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DESIGN AND DEVELOPMENT OF DESK STUDY MULTIFUNCTIONAL IN ORDER TO SAVE SPACE USING QFD METHODE

Wilson Parulian Simatupang
Teknik Industri, Fakultas Teknik, Universitas Singaperbangsa Karawang
JL. HS. Ronggo Waluyo, Puseurjaya, Kec. Telukjambe, Kabupaten Karawang, Jawa Barat
E-mail: wilsonsimatupang14@gmail.com

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ABSTRACT

Today many consumers want to own some product but other things had got in the way for one thing, it's an area of land owned by consumers. So the problem of consumers buying goods is product dimensions. That problem make consumers hesitate to buy a product. Nowadays furniture entrepreneurs, especially desk entrepreneurs, are required to make new innovations in which products are much more space efficient without eliminating the most powerful factors. To be able to design and develop the product that consumers want is done by spreading open questionnaires, then after the results have been obtained from the open questionnaires have taken a closed questionnaire. After getting the data from the questionnaire, then build a QFD (quality function deployment). After build a QFD then analysis product. The feasibility of the product is a step made to analyze whether it is worth the business product. In terms of financial value that's IRR (Internal Rate of Return) 3,45% and positif for NPV.

Keywords: Innovation, Multifunctional , design, QFD, Consumer.

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Universitas Muslim Indonesia
Address :
Jl. Urip Sumoharjo Km. 5 (Kampus II UMI)
Makassar Sulawesi Selatan.
Email :
Jiem@umi.ac.id
Phone :
+6281341717729
+6281247526640

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1. INTRODUCTION

People living in dense population residents own land and buildings which is relatively small. Until that make the people who live in the area densely populated feel less comfortable to buy and design the layout of goods orfurniture in the house. Usually on Many people's houses are still found designed objects have only one value function and usually always spend a lot place space. Like a study table that only has one function. The study table is a too much need it to help students to do work or to study. For this reason, table product innovation need it learning that is multifunctional and not takes up a lot of space when the object is not used or at the time of use.

Furniture manufacturers are required to be more innovative in designing products to meet the criteria that the consumer hopes for. To help design the multifunctional learning table and analyze the desired value on the consumer of the study table products is used the QFD method (quaity function deployment). QFD is a methodology to translate consumer needs and desires into a product that has specific engineering requirements and quality characteristics. (akoa, 1990) while Oakland j. s (1995) isa system for designing a product or service based on customer demand, involving the participation of functions contained in certain organizations.

This research was intended to determine whether or not the furniture of the multifunctional wall desk were worthy (Desk DINGSI) for production and solve the problem of using a lot of space when the product is in use or when not in use.

To do product design of course, a product feasibility analysis is carried out to find out whether from that aspect whether or not the product is worth it. In conduct a business feasibility analysis of the author using the financial aspect, which done is to make decisions in an investment, a method that can used to consider in assessment of an investment, namely; consists of value NPV (Net Present Value) is a method calculate the difference between the first investment value with net cash value in the next period come if the NPV value is positive than investment is said to be can be done and if it is better than investment said to be not can be done, IRR (Internal Rate Of Return) is the calculation of the interest rate equate the first investment value with cash net in future periods investment worth it if the bank's interest rate is higher compared the value of IRR or IRR i and if On the other hand, the investment is said to be not worth it IRR I, and PP (Payback Return) Comparing payback times amount of funds for investment by age project economy. If PP is shorter/smaller and not the economic life of the project, the project proposal is declared can be done and vice versa if it is longer/larger it is declared not possible

2. RESEARCH METHODOLOGY

This research is using primary data from questionnaires. The questionnaire does as much as two times the spread, the first spread of the questionnaire external and then after the data from external is generated the redistribution of a Internal questionnaire. Then ran a validation test to check if the data was viable. After obtaining the desired results from the questionnaire's test was done the drafting of QFD (Quaity Function Deployment) to design the table product that the consumer wants.

The production plan acquired from QFD (quaity functiondeployment) was then calculated for the financial aspect to see if the product would be viable for a new product.

2.1. Questionnaires

2.1.1. External Questionnaires

External questionnaire is a questionnaire that gives freedom to objects (Desk consumers) by asking what factors affect the consumer in buying the desk products. From the open questionnaire's data it then lists into 6 factors affecting consumers to purchase the desk product:

a. Quality Material
b. Price
c. Durability
d. Storage Capacity
e. Minimalist
f. Design

2.1.2 Internal Questionnaires

Internal questionnaire is a questionnaire made by having selected a choice for the consumer. On these questionnaires the factor that counts is the result of an external questionnaire.

2.2 Data Proccesing and Analysis Data

Table 1. Internal Questionnaires Data

Respondent	Factors				
	1	2	3	4	5
1	4	5	5	4	5
2	5	4	4	5	3
3	5	4	4	5	3
4	4	4	5	4	4
5	5	5	5	4	5
6	4	4	3	3	4
7	3	5	4	4	3
8	4	5	4	4	4
9	4	5	5	4	5
10	4	4	4	5	4
11	5	4	5	4	3
12	3	3	5	4	4
13	4	5	5	5	4
14	5	4	3	4	5
15	4	4	4	5	5
16	4	5	4	5	3
17	5	5	5	4	4
TOTAL	72	75	74	73	68

Tabel 2. External Questionnaires Data

Respondent	Factors					
	1	2	3	4	5	6
1	5	5	5	4	4	3
2	5	5	4	4	5	5
3	5	5	5	5	5	5
4	4	5	4	5	4	5
5	5	5	4	3	5	4
6	5	4	3	4	5	5
7	3	5	3	4	5	2
8	3	5	5	3	4	5
9	5	5	5	5	5	5
10	4	5	3	5	4	4
11	5	4	4	3	5	4
12	5	5	4	4	5	5
13	5	4	4	5	5	4
14	2	5	5	4	5	5
15	5	5	5	4	4	4
16	5	4	3	5	5	4
17	5	5	5	4	4	4
18	4	4	5	5	4	5
19	5	5	4	5	5	5
20	5	5	5	5	5	5
21	5	5	5	5	5	5
22	5	4	5	3	4	5
23	5	5	4	4	5	5
24	5	5	3	4	5	4
25	5	3	4	5	5	5
26	5	5	4	5	5	5
27	1	2	3	3	3	4
28	5	3	5	5	5	5
29	5	5	4	4	5	5
30	4	5	5	3	5	4
31	5	5	4	5	5	4
32	4	4	3	4	4	3
33	5	5	5	5	5	5
34	3	4	5	4	4	4
35	5	5	4	5	5	5
36	5	5	4	5	5	5
37	4	3	3	4	5	5
38	4	3	3	4	5	3
39	4	3	4	5	5	4
40	5	5	5	5	5	5
Total	**179**	**179**	**167**	**173**	**188**	**178**

2.2.1 Validation test

Validation test calculations use excel software assistance. Value of X could be determined by the large amount of data and the degree of significant use. Using a significant level of 5% and a large amount of external data of 40 consumers to achieve an an is of 0,32. If value X result ≥ X table then the statement is valid. Calculating results can be seen on Table 3. Validation Test.

Tabel 3. Validation Test

No.	Factors	X		Information
		Table	Result	
1	Quality Material	0,32	0,607	Valid
2	Price	0,32	0,524	Valid
3	Design	0,32	0,742	Valid
4	Strorage Capacity	0,32	0,481	Valid
5	Durability	0,32	0,366	Valid
6	Minimalist	0,32	0,439	Valid

2.2.2 Reliability Test

Reliability tests were conducted using help *Software* IBM SPSS statistic 23. Reliability Coefficient value (Alpha Cronbach) range between 0 up to 1. If this it's value ≥ 6 the value thus indicates that the gauge used is reliable.

Tabel 4. Reliability Test SPSS

Cronbach's Alpha	N of Items
,666	6

Tabel 5. Total Statistical Parameters of SPSS

		x01	x02	x03	x04	x05	x06	TOTAL
x01	Pearson Correlation	1	,369*	,164	,370*	,516**	,273	,749**
	Sig. (2-tailed)		,019	,310	,019	,001	,088	,000
	N	40	40	40	40	40	40	40
x02	Pearson Correlation	,369*	1	,349*	,122	,225	,145	,622**
	Sig. (2-tailed)	,019		,027	,455	,163	,373	,000
	N	40	40	40	40	40	40	40
x03	Pearson Correlation	,164	,349*	1	,078	-,057	,388*	,547**
	Sig. (2-tailed)	,310	,027		,634	,726	,013	,000
	N	40	40	40	40	40	40	40
x04	Pearson Correlation	,370*	,122	,078	1	,333*	,288	,578**
	Sig. (2-tailed)	,019	,455	,634		,036	,071	,000
	N	40	40	40	40	40	40	40
x05	Pearson Correlation	,516**	,225	-,057	,333*	1	,225	,552**
	Sig. (2-tailed)	,001	,163	,726	,036		,162	,000
	N	40	40	40	40	40	40	40
x06	Pearson Correlation	,273	,145	,388*	,288	,225	1	,624**
	Sig. (2-tailed)	,088	,373	,013	,071	,162		,000
	N	40	40	40	40	40	40	40
TOTAL	Pearson Correlation	,749**	,622**	,547**	,578**	,552**	,624**	1
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000	
	N	40	40	40	40	40	40	40

2.2.3. Factor Interests in Consumer Assessments

Factor interests in consumer assessments, processed through statistical calculating methods through statistical distribution calculations. Factor value obtained can be seen on tabel 6 and tabel 7.

Tabel 6. External Consumer Factors Volume

No.	Factors	Total
1	Quality Material	179
2	Price	179
3	Design	167
4	Strorage Capacity	173
5	Durability	188
6	Minimalist	178

Tabel 7 Internal Consumer Factors Volume

No.	Factors	Total
1	Raw Material	72
2	Cofiguration	75
3	Production Cost	74
4	Specification	73
5	Patterns	68

Once assessed value from each criteria then calculated classroom interval values to get the degree of interests from each criteria.

$$i = \frac{Highest\ Value - Smallest\ Value}{5}$$

$$i = \frac{188}{167} = 4{,}2 \approx 5$$

The result of the 5 interval calculations indicated the number of intervals in each class is 5.

Tabel 8. Degree of Interests External

Interval	Degree of Interests
167-171	1
172-176	2
177-181	3
182-186	4
187-191	5

Tabel 9. Degree of Interest Internal

Interval	Degree of Interests
68-69	1
70-71	2
72-73	3
74-75	4
76-77	5

Results of degree of interests at each criteria can be seen at table 10. Result Degree of Interest External and Tabel 11. Result Degree of Interest Internal.

Tabel 10. Result Degree of Interest External

No.	Factors	Total	Degree of Interests
1	Quality Material	179	3
2	Price	179	3
3	Design	167	1
4	Strorage Capacity	173	2
5	Durability	188	5
6	Minimalist	178	3

Tabel 11. Result Degree of Interest Internal

No.	Factors	Total	Degree of Interests
1	Raw Material	72	3
2	Cofiguration	75	4
3	Production Cost	74	4
4	Specification	73	3
5	Patterns	68	1

Tabel 12. External Product Quality Result

Factors	Desk Multifunctional	Desk
1	4,48	4,30
2	4,48	4,40
3	4,18	4,18
4	4,33	4,38
5	4,70	4,43
6	4,45	4,48

Tabel 13. Internal Product Quality Result

Factors	Desk Multifunctional	Desk
1	4,24	4,00
2	4,41	4,24
3	4,35	4,24
4	4,29	4,47
5	4,00	4,41

Setting goals is done to determine whether products will be produced with a better quality or stick to the same quality.
1 = Very bad, 2 = Bad, 3 = Enough, 4 = Good, 5 = Very good.

Tabel 14. Target Value of the External Consumer Factors

Factors	Desk Multifunctional	Desk
1	4,48	4,30
2	4,48	4,40
3	4,18	4,18
4	4,33	4,38
5	4,70	4,43
6	4,45	4,48

Tabel 15. Target Value of the Internal Consumer Factors

Factors	Desk Multifunctional	Desk
1	4,24	4,00
2	4,41	4,24
3	4,35	4,24
4	4,29	4,47
5	4,00	4,41

2.2.4 Priority Development

Scale value calculations are the first stage in determining priorities between consumer criteria and comparisons between target values and product quality.

Tabel 16. Scale Priority External

No.	Factors	Scale Factor
1	Quality Material	1,00
2	Price	1,03
3	Design	1,03
4	Strorage Capacity	1,01
5	Durability	1,06
6	Minimalist	1,01

Tabel 17. Scale Priority Internal

No.	Factors	Scale Factor
1	Raw Material	1,04
2	Cofiguration	1,02
3	Production Cost	1,01
4	Specification	1,04
5	Patterns	1,10

Sales points provide information on how well a customer criteria are to assist in sales of products based on the extent to which consumer needs are met. The sales point point has three levels of 1,0; 1,2; 1,5 in sequence is low, medium, high.

Tabel 18. Sales Point External

No.	Factors	Sales Point
1	Quality Material	1,2
2	Price	1,2
3	Design	1,0
4	Strorage Capacity	1,0
5	Durability	1,5
6	Minimalist	1,2

Tabel 19. Sales Point Internal

No.	Factors	Sales Point
1	Raw Material	1,2
2	Cofiguration	1
3	Production Cost	1
4	Specification	1,2
5	Patterns	1,5

2.2.5 Feasibility Analysis

Assessing financial worthiness requires data from the estimate that raw materials need to be assessed. The data was processed from the search through a direct visit to carpenter and search through one of those online shopping apps. Data amounts to raw materials for a single multifunctional desk unit can be seen at table 20. Estimated cost of raw materials.

Table 20. Estimates Cost of Raw Material

Raw Material	Price	Qty	Total
Teak (80x14x2)	Rp 15.000	2	Rp 30.000
Screws, Rocks, Nails	Rp 10.000	1	Rp 10.000
Mirror (60x30)	Rp 30.000	1	Rp 30.000
Paint	Rp 52.000	1	Rp 52.000
Glue	Rp 9.000	1	Rp 9.000
Hinge	Rp 15.000	2	Rp 30.000
Taek Block(9x4x110)	Rp 25.000	2	Rp 50.000
Wooden Planks (100x40x1)	Rp 10.000	4	Rp 40.000
Total Cost			Rp 251.000

Total investment obtained from total raw materials multiplied by the amount of production a month Rp 250.000 X 125 = Rp 31.375.000 and add fee utility Rp 450.000, maintenance costs Rp 250.000, employee wage costs Rp 10.000.000, shrinking costs Rp 1.401.000. Total investment Rp 43.476.000.

Market price for single desk multifuction Rp 446.170/ unit. If the number of sales get 125 unit, the company profit is amount Rp 55.771.200. The investment can be considered feasible or not by using the analysis method Pay Back Period (PP), Internal Rate Return (IRR), and Ner Present Value (NPV).

$$\text{Pay Back Period} = \frac{Loan\ Capital}{Investment}\ X\ 1\ year$$

$$\text{Pay Back Period} = \frac{Rp\ 50.000.000}{Rp\ 43.476.000}\ X\ 1\ year$$

$$\text{Pay Back Period} = 1{,}2\ \approx 1\ year\ 3\ month$$

Net Present Value (NPV) have a two tipe this is a NPV positive and NPV Negative.

Tabel 21. NPV Positive

Early Invesment	Rp	43.476.000	DF
Net Proceed 1	Rp	12.859.720,48	1,04
Net Proceed 2	Rp	30.369.901,70	1,08
Net Proceed 3	Rp	63.922.778,29	1,12
Net Proceed 4	Rp	69.313.855,98	1,16
Total	Rp	176.466.256	
Interest (i)	3,75%		
Net Present Value	Rp	132.990.256	

Tabel 22. NPV Negative

Early Invesment	Rp	43.476.000	DF
Net Proceed 1	Rp	7.848.211,76	1,04
Net Proceed 2	Rp	11.311.540,48	1,08
Net Proceed 3	Rp	14.530.253,61	1,12
Net Proceed 4	Rp	9.615.609,01	1,16
Total	Rp	43.305.615	
Interest (i)	70,00%		
Net Present Value	-Rp	170.385	

Interval Rate Return (IRR)

$$IRR = i1 + \frac{NPV\ 1}{NPV1 - NPV2}(i2 - i1)$$

$$IRR = 3{,}75\% + \frac{Rp\ 132.990.256}{-Rp\ 170.385}(70\% - 3{,}75\%)$$

$$IRR = 69{,}92\%$$

3. DISCUSSION

Tabel 23. Absolute Weight External

No.	Factors	Degree of Interest	Scale Factor	Sale Point	Absolute Weight
1	Quality Material	3	1,00	1,2	3,62
2	Price	3	1,03	1,2	3,70
3	Design	1	1,03	1,0	1,03
4	Strorage Capacity	2	1,01	1,0	2,02
5	Durability	5	1,06	1,5	7,98
6	Minimalist	3	1,01	1,2	3,64

To determine absolute value by multiplying the degree of interst, scale factors, and Sales Points obtained from priority development calculations. The value of an external absolute weight can be seen at table 23. External Absolute Weight whereas to external weight value at table 24. Internal absolute weight. So it's got a QFD shape as in Figure 1. QFD

Table 24. Internal Absolute Weight

No.	Factors	Degree of Interest	Scale Factor	Sale Point	Absolute Weight
1	Raw Material	3	1,04	1,2	3,74
2	Cofiguration	4	1,02	1	4,08
3	Production Cost	4	1,01	1	4,05
4	Specification	3	1,04	1,2	3,75
5	Patterns	1	1,10	1,5	1,65

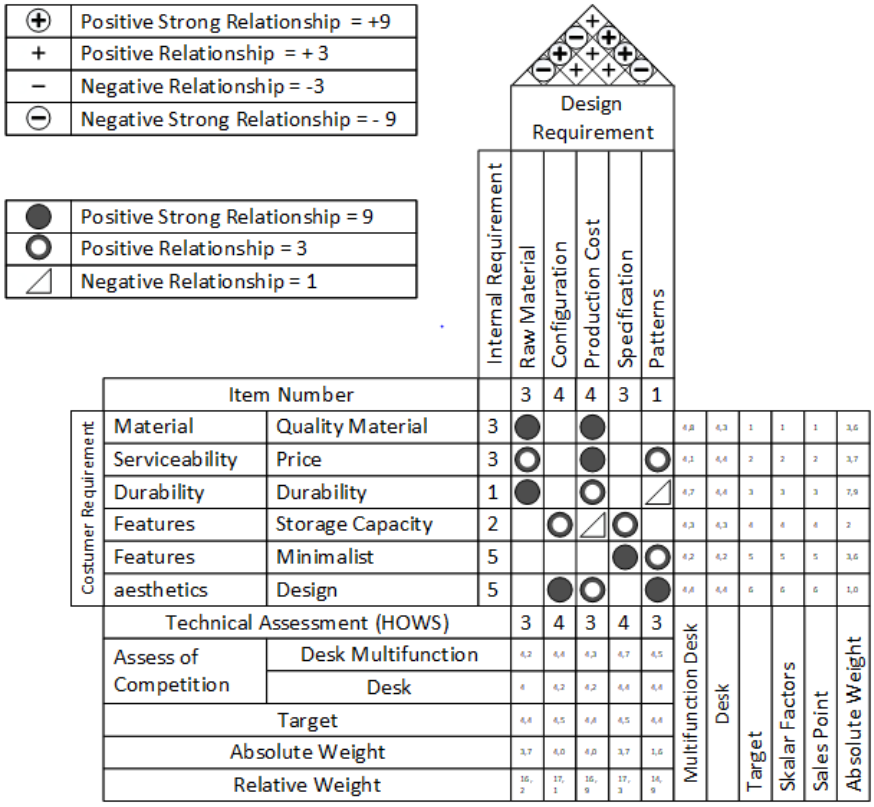

Figure 1 QFD (Quality Function Depoyment)

Based on the QFD image above that consumers are more interested in using a cold table than in using a Desk Multifunction. Viewed in the picture shows a strong relationship with the consumer in buying a desk of learning attention to strong criteria with absolute weight value of 7.98 and followed by affordable and minimalist prices. According to data collected from data analysis on PP, IRR, NPV, which can be seen in the pp. 1 year 3 period Irr (internal rate return) amounts to 69,92% and NPV Rp 132.990.256.

4. CONSLUSION

Based on analysis and data calculations, it may be concluded that a product designed is Multifunction Desk is following;

Multifunction Desk can be liked by consumers because products designed to look at the factors that customers want to look for particularly strong ones, affordable prices, and minimalist ones. This minimalist offers an advantage in the product of a dingsi table because of the design in the form of a wall and when it opens it turns into a table that can be used for learning activities.

The design of the product takes note of the financial aspects listed as feasible. These designs show an PP (Pay back Period) of 1 year 3 months, IRR (Internal Rate Return) of 69,92% and Interest value 3,75% with NPV Rp 132.990.256.

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