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Customer Perspective On The Purchase and Use Of Sustainable And Innovative Furniture In A Co-Creation Process

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Abstract

For developing a European industrial cooperation and involvement in the furniture industry, the international research project INEDIT conducted a survey for furniture customers. By finding out the needs and wishes of the customer regarding innovative products and the production process the project will establish a new way for designing and producing furniture. Within INEDIT a platform is built on which customized, technologically innovative and sustainable furniture can be created and produced in a co-creation process. The furniture industry should thus become significantly more flexible, transparent and sustainable. Following the "do-it-together" approach, a business ecosystem will be generated which creates added value not only for customers but also for designers, suppliers and manufacturing companies. In order to involve the customer even more actively in the design process and the production, the platform will provide access to a mix of digital and physical services and is linked to all other stakeholders in the value chain. To match the platform and the process to the needs, wishes and demands of the customer an anonymous survey with 300 participants was developed and conducted. By analyzing the survey, important factors were found for buying and for using furniture considering new technological inventions (e.g. 3D-printing or smart objects), sustainability of the products and the production process. Furthermore, the potential customer-group and their usage of the do-it-together process and additional activities can be tightened.

Keywords

Co-Creation; Do-it-together; Sustainable Furniture; Smart Furniture; Customer Perspective

1. Introduction – The need of the customer perspective

The overall target of the research project INEDIT is to establish a new way for designing and producing furniture by including several European countries and stakeholders. Therefore, a platform is built on which customized, sustainable and technologically innovative furniture can be created and produced in a co-creation process, following the "do-it-together" approach. To ensure a productive and rentable performance of the platform, the customer perspective is a highly relevant aspect. As the customers must purchase and use the end-products it is important to know and to understand their wishes and needs. Additionally, the platform wants to actively integrate the customers in the design process and the production, and therefore the platform will provide access to a mix of digital and physical services and is linked to all other stakeholders in the value chain. To meet the needs, wishes and demands of the customer to the product, the process and the technologies an anonymous survey with 300 participants is developed. The target of the survey is to show the willingness for buying and for using furniture considering new technological inventions, sustainability of products, sustainability of the production and the usage of the do-it-together process.

2. Methodological Approach

In order to understand the customer's perspective more precisely and to obtain the required answers, the methodology of hypothesis testing is applied. This is a method of testing an assertion by measuring data from a sample. To do this, the first step is to create hypotheses that can be proven or disproven by statistical data. These hypotheses were developed based on an expert workshop within the INEDIT project and are sharpened in this paper with a literature research. By setting up a quantitative survey, the results can be processed afterwards with the tool Excel and the criteria can be made measurable. Thus, a one-sided or a two-sided test can be done. Hypothesis are accepted if the majority (> 50 %) of participants made the assumed specification and rejected if 50 % or less than 50 % made the assumed specification.

In the following, the hypotheses are first defined, afterwards the execution of the study is described and then the results are examined using the measurable data. This leads to the acceptance or the rejection of the hypotheses.

3. Current Research and derivation of Hypothesis

To meet the expectations of the end user of the INEDIT platform it is necessary to understand him and to get to know who the customer is. The advantages of the internet are used by people with a wide age range, nevertheless, young people are more likely to be open to new aspects than older people. Older people are more skeptical and inexperienced, especially when it comes to shopping. Similarly, due to the materials, manufacturing methods, quality, customization, etc., the products will not be able to compete with mass production in terms of price. Thus, the potential customers of the INEDIT Platform will be young and affluent. [1, 2, 3, 4] This leads to the first hypothesis.

H1: Potential customers of the INEDIT platform are young and affluent.

In times of mass production, the same furniture styles can be found in many homes. Therefore, the trend of customizing the existing furniture is becoming more and more desirable and popular. At the same time, the influence of social media, especially among young people, is becoming increasingly important. 90 to 95% of the decisions we make in the store are determined by impulses, emotions and habits. In online media, visual elements play the biggest role. Furniture should represent the character of the buyer. In this context, the otherwise important factors in the furniture purchase move into the background. [5, 6, 7] Therefore, the next hypothesis is:

H2: Potential customers are individuals that buy furniture for design reasons.

The term sustainability is based on three main pillars, namely environmental, social and economical sustainability. However, in many cases there is no differentiation between the three terms and most people only think of environmental sustainability upon hearing the term. There is a difference of perception of the terms, especially for consumers. [8, 9] Therefore, the proposed hypothesis is:

H3: End users place a higher priority on environmental than social sustainability.

In recent decades, the interest and the associated relevance of sustainability has grown steadily. In almost all industries, this aspect is becoming increasingly important for the customer and thus also for the manufacturer. Customers are willing to pay for this additional effort in the manufacturing process. The willingness to pay for sustainable furniture is therefore higher than for conventional furniture. [10, 11, 12, 13] The next hypothesis follows from this:

H4: The willingness to pay is higher for sustainable furniture than for conventional furniture.

The technology of 3D printing is not a recent innovation due to a missing availability. Therefore, many individual customers have not had the chance to experience it and are therefore unsure about its use and

function. Considering furniture is a high investment piece that is supposed to last for a long time and is big in size, customers want to be sure of quality and longevity. For someone who has not experienced 3D printing it is difficult to create confidence in the technology. [10, 11, 12] From this, hypothesis 5 follows:

H5: End users who are interested in 3D printing in general are more willing to buy 3D printed furniture.

An important factor in determining the price of a piece of furniture is the type and quality of materials used. The customer has prices in mind for different materials and their manufacturing methods. With 3D printing, most people associate plastic as the base material, which suggests a lower price. Therefore, the willingness to pay for 3D printed furniture is lower than for conventional furniture. [14, 15, 16] This leads to the next hypothesis:

H6: The willingness to pay is lower for 3D printed furniture than for conventional furniture.

Modern technologies support the customer during the purchase process. In the furniture industry, augmented reality, especially virtual reality, is becoming increasingly important. The customer can view his piece of furniture even before it is manufactured and place it in the desired environment. Combined with good service, this enables the customer to have a successful buying experience. But social interaction is also relevant for those involved in manufacturing. Knowing past interactions helps in discovering and building alliances with companies with whom there has been a transaction history and collaborative relationship. Joint action is thus facilitated for all involved parts. [17, 18, 19] The next hypothesis follows from this:

H7: Driving factors for the participation in the INEDIT platform are social interaction and the use of technologies (VR/XR).

Smart home technologies have created a great support for the everyday life. Everyday problems are simplified or even eliminated as a result. Another benefit is the saving of energy. Whether through intelligent heating behavior, automatic light control or energy-saving end devices, the consumer saves energy and thus money. [20, 21, 22] It follows:

H8: Consumers interested in smart home technologies are looking for support in daily routines and energy savings.

Technology and smartification are slowly but surely entering the private space and more customers start to digitize their homes. However, this development is quite slow and the smart home offerings are limited. Looking at furniture, there is currently not much in the market, therefore it is difficult to assess the situation. [23] The proposition is:

H9: Consumers who are interested in smart home technology are willing to pay more for smart furniture.

4. Framework and execution of the survey

This research consists of one end user-oriented study. Within the main study the perceptions of the end users and therefore potential customers of the INEDIT platform are examined. At the beginning of the survey the participants had to characterize themselves as furniture buyer and their willingness to pay for different kinds of furniture. This was followed by questions regarding the willingness to participate in the design process on a platform and core functionalities. Then the questionnaire focused on the characteristics and functionalities of the furniture to be designed. First by questions about sustainability, followed by questions regarding the smartification of products and last by questions regarding 3D printing. For each characteristic the willingness to pay was also considered in comparison to conventional furniture. At the end of the study, the participants were asked to give information concerning their demographics. That is age, gender, monthly net income (household) and origin.

The study was distributed online via the questionnaire tool LimeSurvey and the platform Fanvoice. The advantage of an online survey is that more people from different backgrounds can be reached within a short amount of time. It cannot be ensured that the participants answer honestly and that they complete the survey. A snowball effect within the INEDIT project team was used to reach more people. Initially, the link to the survey was posted on the research partners' websites and sent out to the respective networks. Concerning the sample, there are no limitations. Furthermore, there was no selection concerning age, gender, education level, income or origin. By distributing the survey online, it is possible that the origin of the participants differs widely. Furthermore, the survey was available in three European languages (German, English and French) to diminish possible language barriers. An online survey may limit the age differentiation of the participants.

5. Evaluation and Results

Over the course of 130 days, a total of 304 people (N=304) complete the study: 45.72 % (n=139) identify as female, 39.15 % (n=119) identify as male, 1 person identifies as other (0.33 %) and 45 participants decided not to disclose their gender (14.8 %). The biggest group is in the age range of 30 and 50 years old (n=117, 38.49 %). 24.67 % of the participants are under the age of 30 (n=75) and 22.37 % are over the age of 50 years old (n=68). 14.47 % of the participants (n=44) did not indicate an age range. The majority of participants is coming from the European Union (78.29 %, n=238), where France (45,1 %, n=137) and Germany (25 %, n=76) are dominating. 2 participants are coming from the United Kingdom (0.66 %) and 3 participants from Africa (0.99 %). Again, 61 participants (20.06 %) did not disclose their country of origin. Lastly, the monthly net household income was quite evenly distributed. 12.17 % of the participants (n=37) have less than 1,500 €, 24.67 % (n=75) have between 1,500 € and 3,000 €, 12.5 % (n=38) have between 3,001 € and 4,000 €, 16.21 % (n=49) have between 4,001 € and 6,000 €, 9.21 % (n=28) have between 6,001 € and 8,000 € and 5.59 % (n=17) over 8,000 € per month to spend. 19.74 % of the participants (n=60) decided not to disclose their monthly net household income.

To analyze **hypothesis 1**, whether potential end users of the platform are young and affluent, the age range and monthly net household income was analyzed for participants that indicated a readiness to use the platform. The analysis included 215 participants out of N=304, because some participants decided not to disclose age nor income. Figure 1 shows the distribution of age and income for potential customers. As shown in the figures above, 31,16 % of the potential end users are below 30 years old, which can be interpreted as young. With regards to affluence, nearly half of the potential end users (48.37 %) have a monthly net household income of less than 3,000 €. The hypothesis 1 has two conditions and is accepted if the majority of end users is in the age range of 20-30 years and their monthly net income is more than 3000 €. The two-sided significance test shows that the hypothesis has to be rejected regarding the age group but can be closely accepted regarding the income.

The following hypotheses are also accepted or rejected according to the same methodology. The repeated mention of this will be omitted.

Age groups sorted by monthly net income of willing end users

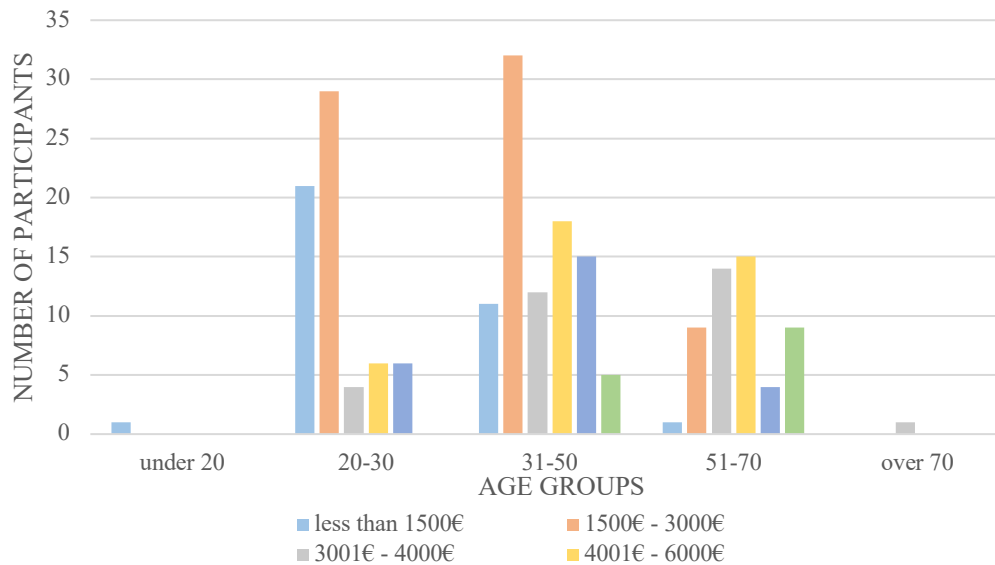


Figure 1: Age groups of potential customers divided in different monthly net income clusters.

For the **second hypothesis**, whether potential end users of the platform are individuals that buy furniture for design reasons, the self-characterization of the participants was used as indicator. Participants could give more than one reason for buying furniture. 50.5 % of the participants indicated design choices as reason to buy furniture, however 59.13 % gave as the reasons that they had to, because of broken furniture or moving. By dividing the groups further, the result is that only 52 participants (17.25 %) buy furniture solely for design reasons and 126 participants (41.86 %), because of damaged furniture or relocations. Therefore the data indicates a rejection of hypothesis 2, because the main motivator to buy furniture is because items are broken or new items are needed for new living spaces, instead of design reasons.

The **third hypothesis** focuses on sustainability and what end users understand as sustainable. To analyze this, two dummy variables are created to differentiate between environmental and social sustainability. The following answer options indicate environmental sustainability: Preservation of natural resources, No pollution and harm of natural habitats, Using only recycled materials, Using only recyclable materials, No waste of resources during the production, Low carbon footprint and Small transport distances for resources and furniture. Social sustainability consists of Fair priced workers within the value creation, Profit for local communities, Health of the workers within the value creation and Fair distribution of profits within the value creation. Participants could give more than one answer what means sustainability to them. Without excluding any of the other answer options, 94.29 % of the participants (N=280) understand sustainability with regards to environmental aspects. 73.57 % of the participants also consider social elements of sustainability. The two most important factors out of eleven possibilities are the preservation of natural resources, e.g. only using wood from reforested forests, (216 of 280) and fair pay for workers in the value chain (172 of 280). By excluding the construct of social sustainability 62 participants (22.14 %) only consider environmental aspects of sustainability. That is relatively high in comparison to excluding environmental aspects, which leaves 4 participants (1.43 %). The data indicates that hypothesis 3 can be accepted, that for end users' environmental sustainability has a higher priority than social.

For the **fourth hypothesis**, the willingness to pay for sustainable furniture is considered. Participants were asked to indicate a percentage range that they would be willing to pay more. Figure 2 shows the data. A large majority of participants (74.61 %, n=191) are willing to pay up to 25 % more for sustainable than for conventional furniture. 45 participants (17.58 %) are even willing to pay more than 25 % more. Only a small

number of participants (7.81 %, n=20) are not willing to pay more for sustainable furniture than for conventional. Therefore, this hypothesis can be accepted.

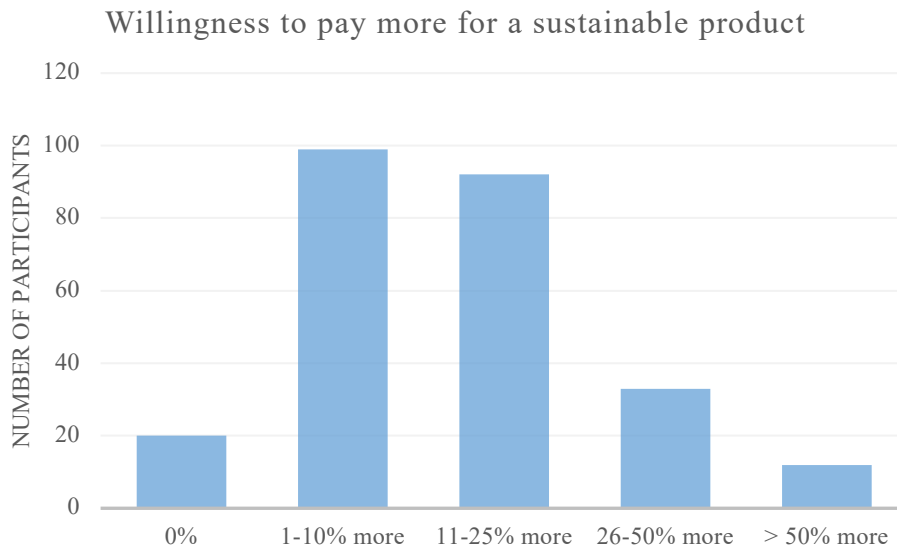


Figure 2: Participants willingness to pay more for sustainable furniture.

Hypothesis 5 focuses on 3D printing and for this, it is analyzed whether end users (N=275) who are interested in 3D printing in general are more likely to buy 3D printed furniture. 70.18 % of the participants (n=193) are interested in the technology of 3D printing and 168 participants (61.09 %) are interested and willing to buy 3D printed furniture. Only 8.72 % of interested end users are not willing to buy 3D printed furniture. These numbers are compared then to end users that are not interested in 3D printing in general, however are interested in buying 3D printed furniture. These are only 6.55 % participants (n=18). Therefore, the hypothesis can be accepted, because end users, who are interested in 3D printing in general are more willing to buy 3D printed furniture.

For **hypothesis 6**, the willingness to pay for 3D printed furniture is analyzed. The assumption is that end users have a lower willingness to pay for 3D printed furniture. The data (N=212) shows that 40.09 % (n=85) of the respondents are willing to pay less for 3D printed furniture than for conventional. However, more than half of the participants (53.30 %, n=113) are willing to pay the same for 3D printed furniture as for conventional. Considering these results, it can be concluded that hypothesis 6 has to be rejected.

To analyze **hypothesis 7**, driving factors for the participation in the INEDIT platform are considered. For this question, participants could give multiple answers as to what is important to them in order to participate in the platform. 146 participants (50.69 %) named social interaction and use of technologies, among others, as driving factors for the participation in the platform. However, 68,06 % of the participants (n=196) named other factors as the motivators for participation. By excluding participants, who named other factors, and only taking those, who are driven by social interactions and use of technology, in consideration, 70 participants (24.31 %) are left. Though the same can be done for participants that regard other factors as more important and excluding those, who are driven by social interactions and use of technology. 120 participants (41.67 %) regard other factors as the main drivers behind participation in the platform. Therefore, hypothesis 7 can be rejected.

For **hypothesis 8**, the end users interested in smart home technology and especially the field of application is analyzed. End users with a general interest in smart home technologies are considered and which features are of special interest to them. Figure 3 shows the results. Again, participants were able to give multiple answers and therefore a more detailed analysis is needed. 197 participants (64.80 %, N=304) are interested in smart home technology in general. Out of these 189 participants (62.17 %) are interested in support in

daily routines and energy savings. However, due to the multiple answers 132 participants are also interested in other fields of application (43.41 %). By excluding the different end user groups, the results are a bit clearer. 21.38 % of all participants (n=65), who are interested in smart home technologies in general, are only looking for objects that help with daily routines and energy savings. However, only 2.63 % of participants (n=8) are only looking for other areas of application. Therefore, hypothesis 8 can be accepted.

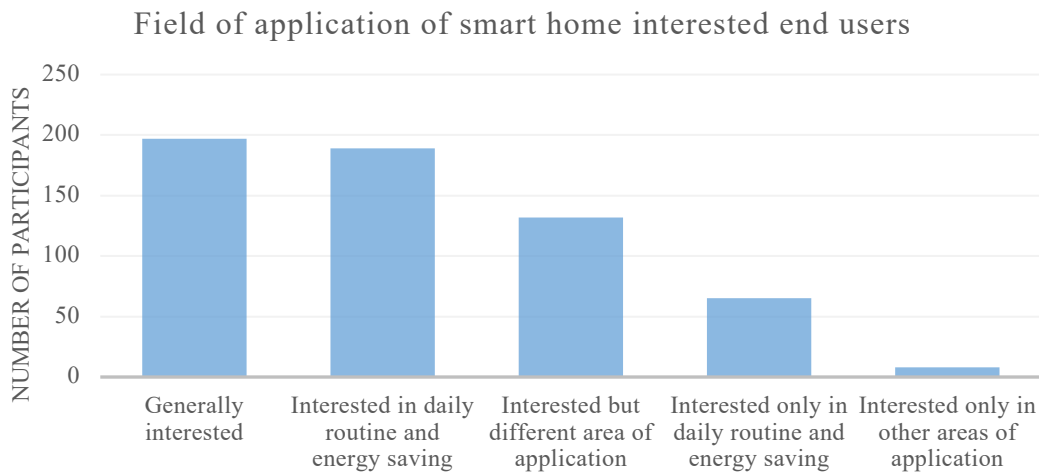


Figure 3: In smart home interested end users and their areas of application.

Hypothesis 9 considers, whether end users, who are interested in smart home technology in general are willing to pay more for smart furniture. Figure 14 shows the results. 43.65 % of the participants (n=86), who are interested in smart home technologies state that their willingness to pay depends on the value that is created through the smart feature. Another 43.14 % (n=85) are willing to between 10 and 30 percent more for a smart product. In comparison, only 14 participants (20.29 %), who are not interested in smart home technologies, are willing to pay 10 to 30 percent more and for 21 participants (30.44 %) it depends on the value created. Therefore, hypothesis 9 can be accepted.

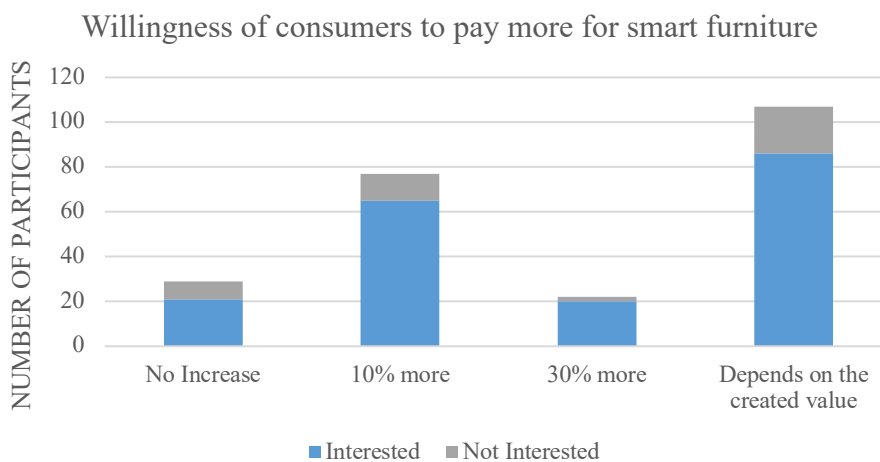


Figure 4: Willingness of smart home interested end users to pay more for smart furniture

6. Limitations, Conclusion and Outlook

There are a few limitations to this study. First, it was only conducted online which means that potential customers, who are not willing to participate in an online survey were excluded from the sample. Second, even though more than 300 people participated in the study, this is only a small sample size regarding the population of the European Union. Additionally, 70,1 % of the participants are living in Germany or France what can lead to a distortion as it does not represent the European Union in a completely equal way.

The survey's objective is to investigate the perspective of the end user of the INEDIT platform. Assumptions are made prior to the survey to investigate customer's reasoning for buying furniture in general, but also their perceptions and expectations of sustainability, smartification and 3D printing in the furniture sector.

The insights from the survey can have a valuable impact to the INEDIT platform. First, the potential customer base is quite diverse regarding age and income. There is not one dominating age or income group, which shows that the platform appeal to anyone. Furthermore, the survey results show that there is a considerable interest in sustainable furniture. Potential customers are also willing to pay more for it. This can be used to address potential manufacturers to register on the platform and offer their services. Second, the community aspect of the platform does not seem to be a driving factor behind the participation on the platform. Further research must be undertaken to find out whether this is true for all platform users (buyers, designers, and manufacturers) or just for one of the stakeholder groups. This leads to the design aspect. It seems that furniture design is also not one of the reasons for using the platform. Therefore, the design process should be as simple as possible to appeal to the end users. Third, there is a good chance that if the knowledge about 3D printing in general is increasing, that the interest in 3D printed furniture and therefore the demand of it will grow as well. Manufacturers should explore this technology to be prepared for the future.

Furthermore, particular statistical methods are not yet applied. To make a deeper validation of the hypothesis further procedures can be performed in the follow-up.

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Biography



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