 1.354 | 87.105 | | | | | | |
| 17 | .396 | 1.237 | 88.343 | | | | | | |
| 18 | .374 | 1.167 | 89.510 | | | | | | |
| 19 | .334 | 1.045 | 90.555 | | | | | | |
| 20 | .319 | .997 | 91.552 | | | | | | |
| 21 | .307 | .958 | 92.510 | | | | | | |
| 22 | .286 | .893 | 93.403 | | | | | | |
| 23 | .277 | .867 | 94.270 | | | | | | |
| 24 | .256 | .800 | 95.070 | | | | | | |
| 25 | .239 | .748 | 95.818 | | | | | | |
| 26 | .234 | .732 | 96.550 | | | | | | |
| 27 | .217 | .679 | 97.229 | | | | | | |
| 28 | .209 | .655 | 97.884 | | | | | | |
| 29 | .196 | .612 | 98.496 | | | | | | |
| 30 | .182 | .567 | 99.064 | | | | | | |
| 31 | .170 | .531 | 99.595 | | | | | | |
| 32 | .130 | .405 | 100.000 | | | | | | |
| Extraction Method: Principal Component Analysis. | | | | | | | | | |

## APPENDIX 2

Table A2. Regional and age correlations using SPSS

Spearman's rho

| Correlations | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | q9_mean | q11_mean | q14_mean | q16_mean | q18_mean |
| Spearman's rho | q9_mean | Correlation Coefficient | 1.000 | .576** | .402** | .464** | .355** |
| | | Sig. (2-tailed) | . | .000 | .000 | .000 | .000 |
| | | N | 344 | 344 | 344 | 344 | 344 |
| | q11_mean | Correlation Coefficient | .576** | 1.000 | .509** | .580** | .425** |
| | | Sig. (2-tailed) | .000 | . | .000 | .000 | .000 |
| | | N | 344 | 344 | 344 | 344 | 344 |
| | q14_mean | Correlation Coefficient | .402** | .509** | 1.000 | .641** | .643** |
| | | Sig. (2-tailed) | .000 | .000 | . | .000 | .000 |
| | | N | 344 | 344 | 344 | 344 | 344 |
| | q16_mean | Correlation Coefficient | .464** | .580** | .641** | 1.000 | .656** |
| | | Sig. (2-tailed) | .000 | .000 | .000 | . | .000 |
| | | N | 344 | 344 | 344 | 344 | 344 |
| | q18_mean | Correlation Coefficient | .355** | .425** | .643** | .656** | 1.000 |
| | | Sig. (2-tailed) | .000 | .000 | .000 | .000 | . |
| | | N | 344 | 344 | 344 | 344 | 344 |

*Note*: ** Correlation is significant at the 0.01 level (2-tailed).

## APPENDIX 3. INTERPRETATIONS OF COMPONENTS

In this step of principal component analysis, the factor loading matrix is displayed. We acquire the variances of each principal component. For factor reduction, we only extract first few principal components. The first five components comprise of almost 67% of total cumulative contribution. Therefore, the first 5 components are the most significant and rest of them are off lower significance.

**First component (18% variance):**

1A. Raw materials and components ensure good air circulation (ventilation possibilities), thus good air quality

1D. Adaptation of construction and systems to your needs, possibility to expand the house, add, re-plan the premises. 1E. Good sound insulation (acoustics) 1G. Material life cycle and management costs (repairs). 1K. Opportunity to modernize the house profitably over time.

From the analysis of the first component and its factor loadings, the component is explaining the different values when it comes to Eco-Houses. This implies what values people are selecting. The factors represented are of greater eigen values. The component displayed a variance level of 17.87% out of the total components.

When we take a closer look into the **second component**, the loading factors with highest values:

2A. House manufacturing technology, environmentally friendly (Eco-friendly manufactruing process); 2B. Efficient manufacturing processes and consumption of raw materials in relation to the use of environmental resources (eco-efficiency); 2C. Rationalization of production process, time savings (pre-preparation, block houses); 2D. Comprehensive quality management production. 2E. Synchronization and continuity of the production process. Smart factory, robotization, high production quality. 2F. The whole chain of resource extraction, manufactuirng, supply and installation is max eco-efficient. 2H. Corporate social responsibility through participation in associations and government programs that protect nature. We will see factors devoted mostly to manufacturing technology. In component 2, people find the arrangement of eco-house set up in a friendly environment better and positively loaded. People could easily set up and arrange according to their wish and requirements regarding manufacturing technology parameters.

Next component – **component 3** is devoted to Cost and Benefit opportunities. **Component 4** is explaining design factors. 3B. Durable – robust, high-quality fabrics 3C. Multi-functional – functional (e.g., reversible) garment, 3D. Dynamic, universal – good fit/size (e.g., adjustable for mobility or growth), 3F. Decorated – creative/stylish

And the last **component 5** is mostly correlated to alternative energy and high quality material relationship.

1H. Built-in solar control. External blinds

1I. Alternative energy. Solar panels.

1L High quality of materials. Precious materials and systems (e.g. oak, etc.)

# APPENDIX 4. STRUCTURE OF SURVEY (QUESTIONS ID)

## 1) I. INFORMATION ABOUT THE COMPANY / EXPERT AND RESPONDENT

2) In case you want to know the result of the conducted research, please provide your e-mail. 3) During the last 10 years, have you been interested in the possibilities of building an eco-house? 4) How many years have you worked in your industry? 5) Your status at work 6) Your place of residence 7) How many people are in your family?

## 8) II. YOUR OPINION ON SOCIAL RESPONSIBILITY

9_1) Lowest price with conventional building materials (Please rate the importance of using smart resources in relation to the price of the final product in the construction of eco-houses.)

9_2) Low price with eco-materials (Please rate the importance of smart use of resources in relation to the price of the final product in the construction of eco-houses.)

9_3) Medium-priced eco-houses with eco-materials and acceptable energy efficiency (Please rate the importance of using smart resources in terms of the price of the final product in the construction of eco-houses.)

9_4) Eco-Homes with high price and quality of eco-materials, ensuring high energy efficiency (Please appreciate the importance of using smart resources in terms of the price of the final product in the construction of eco-houses.)

9_5) Expensive smart eco-houses with eco-houses. for materials that ensure maximum energy efficiency and excellent design (Please appreciate the importance of using smart resources in the price of the final product in the construction of eco-houses.)

10) III. Assessment of green lifestyle factors

11_1) Eco-houses with conventional building materials (Please assess the importance of eco-friendly house factors for you.)

11_2) Eco-houses with raw materials that are natural and biodegradable (Please assess the importance of eco-friendly house factors for you.)

11_3) Eco-homes with raw materials that are recyclable and can be reused (Please rate the importance of eco-friendly home factors for you.)

11_4) Eco-homes with raw materials that are recyclable is eco-efficient in terms of eco-efficiency (Please rate the importance of eco-friendly housing factors for you.)

## RANKING

12_1) Good price (Please rank the answers from 1 to 6 in the 1st place – most important, 6th place – last in order of importance.)

12_2) Good design (Please rank the answers in order of priority from 1 to 6. 1st place – most important, 6th place – last in order of importance.)

12_3) Eco-raw materials (natural) (Please arrange answers from priority 1 to 6. 1st place – most important, 6th place – last in importance.)

12_4) Good energy efficiency of materials, assemblies and systems that allow to significantly reduce costs (Please sort the answers from 1 to 6). 6. 1st place – most important, 6th place – last in importance.)

12_5) Smart home options (maximum energy efficiency) that allow automatic remote control of resource consumption (heat, electricity, water, etc.) (Please sort the answers in order of priority from 1 to 6. 1st place – most important, 6th place – last in order of importance.) 12) Production technology that is environmentally friendly (Please sort the answers from 1 to 6th place – most important, 6th place – last in importance.)

## 13) IV. ECO-HOME FUNCTIONALITY, RAW MATERIAL OPTIONS

14_1) 1A. Raw materials and components ensure good air circulation (ventilation possibilities), thus good air quality (Please rate the importance of factors to give you a high product value.)

14_2) 1B. An efficient resource consumption system (eg a smart home system that automatically switches off light, electricity, heat, etc.). (Please rate the importance of factors in giving you high product value.)

14_3) 1C. Wide range of interior decoration materials (eg paint, surfaces, etc.) (Please rate the importance of factors to give you a high product value.)

14_4) 1D. Adaptation of construction and systems to your needs, possibility to expand the house, add, re-plan the premises. (Please rate the importance of factors to give you high product value.)

14_5) 1E. Good sound insulation (acoustics) (Please rate the importance of factors to give you a high product value.)

14_6) 1F. High energy efficiency of materials, heating systems and systems (eg windows, wall heat resistance, energy efficiency of heating system) (Please rate the importance of factors to give you a high product value.)

14_7) 1G. Material has a long life cycle and low maintenance costs (repairs). (Please rate the importance of factors to give you a high product value.)

14_8) 1H. Built-in solar control. Exterior blinds (Please rate the importance of factors to give you a high product value.)

14_9) 1I. Alternative energy. Solar panels. (Please rate the importance of factors in giving you high product value.)

14_10) 1J. In general, the house is maximally energy efficient (passive house options) (Please rate the importance of factors to give you a high product value.)

14_11) 1K. Opportunity to modernize the house over time. For example. renovation (Please rate the importance of factors to give you a high product value.)

14_12) 1L. High quality of materials. Expensive materials and systems (e.g. oak, etc.) (Please rate the importance of factors to give you a high product value.)

## 15) V. MANUFACTURING TECHNOLOGY

16_1) 2A. Eco-friendly manufacturing process (Please appreciate the importance of factors to give you a high product value.)

16_2) 2B. Efficient production processes and consumption of product raw materials in relation to the use of environmental resources (eco-efficiency) (Please assess the importance of factors to give you a high product value.)

16_3) 2C. Rationalization of the production process, time savings (pre-preparation, block houses) (Please assess the importance of factors to give you a high product value.) 16) 2D. Total quality management in production. Certificates (Please rate the importance of factors to give you high product value.)

16_4) 2E. Synchronization and continuity of the production process. Smart factory, robotization, high production quality. (Please rate the importance of factors to give you high product value.)

16_5) 2F. The whole chain of resource extraction, production, supply and installation is max eco-efficient (Please appreciate the importance of factors to give you a high product value.)

16_6) 2G. Adapting the production process to your needs (design adaptation design) (Please rate the importance of factors to give you a high product value.)

16_7) 2H. Corporate social responsibility through participation in associations and national programs that protect nature (Please appreciate the importance of factors in giving you a high product value.)

## 17) VI. DESIGN

18_1) 3A. Minimalist. minimal / minimalistic – reduced, timeless silhouettes (Please rate the importance of factors to give you a high product value.)

18_2) 3B. Persistent – sustainable. durable – robust, high-quality fabrics (Please rate the importance of factors to give you a high product value.)

18_3) 3C. Multifunctional (anti-stain, burnout, unisex), multi-functional – functional (e.g. reversible) garment (Please rate the importance of factors to give you a high product value.)

18_4) 3D. Dynamic, versatile (easy to renew, versatile) dynamic – good fit / size (e.g., adjustable for mobility or growth) (Please rate the importance of factors to give you high product value.)

18_5) 3E. Unique, uncommon style (Please rate the importance of factors to give you high product value.)

18_6) 3F. Decorative, stylish, aesthetic. decorated – creative / stylish (Please rate the importance of factors to give you high product value.)

18_7) 3G. Manual work with specialized equipment (Please appreciate the importance of factors to give you a high product value.)