

APPLICATION OF VALUE ENGINEERING IN BAMBOO CHAIR PRODUCT DESIGN DEVELOPMENT FOR FOREIGN MARKET

(REKAYASA NILAI DALAM PENGEMBANGAN DESAIN PRODUK KURSI BAMBU UNTUK PASAR EKSPOR)

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ABSTRACT

In this research, bamboo chair design development was based on Value Engineering approach, which consisted of three stage, information stage as consumer needs identification stage, creativity stage as concept building stage and analyzed stage as concept judgment stage.

The development aspects in this research were related to aesthetic aspects function especially shape and color of chair. The alternatives were developed based on variety of shape and bamboo. The strengths and the weaknesses of each alternative were analyzed in relation with other aspects before they were used in concept building.

There were 14 product concepts as concept building stage output. The best concept is the concept with highest value. Value was defined as function per cost. In this research, function was product performance that was appreciated by consumer while cost was variable production cost, fixed cost was not included because it was assumed equal for each concept.

Based on that equation, the best product concept was the bamboo chair in peg appendix, square seat square back of chair in incline position, straight-arm of chair and not connected with front leg of chair, and the material is apus bamboo. The value of this alternative was $3.89.10^3$, while market product was $2,90.10^3$, it means there was an improvement.

Key Words : Value engineering, product design development, bamboo chair

INTRODUCTION

Based on data from promotion service unit of Sleman (2001), Sleman bamboo handicraft was the biggest in the number of production unit and handcrafters that was 2970 production unit with 5115 handcrafters. The products were bamboo furniture and bamboo handicraft. For Yogyakarta special region (Daerah Istimewa Yogyakarta), ration of export value per export volume of bamboo furniture products was a bit lower than bamboo handicraft product because the knowledge of bamboo furniture handcrafters in quality and design was limited. So, the effort of bamboo handicraft development through product design development was still needed and had a wide multiplier effect. It could be implemented through a research with objectives : 1. to know product specification that was needed by consumer that was used in product design development and, 2. to know the best alternative of product design development according to the techniques and economics aspects by value engineering approach.

The meaning of product development in this research was a company's activity to build, design and commercial a product which in generally consists of 6 phases :

planning, concept development, system designing, detail planning, testing and improvement, and beginning production. Among all of those phases, concept development phase is the phase which mostly need coordination is called front – end process that consists of 7 steps : consumer need identification, target specification judgement, product concept building, concept selection, concept evaluation, product specification judgement, and development flow planning (Ulrich and Eppinger, 2001)

Value engineering is a system that is used to identify and detect factors which produce costs or efforts which don't have contribution in product, process, or service is needed by consumer. The goal of value engineering is getting an optimal product value, where value is defined as function per cost. There are two types of functions, use function and aesthetic function. Use function is function where product can perform its using that buyer want and ready to pay while aesthetic function is the function where product is liked by its color, shape or features that buyer want to buy. Beside that there are basic function and secondary function. Basis function is the function that cause user or buyer buys the product while secondary function is the function that support basic function to work effectively (Miles, 1972). In value engineering, we must get a function increasing not a cost decreasing only (Soekanto Tjahjonoadi, 1989). Technically, value engineering is implemented in 4 stages : information stage, analyzed stage, creativity stage, and judgement stage (Miles, 1972). Some techniques of value engineering that was used usually were questionnaire, brainstorming, sinectic, FAST, adjective, and zero-one.

Product development by value engineering approach in this research where product development activity more concern to the objective to had got high value product, was hoped can be reached. So the effort to help bamboo handicraft development could be implemented.

RESEARCH METHOD

Generally we can say that the problem in this research was how the best bamboo chair product design, according to the techniques and economics aspect, that suitable with foreign consumer needs. A bamboo chair product design development process solved the problem by value engineering approach. There were 3 stages : consumer needs identification (information stage), concept building (creativity stage) and concept selection (analyzed stage)

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The first stage was consumer needs identification (information stage). The first step was identification of bamboo chair quality attributes. The methods were questionnaire and interview with exporters and handcrafters of bamboo chair and information gathering from median. Quality attributes were used in this research was valid and reliable quality attributes that were known from validity and reliability test. The second step was assessment of relative necessity rating of quality attributes by using questionnaire. Relative necessity rating of quality attributes was needed to choose development aspect priority. The third step was consumer needs identification for quality attributes by using questionnaire.

The second stage was concept building (creativity stage). The first step was product functions mapping by using FAST diagram. FAST (Function Analyzed System Technique) map product functions and its interactions by using question words "Why?", "How?" and "When?". The answers of question words "Why?" will bring us to the higher function and "How?" to the more specific function that support the higher functions. Next, all identified functions are mapped from the highest function to the lowest function from left to right side. Question words "When?" is asked to each function, mapped vertically and shows when the function is needed (Miles, 1972). The second step was raising and analyzing of development aspect alternatives. The analyzed method used was zero-one method. Zero-one is a technique to select the best alternative by comparing alternatives based on criteria and weight of each alternative. This comparing process is implemented to each criteria and each alternative is compared one by one. If an alternative is better than another, the alternative will get 1 (one) point while the other gets 0 (zero) point. If an alternative is the same as another, both of them will not get any point. Next, the result of comparing is analyzed by a decision matrix. In this analysis, weight of criterion influences the result. In this research, weight of criterion was weight of relative necessity rating of quality attributes from respondent. The best alternative for each development was combined to get product concepts.

The third stage was concept selection (analyzed stage). The first step was concept testing by communicating to the consumers directly product design concept as development output and product market as benchmark. The second step was concept performance assessment. Concept performance was equal with the total of product of a multiplication each quality attribute performance with its weight. The third step was concept cost assessment. In this research, costs for each concept were variable production costs that were needed to produce the product. Fixed cost not included because it assumed equal for each concept. The fourth step was concept value assessment that was equal with performance per cost. The fifth step was the best concept product assessment. Based on performance value that had been known, we could get some new concepts in difference performance and value. It was implemented by combining alternatives of development aspect and by assessing its value theoretically (without tested the concept to the

consumer). The best concept was the concept with the highest value.

The respondents in this research were limited population, they were bamboo chair handcrafters, exporters and buyers in Yogyakarta Special Region.

RESULT AND DISCUSSION

Quality attribute and its necessity rating can be shown in Table 1.

Table 1. The List of Quality Attribute of Bamboo Chair Product and its Necessity Rating

Quality Attribute of Bamboo Chair		Necessity
Basic	Secondary	Rating
1. Duration Term of Life	1. Duration term of life color	4,80
	2. Duration time of life of chair to insects	4,87
	3. Chair could not get wet	3,13
2. Strength	4. The hardness of bamboo	4,53
	5. The strength of appendix	4,87
3. Comfort	6. Chair was comfortable when we sat on	4,87
	7. Chair was not rock when we sat on	4,53
	8. Chair was not crack when we sat on	3,80
	9. Weight of one set of chair	3,47
4. Weight	10. Shape of chair wide or narrow	4,13
	11. Kind of appendix	3,33
	12. Shape of seat	4,53
	13. Shape of back of chair	4,47
	14. Shape of arm of chair	4,13
	15. Shape of leg of chair	3,80
	16. Cover of end of bamboo phalanx	2,33
	17. With or without ornament	1,40
6. Smooth texture of bamboo chair surface	18. Smooth of bamboo surface	3,67
	19. Smooth of appendix	4,87
7. Color	20. Color of chair	3,47
	21. Color of chair glitter or not	3,80
	22. Color texture of chair	3,87
8. Price	23. Price of one set of chair	4,87

Based on quality attribute above, then we identified consumer need. The result was as in Table 2

Consumer need to each quality attribute was interpreted by the answer that had the highest percentage so that output of product development would be suitable with consumer majority need.

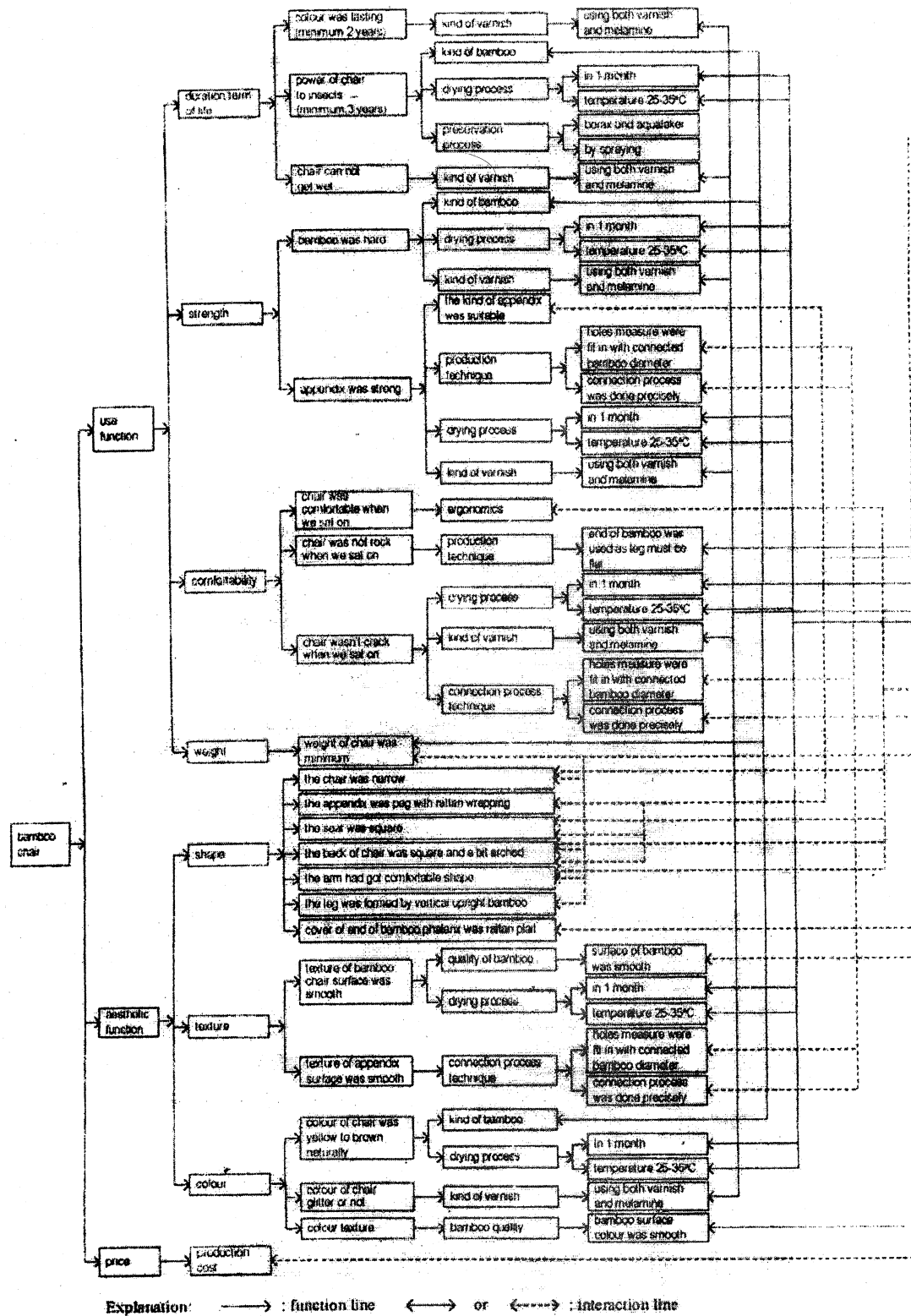


Fig. 1. FAST Diagram of Bamboo Chair Product

Table 2. The List of Consumer Needs to Bamboo Chair Quality Attributes

Bamboo Chair Quality Attribute		Consumer Need	Percentage
Basic	Secondary		
Duration Term of life	1. Duration term of life of color	a. Min 2 Years	0%
		b. Min 3 Years	40%
		c. More than 3 Years	60%
	2. Duration term of life of chair to insects	a. Min 2 Years	13%
		b. Min 3 Years	67%
		c. More than 3 Years	20%
Shape	3. Shape of chair wide of narrow	a. Wide	7%
		b. Narrow	93%
	4. Kind of Appendix	a. Peg appendix with rattan wrapping	93%
		b. Peg appendix without rattan wrapping	0%
		c. Wood appendix	7%
	5. Shape of seat	a. Square	100%
		b. Polygon	0%
	6. Shape of back of chair	a. Square and a bit arched suited bamboo natural shape with small diameter bamboo in the middle	60%
		b. Square and straight with small diameter bamboo in the middle	33%
		c. Polygon with small diameter bamboo in the middle	7%
7. Shape of arm of chair	a. Straight	47%	
	b. Incline	53%	
8. Shape of leg of chair	a. Formed by vertical up right bamboo	87%	
	b. Formed by horizontal piled up bamboo	13%	
9. Cover of end of bamboo phalanx	a. Rattan plait	87%	
	b. Bamboo - lath	0%	
	c. Without Cover	13%	
10. With or without ornament	a. With ornament	0%	
	b. With out ornament	100%	
Color	11. Color of chair	a. Black to brown	14%
		b. Yellow to brown	53%
		c. Yellow	33%
12. Color of chair glitter or not	a. Glitter	13%	
	b. Not glitter	87%	
Price	13. Price of one set of chair	a. Rp. 250.000 - 500.000	80%
		b. Rp. 500.000 - 750.000	20%

Then, identified consumer needs were mapped in FAST diagram. The result can be shown in fig. I. Fast diagram showed that bamboo chair had got two basic functions ; they were use function and aesthetic function, and price function as the consequence of the first function. The development aspects in this research were related to aesthetic aspects, especially shape and color of chair. Shape consisted of shape of chair wide or narrow, shape of appendix, shape of seat, shape of back of chair, shape of arm of chair, shape of leg of chair, and cover material of bamboo end of phalanx, while color of chair was influenced by the kind of bamboo. Due to that, the

alternatives were developed based on variety of shape and bamboo.

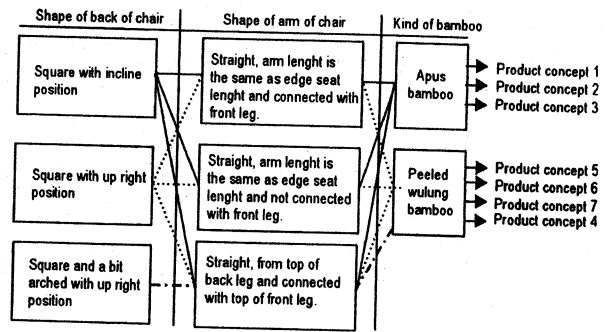


Fig. 2.

The result of surveying can be shown in fig 2

The strengths and the weaknesses alternative above then were analyzed by zero-one method in related to the consumer needs. The result (as in Table 3) was the development aspect alternatives would be used in concept building stage.

Table 3. Development Aspect Alternative.

No	Development aspect	Alternatives
1	Kind of appendix	1. Peg
2	Shape of seat	1. Square
3	Shape of back of chair	1. Square with incline position
		2. Square with up right position
		3. Square and a bit arched with up right position
4	Shape of arm of chair	1. Straight from the middle of back leg and connected with the top of front leg.
		2. Straight from the middle of back leg and not connected with the top of front leg.
		3. Incline from the top of back leg and connected with the top of front leg.
5	Shape of leg of chair	1. Formed by vertical up right bamboo
6	Secondary material	1. Small diameter bamboo
7	Cover of end of bamboo phalanx	1. Rattan plait
8	Color of chair (kind of bamboo)	1. Apus bamboo
		2. Peeled wulung bamboo.

Next, alternative above were combined to get bamboo chair scheme concepts as shown in Fig. 3.

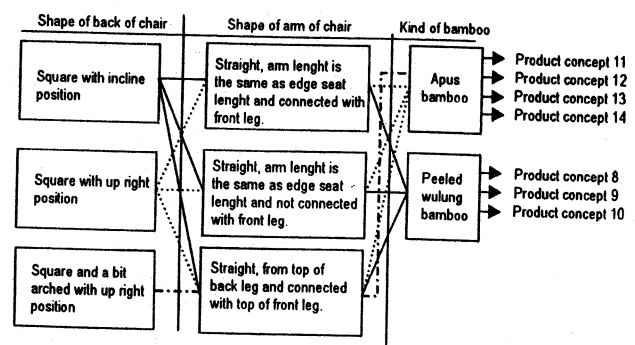


Fig. 3.

Product dimensions for each product concept referred to the dimension of bamboo chair living room for foreign market because earlier survey showed that most of market product models was comfortable enough except for current models. The dimensions were

1. Height of seat : 380 mm (excluded cushion of seat)
2. Length of seat : 640 mm for back of chair in incline position and 540 mm for up right position (excluded cushion of back of chair)
3. Wide of seat : 410 mm
4. Height of arm : 200 mm (measured from the surface of seat)
5. Length of arm : 640 mm
6. Height of back : 470 mm (measured from the surface of chair of seat)
7. Wide of back of : 510 mm chair
8. Slope of back of : 15° (especially for back of chair in chair incline position)

Then, all product concepts above and a market product (as benchmark) were tested to the respondent to know its performance. The product sample for each concept and market product can be shown in supplement. There were 9 appraised quality attribute ; color of chair, the kind of appendix, the shape of seat of back of arm, the shape of arm of chair, the shape of leg of chair, seat comfort, back of arm comfort, and arm of chair comfort.

Product value was assessed by using equation ; value = performance / value. In this research, function was product performance that appreciated by consumer while cost was variable production costs, fixed costs is not included because it assumed equal for each concept. For market product, concept 4,5,6 and 7 were Rp. 92.500, while concept 1,2 and 3 were Rp. 80.500. Each product performance and value was as in table 4

Table 4. The First Product Performance and Value

Product	Performance	Value (10 ⁻³)
Market	268.54	290
Concept 1	284.66	3.54
Concept 2	313.48	3.89
Concept 3	274.37	3.41
Concept 4	283.93	3.07
Concept 5	318.24	3.44
Concept 6	299.29	3.24
Concept 7	284.08	3.07

The significance of product value above tested by statistic method, which was wilcoxon signed ranks test. In this test, each concept was compared with market product. The result showed that output development value were higher than market product.

The next step was combining development aspect alternatives to get new product concepts (beside product concept 1,2,3,4,5,6 and 7). The these value concept were assessed theoretically without testing it to the respondent first.

Based on concept combination table above, for back and arm of chair, concept 8,9,10,11,12,13 and 14 had got the same performance as concept 1,2,3,4,5,6 and 7, either did others quality attribute except color. Color was influenced by the kind of bamboo. Color performance for concepts using apus bamboo was the average of performance of tested concept using apus bamboo, either was peeled wulung bamboo.

Especially for cost, it was influenced by the kind of bamboo. For apus bamboo, the cost was Rp. 80.500 while peeled wulung bamboo was Rp. 92.500.

Performance and value of product concept 8,9,10,11,12,13 and 14 can be shown in table 5.

Table 5. The Second Performance and Value

Product	Performance	Value (10 ⁻³)
Concept 1	293.11	3.17
Concept 2	321.92	3.48
Concept 3	282.82	3.06
Concept 4	275.49	3.42
Concept 5	309.79	3.85
Concept 6	290.84	3.61
Concept 7	275.63	3.42

According to the Table 4 and Table 5, we knew that the best product concept (product concept with the highest value) was concept 2, that was the bamboo chair in square back of chair in incline position, straight – arm of chair and not connected with front leg of chair, and the material is apus bamboo.

SUMMARY

Product design and development in this research was implemented by using value engineering approach that the objective to get product with the highest value. The development aspects in this research were related to aesthetic aspects function especially shape and color of chair. The alternatives were developed based on variety bamboo chair in peg appendix, square seat, square back of chair in incline position, straight – arm of chair and not connected with front leg of chair, and the material is apus bamboo. The value of this alternative was 3,89.10⁻³, while market product was 2,90.10⁻³; it means there was an improvement.

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