

END-USER FEATURES IN THE SUSTAINABLE FURNITURE DESIGN THROUGH SUPRA-FUNCTIONALITY NEEDS

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ABSTRACT

There is an alternative approach to design sustainable furniture beyond functionality and usability needs. In this alternative, emotional and pleasure demands are considered which are referred to as supra-functionality needs. The positive emotional interaction between an end-user and a product can persuade the owner to keep the product for a longer period. Keeping existing products for longer time will help the sustainable design objectives. The important question is what features affect this emotional interaction with the end-user. This study investigates the impact of end-user's gender and income on keeping an existing home sofa for a longer period in case that the product gives them a "Good sense". In this study, three hundred and eighty-eight Malaysian users answered the Likert scale question, which is "I keep my old sofa for longer periods because it gives me a Good sense". "Good sense" presents end-user's supra-functionality needs. The research team used a quantitative approach and two-way analysis of variance to analyse the effect of the end-user's gender and income on keeping a home sofa for longer periods. The results show that there is a significant difference between male, female, and families' household income categories in "keeping the old sofa for Good sense". In all household income categories, men had more agreed with keeping the existing sofa for longer periods except only one income category. A Post-Hoc test shows families with an average household income have more emotional interaction with their sofa. Furniture with supra-functional aspects makes the end-user, especially the men, to keep their existing products for longer time in families with an average income.

Keywords: Sustainable design, supra-functional needs, furniture design, home sofa, end-user needs

1. INTRODUCTION

Jordan (2000) stated that there are three levels of user's needs. A: Functionality; B: Usability; C: Pleasure. There is recognition in the design community that an understanding of end-users needs is central to a successful design development (Strickfaden & Devlieger, 2011), however users seek more than functionality alone. Designers capability to understand the end-user's functionality and usability needs are at acceptable levels. It is no longer sufficient for a product to function properly, be usable and efficient, and have aesthetic appeal; it has to provide positive emotional responses (Desmet, 2002), which is the pleasure level of needs.

Considering the end-users needs and emotions in the design process is fundamental in creating positive feelings for the users. End-users are looking for their dreams, aspirations, values, and in general, their emotional models to be seen in products they are willing to purchase (Weightman & McDonagh, 2004). These types of needs that relate to the end-user's positive emotions, called supra-functionality needs that are completely pleasure ones.

Many industrial products have reached a level of functional maturity, especially in products that are not technology-based like furniture. In the case of sustainable furniture design, the main focus is on the sustainability goals such as recycling, refreshing, and repairing which are related to functional or usability needs. Some strategic approaches pay more attention to end-users needs beyond only functionality ones.

Supra-functional needs can also play an important role in a sustainable development process. End-users willingness to keep their existing products for longer periods will address the agenda of sustainable design (Weightman & McDonagh, 2004). Design factors influence a consumer's tendency to retain their products for longer (Haines-Gadd et al., 2018). Positive emotions between an end-user and a product can convince the end-user to keep an existing sofa for longer periods. The question is what features of the end-user can affect his/her emotional relationship. The objective of this research is to

increase the likelihood of delivering a sustainable furniture product through understanding user's important features in his/her supra-functionality needs.

This study investigates the impact of two features of an end-user (gender and household income) on keeping a home sofa for longer period if that product gives them a good sense. Good sense presents the positive emotions between an end-user and a sofa, which is called supra-functionality needs. The hypothesis is that there is an impact of gender and household income on "keeping old sofas for good sense". The meaning of the old sofa is an end-user's existing sofa.

2. LITERATURE REVIEW

This section goal is to explain sustainable development aspects in product design and provide a clear definition of supra-functionality needs, especially in the furniture design realm, and its impacts on sustainable product design.

2.1 Sustainable product design

In sustainable product design, the main focus is on functional or usability needs as the basic needs. Subjects such as basic needs, life-cycle design, product systems, product durability, long-term resource availability, and natural compatibility will be central points to the concept of sustainable product development (Van Weenen, 1995), however, basic needs have reached a maturity level.

Understanding end-users needs beyond their basic needs such as emotional needs can be an effective approach in the sustainable product design development. More sustainable solutions for sustainable product development can be offered with special attention to the end-user's emotional needs and desires. Once basic utility availability is surpassed, we enter an area of design that deals with the social and positional aspects of material culture (Walker, 2012). Companies create lasting value through sustainable design by managing across the functions and lifecycle phases that shape the sustainability of the final product (White et al., 2008).

Considering an average user's emotional needs and considering them in the product design process can impact the social life cycle aspect of sustainability assessment. Based on the triple bottom line (TBL) (Clark et al., 2009), true sustainability assessment, including the three main aspects which are environmental, economic, and social life cycle assessment (Kloepffer, 2003). The agenda of sustainable product design can be achieved by attending to the end-users emotional needs to extend the consumption period in the product's life cycle (Weightman & McDonagh, 2004). Figure 1 shows different stages in the product life cycle.

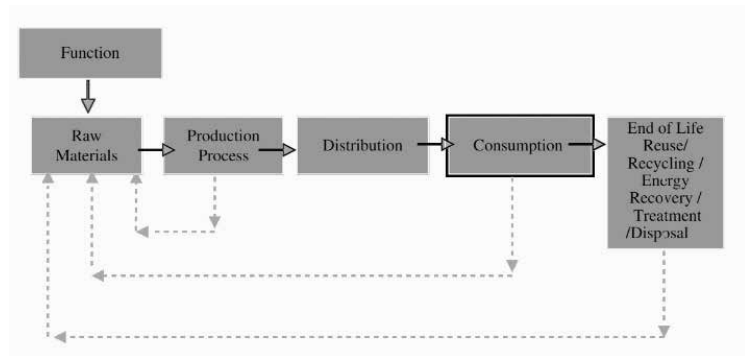


Figure 1: Consumption stage in the product life cycle (Maxwell et al., 2006)

As design has an important role to play in producing more sustainable solutions to the existing problems (Charter, 1998), this paper tries to study the role of design for extending the consumption period of the end-users existing products with attention to users emotional needs based on their features like gender and household income.

2.2 Supra-functionality needs

Based on Patrick Jordan's hierarchy of needs towards an industrial product (Jordan, 2000) there are three different levels of needs: Level 1: Functionality; level 2: Usability; level 3: Pleasure. The fact that products can evoke pleasure and prompt emotions is not a question (Chhibber & Porter, 2005). Users seek a product that answers their pleasure needs, especially when functionality and usability needs are at mature level which there is no obvious difference in the product alternatives. These emotional and pleasure needs are called supra-functionality needs. The goal of supra-functional needs is to create a positive emotional bond with the consumer.

Supra-functionality can be defined as follows: attributes that satisfy a user beyond the utilitarian functional needs (McDonagh & Thomas, 2010). Supra-functionality refers to a more ephemeral needs of a user (Silva, 2010), are often associated with the stakeholder's cultural, emotional, social, inspirational, and tribal needs (Fenech & Borg, 2006) and also user's religious needs, It is advantageous if designers can make it easier for people to gain Allah's pleasure through their design. (Norzaman et al., 2017). Supra-functional specifications can be summarized as below:

- a. Is the final deciding factor when pricing and functional needs are similar and there are no obvious differences between the two products.
- b. Are completely psychological and intangible needs.
- c. Has often-difficult-to-grasp elements and are vibrant and change frequently (Silva & Simões, 2010).
- d. Tools for integrating the supra-functionality are extremely different in terms of content for each product (Watson & McDonagh, 2004).
- e. Supra-functional factors will interact with the functional aspects (McDonagh & Weightman, 2015).

Understanding and responding to the end-users Supra-functional needs has many subsequent impacts on the product design (Weightman & McDonagh, 2004): connecting people to products, pride of ownership, respect for function, pleasure in performance, emotional bonding with products, enjoyable experience, and loyalty to a product. These are outcomes of the perception of pleasurable emotions (Fenech & Borg, 2006) and create a good sense in the end-user mind. This good sense can persuade an end-user to retain their existing product for a longer period, which is a goal of sustainable product development.

2.3 Furniture design

Furniture exports show that the furniture industry has developed positively and contributes to Malaysia's economy by providing a high quality product at reasonable prices (Osman & Rahman, 2019), but quality and price are not everything. There is a huge competition in the furniture industry, especially for home sofa furniture. A home sofa is not a technology-based product and most of the furniture factories and even wood shops can make this product almost in the same way and quality. Thus, the price of the home sofa and functional requirements are almost similar and there is no obvious difference between different sofas. Therefore, considering a positive, pleasurable emotion in sofa design plays a vital role in the end-user's consumption period in the sofa life cycle.

Furniture is a type of product that consumers select with a great deal of consideration and spend a lot of time before finally making a decision to buy one (Oblak et al., 2017). Besides, the home sofa was found to be very useful furniture as people have a prolonged and intimate sensory interaction with this product. It means that people are likely to have a number of opinions and

preferences regarding home sofas and makes this product a good case to study the end-user's supra-functionality needs.

3. METHODOLOGY

This paper goal is to investigate this hypothesis: There is an effect of gender and household income on keeping old sofas for good sense.

Gender differences in the encoding and decoding of emotions have been found and replicated several times (Merten, 2005). Moreover families income and emotional state are interlinked and emotional well-being rises with the income (Kahneman & Deaton, 2010). In this study, "Good Sense" presents end-users supra-functional needs and "old sofa" presents the end-users existing sofa. "Gender" and "household income per month" are two nominal independent variables; and "keeping old sofa for good sense" is one continuous dependent variable.

Research team used questionnaire approach in data collection to understand young Malaysian people opinion about their interaction with home sofa. All the participants in this survey are residing in KL and Selangor province in Malaysia. The raw data has been collected through Google form Likert-Scale questionnaires with 5-point rating scale. The link of this online questionnaire was distributed in Malaysian Facebook and WhatsApp groups and also were emailed to group of people too. Based on the Cochran sample size formula (Cochran, 1977), 388 participants (young people, aged 25 to 49 years old) answered the question "I keep my old sofa for longer periods because it gives me a good sense" to collect end-users supra-functionality opinion about their existing home sofa.

Gender as a nominal independent variable has two categories that are valued: Man=1, Woman=2. "Household income per month" as the other nominal independent variable has five categories based on Malaysian Ringgit (RM) that are valued as: 2000RM and below= 1, 2000RM to 5000RM= 2, 5000RM to 8000RM=3, 8000RM to 10000RM=4, and above 10000RM=5.

The statistical analysis related to the descriptive statistic and two-way factorial ANOVA analysis with a Post-Hoc test has been done by using the SPSS software package. In this study, two-way ANOVA analysis shows two effects which includes separate and interaction effects. Separate effects shows the impact of "gender" and "household income" on "keeping old sofa for good sense" separately. Interaction effect shows the effect of "gender" and "household income" simultaneously on "keeping old sofa for good sense".

4. RESULTS AND DISCUSSION

Three hundred and eighty-eight individuals answered the online questionnaire whom 185 (47.7%) were Male and 203 (52.3%) were Female. 23 people had 2000RM and below household income (5.9%), 131 people had 2000RM to 5000RM household income (33.8%), 138 people had 5000RM to 8000RM household income (35.6%), 55 people had 8000RM to 10000RM (14.2%) and 41 people had above 10000RM (10.6%) shown in Table 1.

Table 1: Descriptive statistic of variables

Dependent Variable: Keeping old sofa - good sense					
Gender	Household income	Mean	Std. Deviation	N	
Male	2000 RM and below	4.15	.801	13	
	2000 RM - 5000 RM	4.62	.661	52	
	5000 RM to 8000 RM	4.53	.872	68	
	8000 Rm to 10000 Rm	4.47	.803	32	
	10000 RM above	3.90	1.410	20	
	Total		4.45	.896	185
Female	2000 RM and below	3.80	.789	10	
	2000 RM - 5000 RM	4.11	1.038	79	
	5000 RM to 8000 RM	4.14	1.067	70	
	8000 Rm to 10000 Rm	4.52	.846	23	
	10000 RM above	3.52	.750	21	
	Total		4.09	1.013	203
Total	2000 RM and below	4.00	.798	23	
	2000 RM - 5000 RM	4.31	.937	131	
	5000 RM to 8000 RM	4.33	.991	138	
	8000 Rm to 10000 Rm	4.49	.814	55	
	10000 RM above	3.71	1.123	41	
	Total		4.26	.974	388

A two-way factorial ANOVA was conducted to compare the main effects of gender and household income as well as their interaction effects on the “keeping the old sofa for good sense”. Gender and household income effects were statistically significant at $p < 0.05$.

The main effect for “gender” yielded an effect size of 0.018, indicating that 1.8% of the variance in the “keeping the old sofas for good sense” was explained by gender ($F(1, 378) = 6.762, p = 0.010$) (see table 2). It means there is a significant difference between male and female in “keeping old sofas for good sense”. In all household income categories, men agreed more with keeping

the existing sofa for longer periods, except the 8000RM to 10000RM category (Figure 2). The total mean for Keeping Old Sofa-good sense is 4.26 (Male=4.45 and Female=4.09).

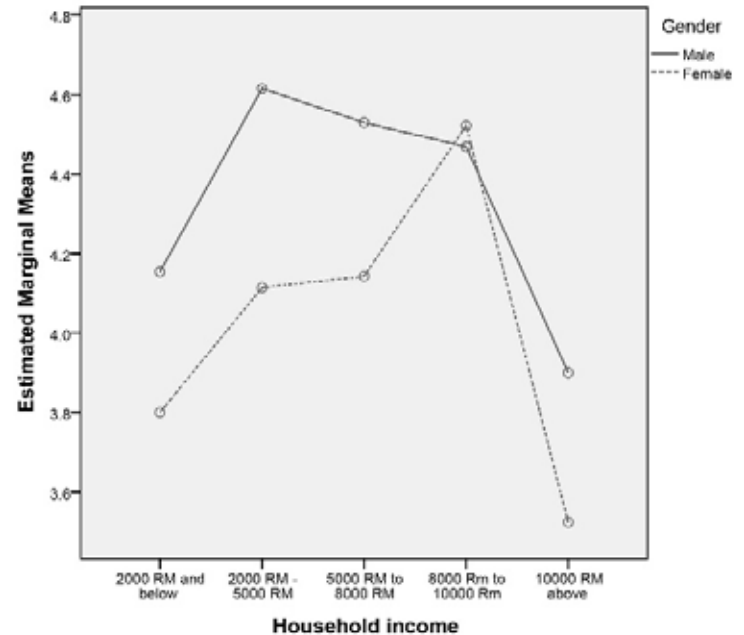


Figure 2: Estimated Marginal Means of Keeping old sofa - good sense

The main effect for “household income” yielded an effect size of 0.054, indicating that 5.4% of the variance in the “keeping the old sofas for good sense” was explained by household income ($F(4, 378) = 5.411, p = 0.000$) (see table 2).

Tests of Between-Subjects Effects						
Dependent Variable: Keeping old sofa - good sense						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	33.352 ^a	9	3.706	4.196	.000	.091
Intercept	4253.823	1	4253.823	4816.611	.000	.927
Gender	5.972	1	5.972	6.762	.010	.018
Householdincome	19.114	4	4.779	5.411	.000	.054
Gender * Householdincome	2.937	4	.734	.831	.506	.009
Error	333.833	378	.883			
Total	7418.000	388				
Corrected Total	367.186	397				

a. R Squared = .091 (Adjusted R Squared = .069)

Table 2: Test of Between Subjects Effects

The results do not indicate which of the five categories of the household income variable differ from one another. Therefore, it is of interest to continue the analysis with a Post-Hoc test or a planned comparison among particular means. If several comparisons between pairs of means are made, it is a good idea to use tests such as the Tukey analysis, which controls for alpha-inflation (Abdi & Williams, 2010).

The Tukey Post-Hoc tests indicated that “Keeping old sofa-good sense” in the “2000RM-5000RM”, $p=0.003$ and “5000RM-8000RM”, $p=0.002$ and “8000RM-10000RM”, $p=0.001$ categories differed significantly from “Keeping old sofa-good sense” in “2000 RM and below”, $p = 0.754$, and “above 10000 RM” categories, $p=0.754$ (summarized in Table 3).

It means families with an average household income exhibit a significant impact of keeping the old sofa because that sofa gives them a good sense. In other words, Malaysian families with an average household income have more emotional bond with their sofa.

The interaction effect of “gender” and “household income” was not significant ($F(4, 378) = 0.831, p = 0.506$), indicating that there was no combined effect for gender and household income on the “keeping the old sofa for good sense” (see table 2).

Table 3: Tukey HSD Post-Hoc Tests for Household income variable

		Multiple Comparisons				
Dependent Variable: Keeping old sofa - good sense		Tukey HSD				
(I) Household income	(J) Household income	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
2000 RM and below	2000 RM - 5000 RM	-.31	.212	.581	-.90	-.27
	5000 RM to 8000 RM	-.33	.212	.514	-.91	-.25
	8000 Rm to 10000 Rm	-.49	.233	.221	-1.13	-.15
	10000 RM above	.29	.245	.754	-.38	.96
2000 RM - 5000 RM	2000 RM and below	.31	.212	.581	-.27	.90
	5000 RM to 8000 RM	-.02	.115	1.000	-.33	.29
	8000 Rm to 10000 Rm	-.18	.151	.764	-.59	.24
	10000 RM above	.61*	.168	.003	.14	1.07
5000 RM to 8000 RM	2000 RM and below	.33	.212	.514	-.25	.91
	2000 RM - 5000 RM	.02	.115	1.000	-.29	.33
	8000 Rm to 10000 Rm	-.16	.150	.831	-.57	.25
	10000 RM above	.63*	.167	.002	.17	1.08
8000 Rm to 10000 Rm	2000 RM and below	.49	.233	.221	-.15	1.13
	2000 RM - 5000 RM	.18	.151	.764	-.24	.59
	5000 RM to 8000 RM	.16	.150	.831	-.25	.57
	10000 RM above	.78*	.194	.001	.25	1.32
10000 RM above	2000 RM and below	-.29	.245	.754	-.96	.38
	2000 RM - 5000 RM	-.61*	.168	.003	-1.07	-.14
	5000 RM to 8000 RM	-.63*	.167	.002	-1.08	-.17
	8000 Rm to 10000 Rm	-.78*	.194	.001	-1.32	-.25

Based on observed means.
The error term is Mean Square(Error) = .883.
*. The mean difference is significant at the .05 level.

5. CONCLUSION

Furniture has reached a level of maturity in functionality and usability that designers should enter the end-user’s emotional realm to satisfy them. The design of successful sustainable furniture can be achieved by creating positive and pleasurable emotions between the end-user and product which are called end-user’s supra-functionality needs.

Keeping existing sofas for longer periods because of positive emotion between end-user and sofa is one of the sustainable product design’s goals. However, it is not clear whether end-user’s features like gender and income have any impact on this matter or not. This paper investigated to answer this question.

This paper indicates that there is a significant difference between male and female and families’ household income categories in “keeping old sofas for good sense”. In all household income categories, men agreed more with keeping the existing sofa for a longer period. It meant men had more emotional interactions with their sofa. Families with an average household income level showed a significant impact on keeping the old sofa because that sofa gives them a good sense. In other words, Malaysian families with an average household income have more emotional bonds with their sofa.

Furniture with supra-functional aspects, making the end-users, especially the men, keep their existing products for longer periods in families with average household income. Therefore, gender and household income are two end-user’s impactful features in supra-functionality needs, which have direct impact on increasing the likelihood of delivering a sustainable furniture.

In addition, it should be noted that the most successful products are those that combine good functionality with the effective satisfaction of supra-functional needs. Other end-user features such as education, race, and marital status should be investigated in future studies.

6. REFERENCES

- Abdi, H., & Williams, L. J. (2010). Tukey’s honestly significant difference (HSD) test. *Encyclopedia of Research Design*, 3(1), 1–5.
- Charter, M. (1998). Sustainable product design. In *The Durable Use of Consumer Products* (pp. 57–68). Springer.
- Chhibber, S., & Porter, S. (2005). Real People: 100 stories of what and why.... *ENGAGE Newsletter*, 2, 5–7.

- Clark, G., Kosoris, J., Hong, L. N., & Crul, M. (2009). Design for sustainability: Current trends in sustainable product design and development. In *Sustainability* (Vol. 1, Issue 3, pp. 409–424). <https://doi.org/10.3390/su1030409>
- Cochran, W. G. (1977). The estimation of sample size. *Sampling Techniques*, 3, 72–90.
- Desmet, P. M. A. (2002). Designing emotions (Doctoral dissertation). *Technical University of Delft, Industrial Design Engineering, Delft*.
- Fenech, O. C., & Borg, J. C. (2006). A model of human sensations as a basis for 'design for product-emotion'support. *DS 36: Proceedings DESIGN 2006, the 9th International Design Conference, Dubrovnik, Croatia*, 705–712.
- Haines-Gadd, M., Chapman, J., Lloyd, P., Mason, J., & Aliakseyeu, D. (2018). Emotional durability design Nine-A tool for product longevity. In *Sustainability (Switzerland)* (Vol. 10, Issue 6). <https://doi.org/10.3390/su10061948>
- Jordan, P. (2000). The four pleasures. *Designing Pleasurable Products*, 11–57.
- Kahneman, D., & Deaton, A. (2010). High income improves evaluation of life but not emotional well-being. *Proceedings of the National Academy of Sciences*, 107(38), 16489–16493.
- Kloepffer, W. (2003). Life-cycle based methods for sustainable product development. In *International Journal of Life Cycle Assessment* (Vol. 8, Issue 3, pp. 157–159).
- Maxwell, D., Sheate, W., & van der Vorst, R. (2006). Functional and systems aspects of the sustainable product and service development approach for industry. In *Journal of Cleaner Production* (Vol. 14, Issue 17, pp. 1466–1479). <https://doi.org/10.1016/j.jclepro.2006.01.028>
- McDonagh, D., & Thomas, J. (2010). Disability + relevant design: Empathic design strategies supporting more effective new product design outcomes. *Design Journal*, 13(2), 180–196. <https://doi.org/10.2752/175470710X12735884220899>
- McDonagh, D., & Weightman, D. (2015). *If kettles are from Venus and televisions are from Mars , where are cars from ? Deana McDonagh and David Weightman. January 2003*.
- Merten, J. (2005). Culture, gender and the recognition of the basic emotions. *Psychologia*, 48(4), 306–316.
- Norzaman, N. Z. A., Shaari, N., Rahman, K. A. A. A., Utaberta, N., & Jaafar, J. M. (2017). Integrating Asma ul Husna values for design excellence. *Pertanika Journal of Social Science and Humanities*, 25, 33–40.
- Oblak, L., Pirc Barčić, A., Klarić, K., Kitek Kuzman, M., & Grošelj, P. (2017). Evaluation of Factors in Buying Decision Process of Furniture Consumers by Applying AHP Method. *Drvna Industrija*, 68(1), 37–43. <https://doi.org/10.5552/drind.2017.1625>
- Osman, N. S., & Rahman, K. A. A. A. (2019). Strategic Design Management Capability Framework for Bumiputera SME Furniture Manufacturer. *International Journal of Advanced Science and Technology*, 28(8s), 653–660.
- Silva, A. (2010). *Handbook of Research on Trends in Product Design and Development: Technological and Organizational Perspectives: Technological and Organizational Perspectives*. IGI Global.
- Silva, A., & Simões, R. (2010). Handbook of research on trends in product design and development: Technological and organizational perspectives. In *Handbook of Research on Trends in Product Design and Development: Technological and Organizational Perspectives*. <https://doi.org/10.4018/978-1-61520-617-9>
- Strickfaden, M., & Devlieger, P. (2011). Empathy through accumulating techné: Designing an accessible metro. *The Design Journal*, 14(2), 207–229.
- Van Weenen, J. C. (1995). Towards sustainable product development. *Journal of Cleaner Production*, 3(1–2), 95–100.
- Walker, S. (2012). *Sustainable by design: Explorations in theory and practice*. Routledge.
- Watson, B., & McDonagh, D. (2004). Design and emotion. *Engineering Designer*, 30(5), 8–11.

- Weightman, D., & McDonagh, D. (2004). Supra-functional factors in sustainable products. *Design and Manufacture for Sustainable Development*, 91–101.
- White, C., Stewart, E., Howes, T., & Adams, B. (2008). Aligned for sustainable design: An ABCD approach to making better products. *Business for Social Responsibility and IDEO*.