

HOUSE OF QUALITY (HOQ) APPROACH TO WOMEN'S BACKPACK DESIGN USING QUALITY FUNCTION DEPLOYMENT (QFD) METHOD

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Article history: received 31 November 2023; revised 02 December 2023; accepted 04 January 2024

DOI: <https://doi.org/10.33751/jhss.v8i1.9449>

Abstract. The need for backpacks is increasing along with increased mobility, including among women. Backpacks are needed by women who do a lot of activities and have to carry lots of things to support their daily activities, be it school, college, or work. With so many choices of backpacks available in the market, it is not uncommon for many women to be confused about choosing a backpack that suits their needs. Therefore, it is necessary to conduct a study to help formulate the characteristics of an ideal backpack for students, university students, and women in general who often carry a lot of things to support their various daily activities. Using the Quality Function Deployment Method or House of Quality approach, the authors try to find a formula for the design characteristics of backpacks that are expected by consumers in the market, especially students, female students and women in general who have high mobility. The characteristics used as a reference will be based on the seven dimensions of product quality. Expectations and wishes of consumers regarding the characteristics of an ideal backpack will be contained in an opinion poll which is then formulated using the QFD or HOQ methods. The result of the analysis of this research is to know the characteristics of an ideal backpack to support the activities of students, female students and women who have high mobility.

Keywords: backpack; characteristics; consumers; quality; design; quality function deployment; house of quality

I. INTRODUCTION

As time goes by and women's mobility increases nowadays, they need a backpack to be used as a tool that can support their activities. The number of backpack manufacturers on the market is directly proportional to the many variants available and this makes women confused in making choices. Ideally, the choice is made according to the needs and desires [1]. Thus, a method is needed to analyze these problems, in order to formulate customer needs and desires as a basis for decision making in choosing an ideal quality backpack to use. The quality of a product can be influenced by the attributes attached to the product. As for referring to product attributes according to Garvin [1], the product quality dimensions of backpacks must meet the Performance criteria, which relate to several functional aspects of a product and are the main characteristics that consumers consider when buying a product. [2] Feature, is a performance aspect that is very useful for adding basic functions, which are related to product choices and product development [3]. Reliability, is related to the probability or likelihood that a product will succeed in carrying out its functions every time it is used or used within a certain period of time and under certain conditions. Conformance, related to the level of conformity related to predetermined specifications based on the wishes of consumers [4]. Durability, is a reflection of the economic age in the form of a measure of the durability or service life of a product [5]. Serviceability, is a characteristic related to competence, speed, accuracy and ease in providing repair services of an

Aesthetics product, is a characteristic that is subjective about aesthetic values related to personal considerations and references from an individual. Fit and finish, is subjective related to consumer feelings about the existence of a product as a quality product. Backpacks on the market are very diverse and have their own advantages and disadvantages. However, even though there are many variants available, it is not uncommon for consumers to have to sacrifice one of their needs and wants because they do not get a backpack that can meet their expectations, so it is not uncommon for consumers to choose products that do not suit them. This is an opportunity to increase consumer satisfaction by presenting products that meet the expectations of consumers, who in this case study are women. To design a backpack product that is expected by consumers, it is necessary to use a product design method that can accommodate the needs and desires of consumers, so that the product design obtained is the fruit or result of consumer expectations. This product development is carried out to find the best solution for the development of the desires and needs of different consumers. The following is a phase in product development which can be seen in Figure 2.1.

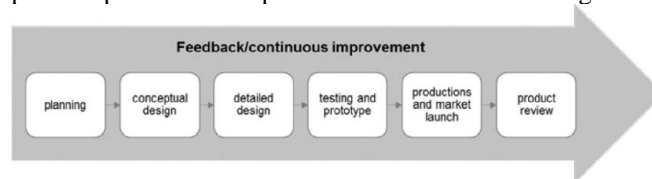


Figure 1 Phases of product design and development (Ulrich, 2001)

Quality Function Deployment (QFD) is a "concept that provides a means to translate customer needs into appropriate technical requirements at each stage of product development[6]. Mizuno and Akao (1978, in Akao and Mazur, 2003) define QFD as "... step by step deployment of a job function or operation, that embodies quality, into their details through systematization of targets and means". QFD focuses on determining a customer's needs and an organization's commitment to satisfying those needs [7]. The QFD process begins with hearing the voice of the customer and then continues through 4 main activities, namely: product planning, product design, process planning, process planning control. The main benefits if the company using QFD, namely to reduce costs, increase revenue and reduce production time. Quality Function Deployment (QFD), also known as House of Quality (HoQ), is a method that supports the product identification process into a design specification. HoQ is used to translate the needs or requests of each customer, which is based on market research, benchmarking data, into an amount according to the target that must be met by a new product design with a cycle shape resembling a house.

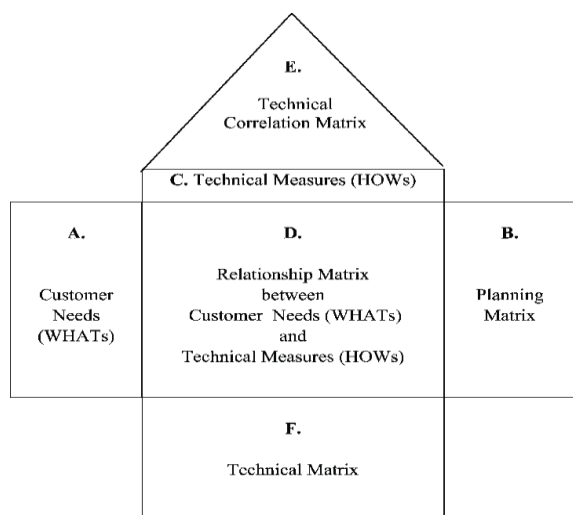


Figure 2. House of Quality

II. RESEARCH METHODS

A good product design is a product design that is based on the needs and desires of consumers [8]. This is related to a very diverse combination of appearance and function [9]. If there is a product that meets expectations, then the selection of products to buy will not be too confusing even though there are many variants available. Product design is a bigger concept than style. Styles that only describe a product display. Style can be interesting or it can also be boring. Sensational styles can be attractive and can then produce beautiful aesthetics, but these styles do not actually make product performance better [10]. Unlike style, design is not just skin deep, design is the heart of the product. To obtain a product design that meets consumer expectations, the Quality Function Deployment (QFD) or House of Quality (HoQ)

method is used [11]. The following is the flow or stages of this research for designing women's backpack products using the Quality Function Deployment (QFD)/House of Quality method [12].

- Identify the characteristics of respondents from each consumer needs
- Identify the required attributes of the product
- Calculating the value of the weight that is considered important from each weight importance criterion
- Designing product designs using the House of Quality (HOQ) method
- Analyzing the selected product concept designs from each category in the HOQ

The following describes the stages in the research.

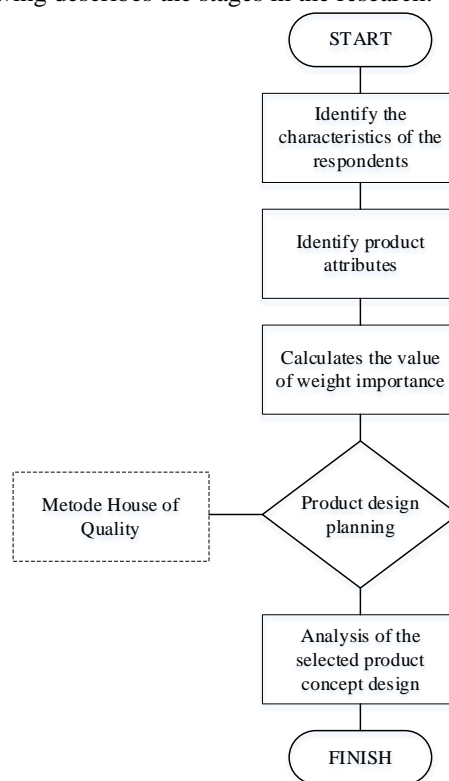


Figure 2. the stages in the research

Considering that the topic raised is a product that is widely used by the public, the authors limit this research to only women's backpacks / backpacks that are commonly used by women. So the object of research or respondents to this study are women who have been categorized as teenagers to adults[13].

III. RESULT AND DISCUSSION

Respondents who will provide responses to the questionnaire are young women aged over 17 years, or in other words, respondents are high school students to college students. The following are product attributes that are included in three levels, levels I and II are made by the author and level III attributes are directly selected by the respondents.

Table 1. Product Attributes

No	Backpack attributes based on consumer desires			
	Performance			
	Level I	Level II	Level III	
1	The product material used	leather	35,7%	leather
		Synthetic leather	19,6%	
		Kanvas	26,8%	
		Material cloth	17,9%	
		Nilon	0%	
2	Additional featured attributes to support the main function	Feature		Strong rope
		Strong rope	48,2%	
		Easy assembly of backpack straps and stitching	30,4%	
		There are several small pockets	21,4%	
3	The durability of the product when it is used to perform its main function and the possibility that the product will not function for a certain period of time	Reliability		Ability to accommodate large and heavy loads
		Ability to accommodate large and heavy loads	41,1%	
		Good strength on bag straps	19,6%	
		The strength of the seams that exist in backpacks	32,1%	
		The strength of the zipper or strap used on the backpack	7,1%	
4	Conformity of product performance/Product comfort	Conformance		The comfort of a backpack when used
		The comfort of a backpack when used	66,1%	
		Suitability of the shape and size of the bag with the anatomy of the human body	16,1%	
		The suitability of the seam on the bag	7,1%	
5	Product usage period	Durability		Ransel yang digunakan awet dan tahan lama (diatas 3 thn)
		The backpack used is durable and long lasting (over 3 years)	67,9%	
		Colors that do not fade when washed (over 3 years)	8,9%	
		Zippers are not easily damaged (over 3 years)	10,7%	
		Fabric is not easy to peel off (over 3 years)	5,4%	
		The rope is not easily cut or released (over 3 years)	7,1%	
6	Ease of service/repair	Serviceability		Ease of product maintenance
		Product warranty (long warranty time)	19,6%	
		Ease of product maintenance	41,1%	
		Materials (backpack components) that are easy to get	3,6%	
7	Expected bag model	Aesthetics (Tampilan produk)		It has a zipper on the front to store various accessories
		The flap model is equipped with a metal ring in the middle	8,9%	
8	Expected backpack color	Aesthetics (Tampilan produk)		Soft colors (dark gray, cadillac pink, easy green)
		It has a zipper on the front to store various accessories	71,4%	
		Strap model with two straps on the front	19,6%	
		Light colors (red, pinks, yellows)	5,4%	
		Dark colors (purple, dark blue, black)	30,4%	
Soft colors (dark gray, cadillac pink, easy green)	64,3%			

Table 2 Attributes backpack

No	Attributes backpack	Variabel
1	The material is made of leather	x1
2	Have a strong rope	x2
3	It has the ability to accommodate large and heavy loads	x3
4	Backpacks provide comfort when used	x4
5	The backpack used is durable and long lasting (over 3 years)	x5
6	Easy product maintenance	x6
7	It has a zipper on the front to store various accessories	x7
8	Soft colors (dark gray, cadillac pink, easy green)	x8

The weight importance value of the product is calculated based on the average of the numbers input by the respondents in the questionnaire that has distributed previously. How to calculate weight importance is as follows :
 Weight importance = $\frac{\text{Total Value } x}{10}$

The weight importance value can also be said to be the average value of the number of x values. The following is the data obtained from the respondents.

Tabel 3 Weight mportance

Statement	Value										Total	Average
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10		
x1	5	2	3	4	4	5	4	3	4	4	38	3,8
x2	5	5	5	5	5	5	4	5	5	4	48	4,8
x3	5	5	5	5	5	5	5	5	5	4	49	4,9
x4	5	4	5	5	5	5	5	5	5	4	48	4,8
x5	5	5	5	5	5	5	5	5	5	4	49	4,9
x6	5	5	5	5	5	5	5	5	3	4	47	4,7
x7	5	4	5	5	5	5	4	5	4	4	46	4,6
x8	5	3	5	3	5	5	5	5	3	4	43	4,3

For the design of product concepts based on the wishes and expectations of consumers contained in the House of Quality, the priority order of the product attributes is as follows.

Table 4. Ranking of backpack product attributes

No	Atribut Produk	Skor weight importance	Skor relative weight
1	Performance	604,3	16,9
2	Feature	567,4	15,9
3	Durability	548,4	15,4
4	Conformance	510,9	14,3
5	Reliability	500,0	14,0
6	Serviceability	495,7	13,9
7	Aesthetics	340,2	9,5

Design analysis of the selected product concept

Based on the ranking that has been done in designing the product concept, the backpack that is made must have the characteristics of being strong, comfortable and durable rather than having an aesthetic appearance. This can be seen in the ranking table of attribute priority expected by consumers, the top sequences are dominated by strength, comfort and product durability factors while aesthetics ranks last.

IV. CONCLUSIONS

Through analysis using the Quality Function Deployment (QFD)/House of Quality (HoQ) method, the desires and needs of respondents who are women related to backpack products can be identified. The desires and needs of consumers can be channeled into a backpack product design

Calculate the value of weight importance

Based on the results of distributing the first questionnaire, the attributes selected for the women's backpack are as follows table 2. The attributes contained in the table above will be included in the questionnaire for determining the weight importance value or in other words, the order/ranking of the attributes will be determined by the respondent by giving a value ranging from 1 (lowest) to 5 (highest).

concept. Therefore, by using the Quality Function Deployment (QFD)/House of Quality (HoQ) method, consumers will not be too confused when choosing what kind of backpack they should buy to support their daily activities.

REFERENCES

- [1] L. Fonseca, J. Fernandes, And C. Delgado, "Sciencedirect Sciencedirect Qfd As A Tool To Improve Negotiation Process , Product Quality , And Market Success , In An Automotive Industry Battery Components Supplier," *Procedia Manuf.*, Vol. 51, No. 2019, Pp. 1403–1409, 2021, Doi: 10.1016/J.Promfg.2020.10.195.
- [2] W. Chen, B. Yang, And Y. Liu, "Advanced Engineering Informatics An Integrated Qfd And Fmea Approach To Identify Risky Components Of Products," *Adv. Eng. Informatics*, Vol. 54, No. November, P. 101808, 2022, Doi: 10.1016/J.Aei.2022.101808.
- [3] F. K. Gündoğdu And C. Kahraman, "Engineering Applications Of Artificial Intelligence A Novel Spherical Fuzzy Qfd Method And Its Application To The Linear Delta Robot Technology Development ☆," *Eng. Appl. Artif. Intell.*, Vol. 87, No. July 2019, P. 103348, 2020, Doi: 10.1016/J.Engappai.2019.103348.
- [4] E. Meladiyani And D. A. N. H. Moektiwibowo, "Analisis Quality Function Deployment (Qfd) Guna Meningkatkan After Sales Spare Part S & Service Lift Truck Jungheinrich Dipt Kobexindo Equipment," 2016.
- [5] M. Basuki And S. Aprilyanti, "Perancangan Ulang Alat Perontok Biji Jagung Dengan Metode Quality Function Deployment," Vol. 6, No. 1, Pp. 23–30, 2020.
- [6] M. W. Nugroho And U. K. Kediri, "Pendekatan House Of Quality (Hoq) Terhadap Kinerja Jalan Dengan Metode Quality Function Deployment (Qfd)," Vol. 7, No. 27, Pp. 785–792, 2022.
- [7] C. Jin, Y. Ran, Z. Wang, And G. Zhang, "Engineering Applications Of Artificial Intelligence Prioritization Of Key Quality Characteristics With The Three-Dimensional Hoq Model-Based Interval-Valued Spherical Fuzzy-Oreste Method," *Eng. Appl. Artif. Intell.*, Vol. 104, No. November 2020, P. 104271, 2021, Doi: 10.1016/J.Engappai.2021.104271.
- [8] R. Pandiya, A. Wahyudin, And S. P. Nareswari, "Penentuan Skala Prioritas Regulasi Tarif Interkoneksi Menggunakan Metode Fuzzy Qfd - Topsis Determining Priority Scale Of Interconnection Tariff Regulation Using Fuzzy," Vol. 1, No. 1, Pp. 77–88, 2016.
- [9] D. Kim, "An Integrated Framework Of Hoq And Ahp For The Qoe Improvement Of Network-Based Asp Services," Pp. 19–29, 2010, Doi: 10.1007/S12243-009-0143-9.
- [10] J. Jdm, V. I. N. Sept, A. H. Sutawidjaya, S. Asmarani, J. Jdm, And V. I. N. Sept, "Sutawidjaya Dan Asmarani , Hal . 32-45," Vol. I, No. 02, Pp. 32–45, 2018.
- [11] R. R. Menon And V. Ravi, "Using Anp And Qfd Methodologies To Analyze Eco-Efficiency Requirements In An Electronic Supply Chain," *Clean. Eng. Technol.*, Vol. 5, P. 100350, 2021, Doi: 10.1016/J.Clet.2021.100350.
- [12] A. Ebadi, M. Yazdani, D. Ribeiro-Soriano, And U. De Val, "Journal Of Industrial Information Integration Analysis Of Industry 4. 0 Implementation In Mobility Sector : An Integrated Approach Based On Qfd , Bwm , And Stratified Combined Compromise Solution Under Fuzzy Environment," *J. Ind. Inf. Integr.*, Vol. 30, No. October, P. 100406, 2022, Doi: 10.1016/J.Jii.2022.100406.
- [13] E. Kulcsár, I. G. Gyurika, And T. Csiszér, "Techniques," *Comput. Ind.*, Vol. 136, P. 103592, 2022, Doi: 10.1016/J.Compind.2021.103592.
- [14] L. A. Ocampo, J. J. T. Labrador, A. M. B. Jumao-As, And A. M. O. Rama, "Integrated Multiphase Sustainable Product Design With A Hybrid Quality Function Deployment – Multi-Attribute Decision-Making (Qfd-Madm) Framework," *Sustain. Prod. Consum.*, 2020, Doi: 10.1016/J.Spc.2020.06.013.
- [15] H. M. Higgins, J. N. Huxley, W. Wapenaar, And M. J. Green, "Quantifying Veterinarians ' Beliefs On Disease Control And Exploring The Effect Of New Evidence : A Bayesian Approach," *J. Dairy Sci.*, Vol. 97, No. 6, Pp. 3394–3408, 2014, Doi: 10.3168/Jds.2013-7087.