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# Product design simplification to increase competitiveness with a value engineering approach to the wastafel flean industry

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**Abstract**

International competitiveness encourages companies to optimize their profiles. Therefore, increasing productivity as one of them that increases competitiveness must be done. And also, the tap industry in Indonesia, the competition is very fierce. The purposes of this study were to find the best solution to optimize the product design with the best value and the cheapest engineering approach that can be implemented in the production of sink faucets. By optimizing production costs and increasing productivity, of course the company will be able to survive. After value engineering is carried out, a study can be obtained that provides recommendations to producers in the form of simple tap product designs in terms of construction design and production process design, namely: Low Pressure Die Casting (LPDC) and the machining process. The results of value engineering is a design that meets requirements for the product by replacing the construction and dimensions of the faucet that still meets the quality requirements, namely comfort, functionality and safety in use. With this alternative, savings of 21.38% are obtained from the total cost.

**Keywords:** Competitiveness, Value Engineering, Design, Sink Faucet

## 1. Introduction

In the era of free trade agreed in the framework of AFTA, APEC and WTO, every company must face tough competition with other companies from all over the world. As a framework for competitiveness, every company in the world strives to reduce various costs associated with the production process and product design. Good productivity also describes good competitiveness, and maximum competitiveness has the opportunity to create high economic growth [1]. Increased productivity is very important to increase competitiveness. To have high competitiveness and operational excellence (Operational Excellence), productivity must be increased because productivity is closely related to competitiveness [2].

Production optimization is a way of increasing the value of a production with variable influence. How to optimize production can be by increasing the quality of production, the amount of production, the benefits of production, the physical form of production, and others [3][4].

The dimensions of a company's competitiveness as stated by [5][6]consist of cost, quality, delivery time, and flexibility. In order to become a country with high competitiveness there must be several things fulfilled including infrastructure, quality of the bureaucracy, macroeconomic stability, and education, all of them led to efforts to increase economic competitiveness. Globally, there are several institutions that rank countries' competitiveness, such as the World Economic Forum (WEF), the IMD World Competitiveness Center, the ASEAN Economic Community (AEC) and the World Bank.

Value engineering is a systematic evaluation of the engineering design of a product/service so that the most optimal value is obtained for each cost incurred and assesses and considers all product components related to costs with its function which aims to reduce production and product costs [7][8][9]. The research was conducted in a plumbing fitting company that produces faucets and only focuses on analyzing the influence and relationship between value engineering on production optimization and increasing competitiveness so that it can provide something optimal for the company[10].

## 2. Method of the Study

The data analysis methods used in this study are:

1. Quantitative Analysis: Calculating direct raw material costs, direct labor costs, overhead costs, non-production costs, the amount of profit margin [11][12].
2. Value Engineering Method, with tools: Brainstorming, Pareto Diagram, Function Analysis System Technique (FAST), Mudge Diagram, Resource Consumption Matrix [13].
3. Comparative Descriptive Analysis; done by describing the comparison data between elements, phenomena, and statistical data for several consecutive periods, so that it can provide a clear, easy to understand and informative picture [14].

The following is the flow of the study:

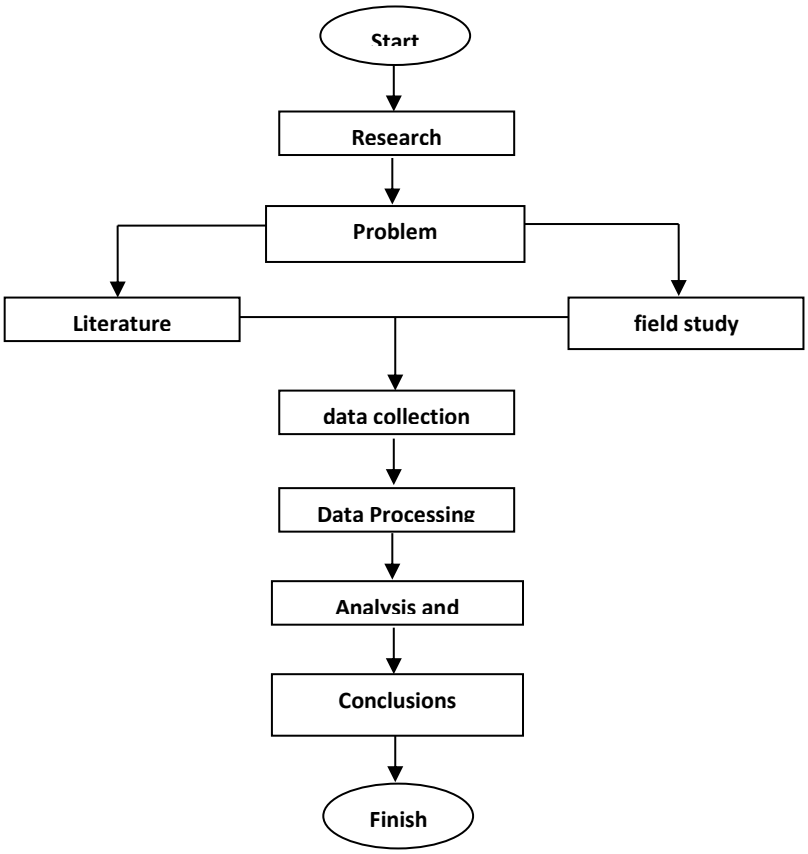


**Figure 1**. Flow Chart

**Hypothesis of The Research**

Hypothesis of a study is also called an assumption in the form of a temporary answer to the problem to be researched and must be verified [15,16]. An experiment must be carried out to prove the truth of the allegations or hypotheses that are made. Figure 2 below is a research hypothesis that illustrates the alleged relationship between value engineering and competitiveness.

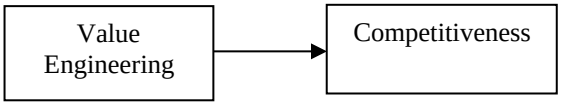


**Figure 2.** Research Model

1. H0: Value engineering has no effect on increasing competitiveness.
2. Ha: Value engineering has an effect on increasing competitiveness.

3. **Results And Discussion**

Engineering process of sink faucet product construction:

1. The main body has functions A, C, E with an initial construction that consumes quite a high amount of material, and a high level of difficulty (Figure 3)
2. Using 2 cores, it is modified into 1 inner construction using 1 core so as to save material and speed up the casting process (Figure 4)

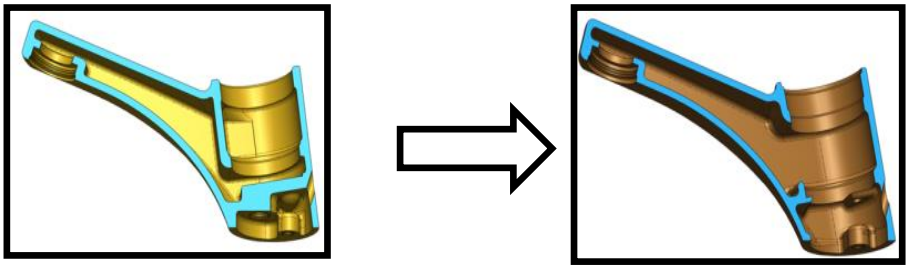

**Figure 3.** Main Body Component Engineering

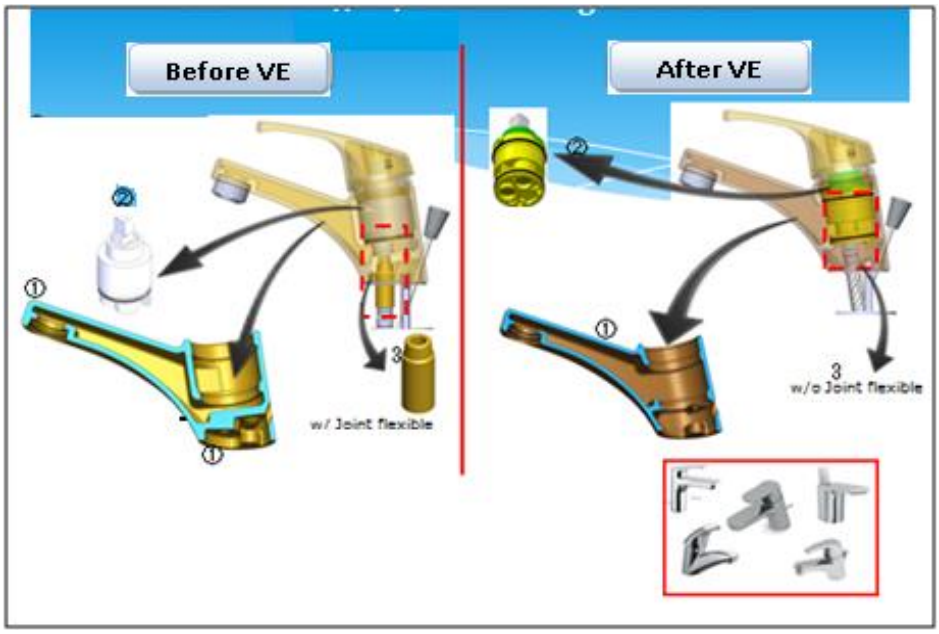


**Figure 4**. Design Engineering Product Construction design

3. The cartridge which functions as a regulator of water output and the stop valve must be set directly to the main body so that it can be set/connected directly to the water source. (Figure 4).
4. This the use of joint flexible of brass can be eliminated, which can automatically save costs, speed up the assembling process and easier for maintenance. (Figure 4)

The results obtained from the value engineering process (Velue Engineering) are:

1. Brass material savings of 5 grams / pc x 1800 = 9000 grams / month = 9.0 Kg.
2. Saving human resources; which was originally 2 cores is done by 2 people into 1 person.
3. Lead and delivery times becomes faster
4. Production process costs can be reduced (cheaper)

The full value engineering results can be seen in Table 1.

**Table 1.** Before and After VE Comparison

| Cost Calculation Before VE | | | | | Cost Calculation After VE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Kode | Function | Type Alt 1 | Name/No. Part | Price (Rp) (a) | Type Alt 1 | Nama/No. Part | Price (Rp) (b) | Selisih c = (a)-(b) | % | Cost Down c x use'm |
| A | Adjusting the Water Flow Output | TX108LDN | Body, Catridge<br>Handle, Aerator | 111,573 | TX108LDZ | Body, Catridge<br>Handle, Aerator | 77,864 | 33709 | 30.21% | 71,976 x 900 = 64,778,400 |
| B | Maintain cleanliness | | Pop Up Waste<br>Packaging Part | 23,599 | | Pop Up Waste<br>Packaging Part | 23,599 | | | |
| C | Easy operation | | Handle Cast<br>1 1/4 Pop Up Waste<br>Mini Flexible Hose<br>Catridge Push Rod<br>Push Handle (S)<br>Setting Bolt, Washer<br>Cap Nut (S), Packing<br>Setting Bolt Nut<br>Hex Screw Keys (S)<br>Screw, Sticker<br>Manual | 90,465 | | Handle Cast<br>1 1/4 Pop Up Waste<br>Mini Flexible Hose<br>Catridge Push Rod<br>Push Handle (S)<br>Setting Bolt, Washer<br>Cap Nut (S), Packing<br>Setting Bolt Nut<br>Hex Screw Keys (S)<br>Screw, Sticker<br>Manual | 71,829 | 16,636 | 20.60% | |
| D | Save Water | | Aerator | 3,805 | | Aerator | 3,627 | 181 | 4.76% | |
| E | Pressure Resistant | | Body, Catridge<br>Joint, Flexible Hose<br>Conecting Nut<br>Cup Nut (S), Packing | 94,362 | | Body, Catridge<br>Joint, Flexible Hose<br>Conecting Nut<br>Cup Nut (S), Packing | 78,897 | 15,465 | 16.39% | |
| F | eye catching | | Aerator, Cup Nut<br>Innerbox, index<br>Push Handle (S) | 12,781 | | Aerator, Cup Nut<br>Innerbox, index<br>Push Handle (S) | 8,796 | 3,985 | 31.18% | |
| TOTAL | | | | 336,585 | | | 264,609 | 71,976 | 21.38% | |

From Table 1 it can be explained that the value engineering of the TX108LDN sink faucet product is carried out on several functional components, namely:

1. Code A: Components function to regulate output, where value engineering can reduce production costs by 30.21%
2. Code C: Components function to facilitate operation, where value engineering can reduce production costs by 20.60%
3. Code D: Aerator component which functions to save water, which can reduce production costs by 4.76%.
4. Code E: Components function to withstand pressure sink faucets, where production costs can be reduced by 16.39%.
5. Code F: Components function as aesthetics, where production costs can be reduced by 31.18%.

The total reduction in component costs from the calculation results is:

1. The reduction in component costs is = pre-engineering costs - post-value engineering costs: IDR 336,585 - IDR 264,609 = IDR 71,975 or 21.38% or savings in the cost of TX108LDN components for one year is IDR 71,975 x 900 x 12: IDR 777,330,000
2. Profit earned; (Selling price - (factory price + factory expenditure))
   IDR 1,020,000 - (IDR 264,609 + 12,944) = IDR 742,447
3. The total profit generated during one year is:
   IDR 742,447 x 900 x 12 = IDR 8,018,427,600 (8.01 billion/year)

The result of value engineering on the TX108LDN faucet product can be used for a reference for similar products to make improvement/optimization of production costs through value engineering. Other similar products that allow value added can be seen in Table 2.

**Table 2**. Value engineering sales data table

| No | Type | Jan-Sept 2020 | | | |
|---|---|---|---|---|---|
| | | Qty | Sales Value | % Qty | % Sales Value |
| 1 | TX108LDN | 5,201 | 5,305,020,000 | 25.45% | 21.49% |
| 2 | TX108LG | 686 | 1,557,220,000 | 3.36% | 6.31% |
| 3 | TX108LHBR | 10,925 | 12,534,490,000 | 53.46% | 50.78% |
| 4 | TX108LI | 3,623 | 5,289,560,000 | 17.73% | 21.43% |
| Grand Total | | 20,435 | 24,686,290,000 | 100.00% | 100.00% |

**Value engineering (X) against competitiveness (Y)**

From the simple regression test process that examines the relationship between Value Engineering on Power, the following results are obtained:

1. The significance test shows that sig 0.003 is less than 0.05, meaning that t is significant, so H0 is rejected and the alternative hypothesis (Ha) is accepted.
2. The magnitude of the effect of Value Engineering on Competitiveness by looking at the adjusted R square of 0.613 or 61.3%, the remaining 38.7% is influenced by other variables outside of this study. The coefficient of determination ($R^2$) in this study is not too big. This is because the competitiveness of sink faucets is not only influenced by value engineering. However, there are several things that affect, for examples, the quality and marketing strategy, which may be possible to be studied further.
3. The regression equation is Y2 = 0.903 - 1.710X this means that competitiveness will increase if Value Engineering decreases by 1.710 x, with a constant of 0.903. Minimal production cost of a value engineering result (Value Engineering) and without reducing the function and also quality will have an impact on increasing competitiveness

## 4. Conclusion

The study concluded that the application of value engineering in the sink faucet construction process through engineering construction designs can save part component costs of Rp. 777,330,000 a year. Value engineering deals with and influences competitiveness. The application of value engineering has a positive impact on production cost savings and sink faucet components, with these savings the selling price of products in the market will be accepted by consumers thereby affecting the competitiveness of the company.

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