ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP217

Optimization of Wood Waste through the Design of Multifunctional Clocks Using KANO and QFD Methods to Increase the Economic Revenue of CV. PIRANTI

Chico Eka Pramudita
Expert Laboratory Technician
Faculty of Engineering, Dian Nuswantoro University.

Abstract:- One of the companies engaged in the teak wood furniture industry and interior design of the room is CV. PIRANTI. The problem found by researchers is the occurrence of the accumulation of waste of wood which becomes fuel for wood oven, causing environmental pollution. As such, to minimize wood-waste accumulation—a scenario in which the accumulation of timber waste in December 2018, January 2019, and February 2019 totaled 177 kg—the author will waste the wood into clocks that have value that can also add economic income for the company. The KANO and QFD methods are used in this study. This research is aimed at: 1) Product design planning using waste wood; 2) Product design planning using the Kano and QFD methods; and 3) Knowing the increase in income of CV. Tools by utilizing waste wood. The result of this research is 1) can process the waste of wood using the method KANO, 2) can know the level of satisfaction and the interests of customers using QFD method, 3) and can know the advantages of wood waste treatment when used Multifunction Wood. In processing QFD data, obtained 2 types of product design. Got a price calculation with a price margin of 25% for the product, where the price ranged from 52 000 rupiah to 65 000 rupiah per product with a profit of 13 000 rupiahs for product A, and product B with prices ranging from 46 000 rupiah to 57 500 rupiah with a profit of 11 500 rupiah per product.

Keywords:- *Wood Waste, Clocks, KANO, QFD (Quality Function Deployment), Product Price, Price Margin.*

I. INTRODUCTION

Waste itself is a serious issue with the companies, and more so with the small business. Waste may be in form of solid, gaseous, and liquid waste. Every company does waste management in its own way. For instance, a company with solid waste that can be re-used will sell it to waste dealers or collectors who can reprocess it further.

CV. PIRANTI is a business involved in manufacturing furniture and providing design services for rooms, where wood is used as the main raw material for the furniture. Regarding its activities' wood waste management, CV. PIRANTI faces some problems. Wood wastes are now stored in a 250 kg per year capacity warehouse measuring 15 cm x 15 cm. The raw wood, which is supposed to be processed into finished products and will also be used as fuel in curing the raw materials before production, fills the warehouse half way. Some of the wood waste is stored around the business premises, thereby accumulating and causing environmental pollution.

Table 1 Waste list on CV. PIRANTI

Week of -	Month/kg		
	December (2020)	January (2021)	February (2021)
1	8	10	12
2	19	15	22
3	17	23	16
4	10	10	15
Total per Month	54	58	65
Amount	177		
Average per Month (%)	20.51	32.77	36.72

Therefore, from the above table, it is concluded that the total amount of waste collected in December 2018, January 2019, and February 2019 is 177 kg with an average percentage of 30.51% in December 2018, 32.77% in January 2019, and in February 2019, it reaches 36.72%. The amount of waste in the accumulation of the last 3 months is very large, causing solid waste buildup for CV. PIRANTI. Therefore, the best solution is to process these wood wastes into finished products that are of a very high market value,

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP217

which means not only increasing the economic revenues of CV. PIRANTI itself but also benefiting the environment.

In developing a design to draw out from the wood waste processing, the researcher made an initial questionnaire that the questions involved a consideration of what designs are suitable and needed by customers in the future.

Table 2 Initial Questionnaire Recapitulation Data

Parameter	Questionnaire Options			Dominant Choice
	1	2	3	
Target Market	15-20 yo	20-25 yo	25 yo - above	age 20-25 yo
(Age of the respondent)	21%	65%	14%	65%
Products tested	Mini Figure	Pencil Case	Clock	Clock
	26%	8%	66%	66%
Characteristics of needs	Multifunctional Pencil Case	Multifunctional Calendar	Multifunction Clock	Has the function of both
	19%	31%	50%	50%
Function	View the date	Pencil Case	View the time, date and Pencil Place	View the time, date and Pencil Place
	38%	17%	45%	45%
Price	< Rp. 80000,00	Rp. 80000,00 - Rp. 100000,00	Rp. 100000,00 <	< Rp. 80000,00
	43%	34%	23%	43%

This study serves to enhance the added value for the economy of CV. PIRANTI through the processing of wood waste into multipurpose clocks using the Kano and QFD methods.

II. LITERATURE REVIEW

KANO Model The Kano model is one of the ways that can be used to identify consumer satisfaction, where this model has the purpose of categorizing the characteristics of products or services based on how well the product or service can satisfy customer needs, developed by Dr. Noriaki Kano. In its model, Kano distinguishes three types of desired products that can affect customer satisfaction, namely: Must-be requirements; One-Dimensional Requirements; Attractive Requirements [7]

Quality Function Deployment (QFD) including new methods of Quality Engineering which focuses on customer needs and product quality is increasing rapidly. In other words, the basic philosophy of implementing the QFD is to consider and use customer quality demands in the different stages of development or service. Therefore, all product design features and specifications are determined in accordance with the point of view of "customers", thus the role of experts in designing new products and services is nothing more than "translators" who alter, in considerable quantitative, customer demands on data design using the QFD Method [10]

Quality function deployment (QFD) is a methodology that helps translating customer needs into design requirements to ensure that the output, whether this is a product or process, meets these needs. Originated in the manufacturing industry, QFD also finds applications in service industries. QFD was developed in Japan in the late 1960s as a design process aid to incorporate customer voice into a product before it was manufactured. Its success came in the form of reduction in start up costs and development time and increased quality of a new product. [14]

QFD is a methodology that takes the voice of customer, i.e. customer expectations, and translates them into technical requirements to achieve the identified needs. Since its introduction, it has been used in various industries. A review of literature containing studies from 1992 to 2017 in over fifty-five journal titles shows a wide application scope. [13]

III. RESEARCH METHOD

The purpose of identifying and knowing the conditions, needs, and expectations of consumers for processed wood waste is made into a clock which has multifunctional value is carried out by distributing open questionnaires and also interviewing art observers, especially in the field of wood-based art as well as lovers of artworks based on teak wood.

➢ *Collection of Voice of Respondents*

The questionnaire is aimed at 60 respondents, where the results of this questionnaire will later go through the processing stage and also be developed for the making of further statements.

➢ *KANO Data Processing*

In this stage, the processing of KANO Data will be carried out as follows:

- Distribution of Functional and Dysfunctional questionnaires to respondents
- Validity and Reality Test using SPSS
- Processing KANO Questionnaire data Clarifying attributes into KANO diagram models

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP217

- Analyze KANO results by determining attributes that have an influence on consumer satisfaction

➢ *QFD Data Processing*

In this stage, it is almost the same as KANO data processing, but the first thing is to distribute a questionnaire on the level of interest and customer satisfaction, prioritizing attributes desired by consumers and design, and then distributing a questionnaire on the level of consumer satisfaction with the designed product

➢ *House of Quality Arrangement*

Stages should be done to arrange house of quality are:

- Stage I Identification of Customer Requirements
- Stage II Registration of Technical Requirements
- Stage III Direct of Improvement
- Stage IV Improvement of Interrelationship Matrix between Customer Requirements (What) and Technical Requirements (How)
- Stage V Improvement of Interrelationship Matrix between Technical Requirements (How)
- Stage VI Customer Competitive Assessment
- StageVII Priority Improvement of Customer Requirements
- Stage VIII Target Value of customers
- Stage IX Vertical Scale Factor
- Stage X Selling Point
- Stage XI Absolute Weight of Customer Requirement

➢ *Analysis and Interpretation are the Technical and Implementation Stages of QFD*

In this stage, analysis and interpretation were performed on the house of quality that has been arranged in the previous stage.

➢ *Product Planning*

In this stage, the 3D modeling Product design uses Fusion 360 Software.

➢ *Making Product*

In this stage, product manufacturing uses 2 machines in terms of manufacturing, First CNC Router and Laser Cutting.

➢ *Product Benchmarking*

Product Benchmarking is intended to compare the Design Product with the products on the market, which can determine which product the respondent wants.

➢ *Calculation of Cost of Production and Determination of Profit of each Product*

IV. RESULT AND DISCUSSION

A. KANO Questionnaire data collection

Table 3 Functional and Dysfunctional KANO Questionnaire

No.	Functional Statement	Dysfunctional Statement
1	Watch products have a level of durability that is durable and strong	Watch products do NOT have a durable level of durability and are NOT strong
2	Clock products have a function as a calendar	Produk jaam TIDAK memiliki fungsi sebagai kalender
3	Watch products can be moved easily and lightly	Watch products can NOT be moved easily and are NOT lightweight
4	Easy in time and month management	NOT easy in time and month management
5	The design of the watch product has an engraved motif	The design of the watch product does NOT have an engraving motif
6	Costumable Design	The design of the watch product does NOT have an engraving motif
7	Price is directly proportional to quality	Prices that DO NOT match the quality

The questions were grouped into 3 variables including the variables of use, design and price of multifunctional wooden clock products. The variables that represent usability are questions with numbers 1, 2, 3, 4, and 5. The variables that represent in terms of design are the numbers 6 and 7. While the price variable is found in number 8.

The results of filling out the KANO questionnaire will be reprocessed in the form of tabulation of functional statement data and dysfunctional statements.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP217

Table 4 Recap of the Fiscal KANO Questionnaire

	QUESTION	SCALE					TOTAL
		VS (5)	S (4)	QS (3)	D (2)	VD (1)	
FUNCTIONAL	1	34	10	13	6	12	75
	2	10	15	36	10	4	75
	3	7	18	29	13	8	75
	4	24	13	14	11	13	75
	5	6	9	32	23	5	75
	6	10	19	29	5	12	75
	7	16	16	24	11	8	75

Table 5 Recap of the Dysfunctional KANO Questionnaire

	QUESTION	SCALE					TOTAL
		VS (5)	S (4)	QS (3)	D (2)	VD (1)	
DISFUNCTIONAL	1	9	3	15	18	30	75
	2	10	5	14	26	20	75
	3	4	6	10	19	36	75
	4	11	9	7	14	34	75
	5	4	10	18	19	24	75
	6	7	7	9	16	36	75
	7	8	6	9	13	39	75

B. KANO Questionnaire Data Testing

➢ *Validity Test*

Before the data obtained is used further, it is necessary to test the accuracy of the data and whether the elements of the data are homogeneous.

➢ *Reliability test*

The reliability test is carried out after the validity test. This reliability test is used to determine the level of consistency of respondents in filling out questionnaires that have been distributed to explore the needs of the necessary data.

C. KANO Evaluation

In the Tabulation of Survey, there are 6 groups, namely Attractive (A), Must Be (M), One Dimensional (O), Reverse (R), Questionable (Q), Indifferent (I). The results of the attribute grouping were obtained from the results of the correlation of the functional and dysfunctional Kano questionnaires.

Table 6 Tabulation of Survey and Satisfaction and Dissatisfaction Index

ATTRIBUTE		FORMULA						CLARIFICATIO		TOTAL	GRADE	SATISFACTION			DISSATISFACTION		
		A	M	O	R	Q	I	A+O+M	I+R+Q			A+O	A+O+M+I	HASIL Si	O+M	(A+O+M+I)(-1)	RESULTIN
QUESTION	1	15	10	17	11	5	17	42	33	75	A	32	59	0.54	27	-59	-0.46
	2	8	17	3	11	0	36	28	47	75	I	11	64	0.17	20	-64	-0.31
	3	4	31	3	8	2	27	38	37	75	M	7	65	0.11	34	-65	-0.52
	4	6	18	15	13	4	19	39	36	75	M	21	58	0.36	33	-58	-0.57
	5	1	20	5	8	0	41	26	49	75	I	6	67	0.09	25	-67	-0.37
	6	2	28	8	12	1	24	38	37	75	M	10	62	0.16	36	-62	-0.58
	7	5	28	8	11	1	22	41	34	75	M	13	63	0.21	36	-63	-0.57

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP217

Dari Scatter Diagram dapat dilihat pernyataan dalam atribut mana yang harus dieliminasi sesuai dengan posisi 4 kuadran.

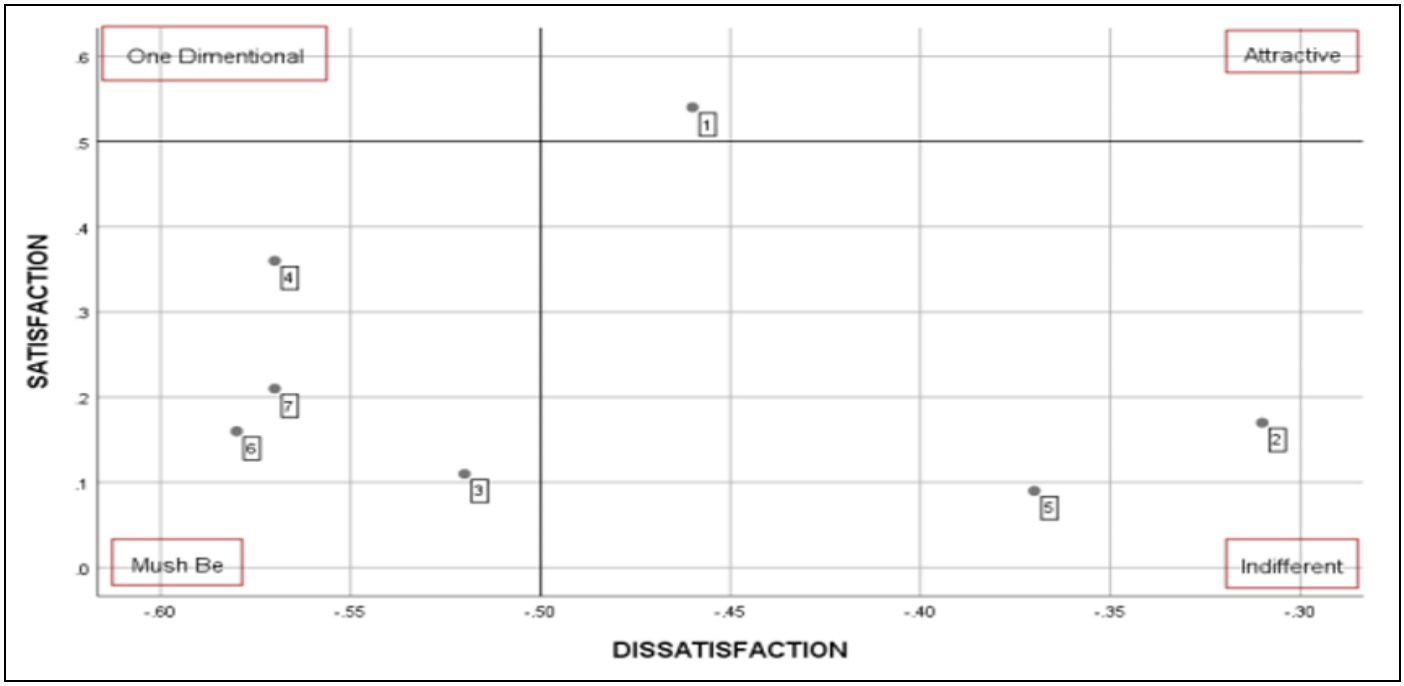


Fig 1 KANO Diagram

D. Recap QFD Questionnaire

Table 7 Customer Interest Questionnaire Rencap

No	QUESTION	Skala					TOTAL
		VS	S	QS	D	VD	
		1	2	3	4	5	
1	Watch products have a level of durability that is durable and strong	30	34	13	0	0	77
2	Clock products have a function as a calendar	7	17	53	0	0	77
3	Watch products can be moved easily and lightly	5	38	31	3	0	77
4	Easy in time and month management	16	33	26	2	0	77
5	The design of the watch product has an engraved motif	2	20	50	5	0	77
6	Costumable Design	15	36	26	0	0	77
7	Price is directly proportional to quality	12	14	49	2	0	77

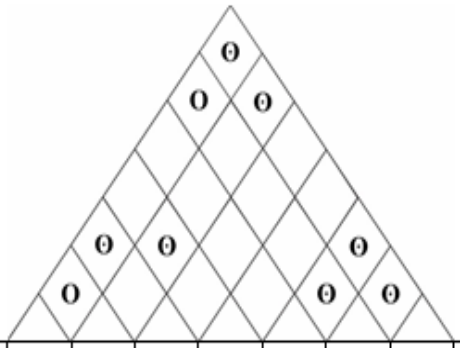
E. Results of QFD Analysis

The analysis of the results in the QFD and HOQ methods is carried out by sorting and prioritizing the most suitable attributes developed with the technical specifications of the designer in the design of wood waste processed products. From these attributes, there will be weighting and ranking, where from the main order will be the attributes that must be present in the design.

F. House Of Quality (HOQ) Preparation

The preparation of the HOQ has several stages, the first is the creation of a needs matrix. making Customer Importance Satisfaction, then Custome, K-Value, improvement Ratio, Raw Weight, Normalizes Raw Weight and related technical respondents. Also at the bottom is the weight of technical respondents, benchmarking, and priorities achieved by the product.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP217



Θ = 9 (Strong Relationship)
O = 3 (Simple Relationship)
Δ = 1 (Weak Relationship)

Product Requirement	Product Characteristic	Importan to Customer	The product is made of teak wood, durable and safe from termite pests	In the setting by sliding	Product dimensions are easy to hold in the palm of your hand	Time setting by turning the pin on the clock machine on the reverse of the product	Motives according to consumer demand	Design according to consumer demand	Prices adjust to consumer demand criteria	Scale of Importance	K Value	Improvement Ratio (Ro)	*Raw Weiger*	Competitive Analysis (1=Worse, 5=Best) Wood Waste Processing Clock Design	Existing Wooden Clock Design
Watch products have a level of durability that is durable and strong		4.78	Θ		O				O	4.78	1.5	1.1	8.1	4.78	3.81
Clock products have a function as a calendar		3.40		Θ		Δ		O	O	3.40	0.0	1.0	5.1	3.40	3.36
Watch products can be moved easily and lightly		3.61	O		Θ					3.61	0.5	1.0	5.5	3.61	3.61
Easy in time and month management		3.96		O		Θ				3.96	0.5	1.0	6.2	3.96	3.97
The design of the watch product has an engraved		3.32					Θ	O	O	3.32	0.0	1.0	5.1	3.32	3.32
Costumable Design		3.90		O			O	Θ	O	3.90	0.5	1.0	5.9	3.90	3.90
Price is directly proportional to quality		3.48	O	O		Δ	O	O	Θ	3.48	0.5	1.0	5.2	3.48	3.47
Target Product Characteristics			The product is made of teak wood, durable and safe from termite pests	There is a month and date clearly	Lightweight and strong material with dimensions of 20x20 cm	The swivel pin is located on the back of the product	Carved motifs according to consumer demand with a size of 6x7 cm	Design with dimensions of no more than 15x15 cm	Prices adjust to the design dimensions of consumer demand						
Contribution			2.96	1.99	1.59	1.80	1.86	2.59	2.81						
Normalized Contribution			0.20	0.12	0.13	0.15	0.12	0.14	0.13						
Order of Priority			1	4	7	6	5	3	2						

Wood Waste Processing Clock Design

Existing Wooden Clock Design

Fig 2 House of Quality

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP217

G. Product Planning

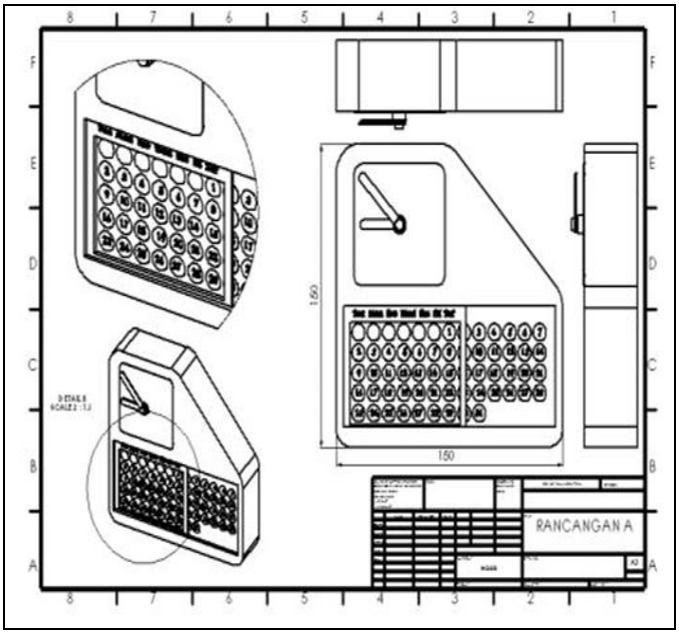


Fig 3 Blueprint Design A

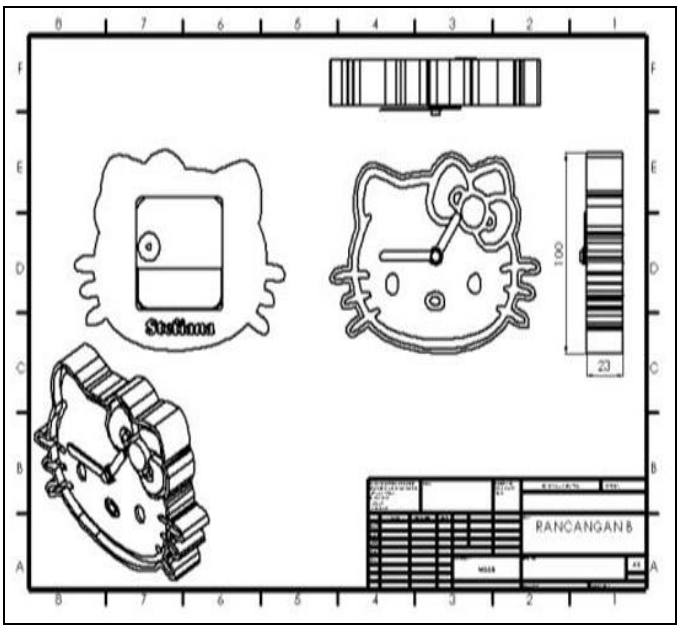


Fig 4 Blueprint Design B

H. Benchmarking Analysis

This benchmarking analysis was carried out to compare the scale of consumer satisfaction with wooden clock products from processed wood waste with existing wooden clock products. The benchmarking questionnaire containing packaging specifications was distributed to 60 respondents. Here are the results of product benchmarking.

Table 8 Product Banchmarking

No.	Produk	Karakteristik	Jawaban
1		From wood	✓
		Manual Clockwork	✓
		Calender	✓
2		From wood	✓
		Manual Clockwork	✓
		Calender	x
3		From wood	✓
		Manual Clockwork	✓
		Calender	x

In table 9 it can be seen that the 3 watch products are both made of wood and also have the property of Costumable Design (According to Consumer Demand), but it's just that the design of the B and C clocks does not have additional components in the form of a calendar/date which is very influential in terms of price and aesthetic value of the watch product.

I. Determination of Cost of Products

The Determination of the Cost of Products is used to determine the price of the product per unit by adding several additional components related to the cost of manufacturing the product per unit. Here are the details of the details that will be discussed.

➢ *Determination of Production Machine Rental Costs*

In determining the rental of production machines, this study uses the reference "List of Service Tariffs in Accordance with Governor's Regulation No. 4 of 2017 of the Metal and Wood Technology Development Center at the Central Java Provincial Industry and Trade Office"

➢ *Product Pricing per Unit*

Determination of product prices by adding up the components of consumable materials in the production process by estimating the total production capacity of 100 units per month. Here are the details of the calculation per unit.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP217

➢ *"A" Clock Products*

1)CNC Process Time	= 137 minutes
	= 2,28 hours
CNC Milling per hours	= Rp. 12500
CNC Milling per unit	= Rental Cost x Prod Processing Time
	= Rp. 12500 x 2,28 hours
	= Rp. 28500
2)Laser Processing Time	= 5 minutes
	= 0,08 hours
Laser Cutting per hour	= Rp. 15000
Laser Cutting per unit	= Rental Fee + Prod Processing Time
	= Rp. 15000 x 0,08 hours
	= Rp. 1250
3) Clockwork	= Rp. 6000
4) Manpower	= Rp. 15000
5) WD 40	= Rp. 400
6) Gemuk/ vaselin	= Rp. 64,2
7) Brush	= Rp. 2,6
8) Sandpaper 1800	= Rp. 5,2
9) End Mill 3 mm	= Rp. 750
10) End Mill 6 mm	= Rp. 66,7
	+
TOTAL	= Rp. 52.038,7
	≈ Rp. 52.000, -

The price obtained by product A with the total sum of the details of the price details by estimating the production capacity per month of 100 units is obtained at the product price per unit of 52,000 rupiah.

➢ *"B" Clock Products*

1)CNC Process Time	= 112 minutes
	= 1,87 hours
CNC Milling per hours	= Rp. 12500
CNC Milling per unit	= Rental Cost x Prod Processing Time
	= Rp. 12500 x 1,87 hours
	= Rp. 23000
2)Laser Processing Time	= 2 minutes
	= 0,03 hours
Laser Cutting per hour	= Rp. 15000
Laser Cutting per unit	= Rental Fee + Prod Processing Time
	= Rp. 15000 x 0,03 hours
	= Rp. 500
3) Clockwork	= Rp. 6000
4) Manpower	= Rp. 15000
5) WD 40	= Rp. 400
6) Gemuk/ vaselin	= Rp. 64,2
7) Brush	= Rp. 2,6
8) Sandpaper 1800	= Rp. 5,2
9) End Mill 3 mm	= Rp. 750
10) End Mill 6 mm	= Rp. 168
	+
TOTAL	= Rp. 45.890
	≈ Rp. 46.000, -

The price obtained by product B with the total sum of the details of the price details by estimating the production capacity per month of 100 units is obtained the product price per unit is 46,000 rupiah.

➢ *Determining the Selling Price*

In determining the selling price using a market price comparison, the researcher used a margin profit of 25% which was supported by the company and also supported by the results of the researcher's initial questionnaire where 100 respondents, 43% chose the product price less than Rp. 80,000.00. The reasons why the company agreed to the 25% margin profit include:

- If you use a price margin advantage above 25%, then the product will later have a little attraction from customers, because the product is a new product.
- By using a low-price margin and having good quality, products that will be sold in the market will easily attract buyers.

Table 9 Selling Price Calculation

SUB	PRICE	
	Product "A"	**Product "B"**
Cost of Products (COP)	52000	46000
25%	13000	11500
Total	65000	57500

In table 10, it is found that the selling price of product A is 65,000 rupiahs and product B is 57,500 rupiahs which is obtained with a price margin of 25%.

V. CONCLUSION

- In planning the design of multifunctional watch products using the Kano method where from 7 attribute questions are obtained 4 (Must Be), 2 (Indifferent), and 1 (Attractive). From the QFD processing, 3 highest priority results in product design were obtained with a value of 2.96, namely the watch product has a durable and strong level of durability where the product is made of teak wood with dimensions that are easy to hold in the hand, 2.81 is the price is directly proportional to the quality, and 2.59 is the Customable design (as desired). From the 3 priority result values, it can be made into 2 watch product designs where the clock products use calendar attributes and do not use calendar attributes, which of course the price and design of the watch product will later be in accordance with consumer demand.
- CV's revenue increase. The device by utilizing teak wood waste which is used as a multifunctional clock product where from the initial price of wood waste 0 rupiah by using a margin profit of 25% where the price margin has been approved and with consideration from the company the selling price of product A is obtained at a price of 65,000 rupiah per product and product B at a price of 57,500 rupiah per product, but the price can change AProduk B HPP (Cost of Product) 52000 46000 25% 13000 11500 TOTAL 65000 57500 SUB PRICE changes according to the region and also the criteria desired by the consumer.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP217

REFERENCES

[1]. Anggraini, Mutiara et al. 2013. Multifunctional Kitchen Table Design Using QFD. Semarang

[2]. Budi, Anang Yanuar Setia. 2015. Development of Liquid Organic Fertilizer Packaging Design Using Canoe and QFD Methods. Dian Nuswantoro University. Semarang

[3]. Cohen. Lou. 1995. Quality Function Deployment : How to Make QFD Work Of You. New York: Wesley Publishing CompanyKano, N., K. Seraku, F. Takahashi, S. Tsuji., 1984. "Attractive Quality and Must-be Quality". The Journal of The Japanese Society for Quality Control

[4]. Hashim, Adila Md, dkk. 2012. Kano Model and QFD Integration for Ergonomics Design Improvement. University of Malaya. Kuala Lumpur, Malaysia.

[5]. Ulrich, Karl T. and Steven D, Eppinger. 2001. Product Design and Development. Jakarta: Salemba Teknik.

[6]. Umar, B. 2005. Marketing Research and Consumer Behavior. Jakarta: PT Gramedia Pustaka Utama.

[7]. Wahyuni, Hana Catur, et al. 2012. Application of Canoe and QFD Methods in Women's Shoe Design to Increase the Competitiveness of SME Products. University of Muhammadiyah Sidoarjo. Surabaya

[8]. Yulismatun, F., Singgih, L.M. and 2012. Development of KANO QFD Integration Model for Consumer Satisfaction Optimization.Sepuluh Nopember Institute of Technology, Surabaya.

[9]. Yulismatun, F., Singgih, L.M. and 2012. Development of KANO QFD Integration Model for Consumer Satisfaction Optimization. Sepuluh November Institute of Technology, Surabaya.

[10]. Elahi M, Hoursali GH. (2015). Application Of Qfd Model For Automobile After Sale Service Quality Improvement (Case Study: Bushehr Saipa Agencies). Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231– 6345 (Online) An Open Access, Online International Journal Available at www.cibtech.org/sp.ed/jls/2015/01/jls.htm.5(S1): pp. 5058-5063

[11]. List of Service Tariffs in accordance with Governor's Regulation No. 4 of 2017 of the Metal and Wood Technology Development Center at the Central Java Provincial Department of Industry and Trade

[12]. Anwar A, Mulyati DS, Amelia W. (2013). Application Quality Function Deployment to Improve the Quality of Services in Ngodoe Cafe. I nternational Journal of Innovation, Management and Technology. 4(6).

[13]. Erdil, N. O., & Arani, O. M. (2019). Quality function deployment: more than a design tool. *International Journal of Quality and Service Sciences*, *11*(2), 142-166.

[14]. Evans, R.J. and Lindsay, M.W. (2015), An Introduction to Six Sigma & Process Improvement, Cengage Learning, 2nd ed., Stamford, CT.