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DESIGN CONCEPT OF WASHING GALLON USING DESIGN METHOD RATIONAL

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ABSTRACT

Bottled Drinking Water is one of human needs at this time. PDAM Tirta Wening is a company engaged in Bottled Drinking Water that produces Cup and Gallon. The process of reproduction started at unloading gallons - gallons that have been previously distributed. Furthermore, continue on process washing of outside gallons and followed by washing the inside using machine. Both of this operation process take about 54 seconds for each gallon, compared with the expected time from the company is about 30 seconds per gallon. By using rational product design process by Nigel Cross through six stages can make a concept design of Washing Gallon that can combine two process become one process
Key words: Concept Design, Washing Gallon, Rational Product Design Method, Nigel Cross

1. INTRODUCTION

Tirta Wening drinking water company is a startup company that is engaged in the production of drinking water (Bottled Water). The company is located at Jalan Sergeant Bajuri No. 5, Bandung. The company started moving in 2002 to produce two types of Bottled Drinking Water (bottled water), which is packaged in the form of cup and gallon.
In the process of refilling the gallon in PDAM Tirta Wening, there are several processes. First, unloading empty gallon from the trucks. Then, all gallons are collected in the area of collecting gallon. After that, a collection of gallons were led to a work station of washing gallon. After that, the operator wash the inside of gallon using HCl liquid. After that the liquid are removed by the operator. Then, there are 3 operators gallon washing outside to start wash the outside gallon. After one operator who using liquid HCl is complete, then the operator helps both operators wash the outside gallon. After half the total of gallons are washed, then, 1 operator of washing the exterior began rinsing the gallon and taken to a work station of washing inside gallon. The inside of washing gallon is done by two operators which each operator had to wash the inside as much as 2 gallons in one process. At washing inside gallon, they are using a rotary machine to clean the inside. Afterwards the gallons are brought to the rinser machine, which can neutralize the gallons from germs and bacteria after washing the inside by one operator. Then continue to the process of filling water using machine filling which have the capacity to fill 4 gallons in one process.
After that, sealing the gallon by one operator. Afterwards the gallons led to the loading area where the gallons were collected before put into the truck. Once collected, put in a truck and the truck will be distributed to the region - a region which has been set from the company. In the process of washing gallon, it is a process that takes a long time. Where the washing time is expected from companie different with the actual time that occurs using Westinghouse. It can see in the table below:

Table 1 The difference between the actual time with the company's standard time

Operations	Actual Time (Seconds)	Standard Time (Second)	Difference
Washing using HCl Liquid	9	5	4
Washing outside Gallon	**29**	**10**	**19**
Washing Inside Galon	**25**	**20**	**5**
Sterilization	42	40	2
Filling Water	27	25	2
Sealing Galon	4	4	0
Total	136	104	32

Based on the above information, the problems now faced by PDAM Tirta Wening is not achieved the expected target of the company itself . On the other , the company added that the existence of mass production this year by the number of gallons of 2,000 gallons . And from the company itself wants the tool that can reach the target of the company itself. With the design tool of washing gallon will help the company to achieve the targets they are expect.

2. THEORETICAL BACKGROUND

2.1. Rational Product Design Method

Rational method is a method of designing a product with a systematic approach for each stage. This method aims to broaden the scope of research for potential solutions or facilitate teamwork decision makers. It is the simplest of the rational method is a checklist or checklist. By using the checklist, can externalise what to do so it does not need to store everything in memory designer, but it will not lose anything (Ginting, 2010).
Rational product development has seven stages (Cross, 2008), these stages are:
1. Clarifying Objective
2. Setting Requirement
3. Establishing Functions
4. Determining characteristics
5. Generate Alternative
6. Evaluate Alternatives
7. Product Improvement

2.1.1. Clarifying Objective
The purpose of Clarifying Objective is the determination of design objective. The method used at this stage is the objective tree. The use of this method is to identify the goals and sub-goals of product design and the relationship between the two. The way to achieve a goal can be made in the form of a branch in the tree of interest.

2.1.2. Setting Requirement
The purpose of this phase is to determine the functions required in the design of the product. This stage using methods of functional analysis.

2.1.3. Establishing Requirement
This stage is used to determine the accurate specification of solution designs. The method used in this stage is the performance specification modeli, with the following stages:
1. Taking into account the levels of solutions that can be applied
2. Determine the level of operating
3. Identify the performance attributes with 5W, namely:
   - What
   - Who
   - Why
   - Where
   - When
4. Determine the performance requirements for each attribute.

2.1.4. Determining Characteristics
The purpose of this phase is to set targets to be achieved by the technical characteristics of the product in order to realize the needs of consumers.

2.1.5. Generate Alternative
Determining alternative is the stage in the design of products to generate alternative-alternatives that can achieve solutions to design problems. The method used in this stage is the morphological Chart. Morphological Chart used to identify the combination of new elements to get new solutions that enable the achievement of a solution.

2.1.6. Evaluating Alternatives
At this stage , develop alternative that has been obtained will be evaluated and selected the most good . At this stage of the method used is Weighted Objective which aims to compare the value of each alternative based on the weight of a particular purpose .

2.1.7. Product Improvement
In the final step is to improve and maintain the value of a product to the buyer and on the other reduce costs for manufacturers. The method used in this phase is the Value Engineering.

3. RESEARCH METHOD

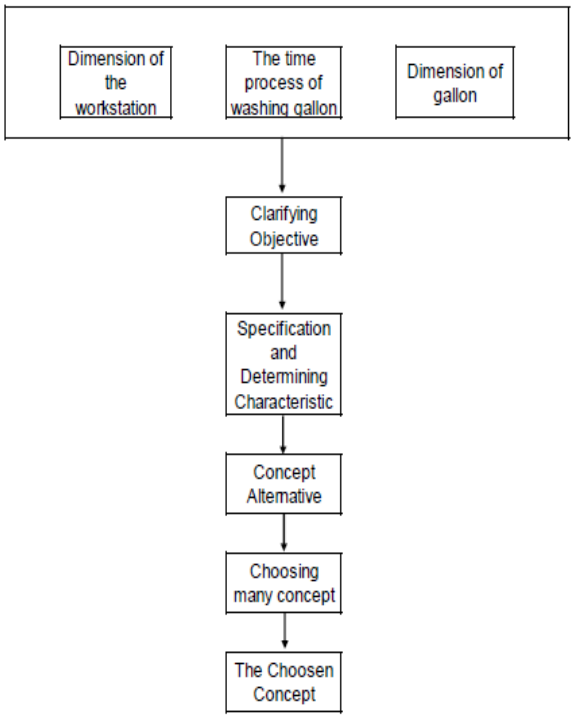

Figure 1 Conceptual Model Research

This study will make a concept design of washing gallon. In which to develop this concept design, it need some variables to launch a concept design of washing gallon. Variables required obtained from observations and interviews directly to the head of production to find out what are the attributes in the concept that will be develop and the technical specifications of the development. After doing that, do the design concept is based on the processes required . And thereafter look up the specs for the device to be designed in the form of a range. And then performed several alternative concepts that include criteria - criteria dibutuhan of the needs of the process , which will select one as a concept optimally to reduce processing time on the washing gallon.

4. RESULT AND DISCUSSION

a. Clarifying Objective

At this stage of clarifying or purpose of the product development . How to do this is to menggunakann Objective tree . Its purpose is to carry out the identification of objectives and sub- objectives of the tool will be designed as well as the connection between the two of the studied product development . and the object of this product are :

1. Cleaning both sides
2. Easy on operation
3. Mechanism of irigation
4. Disposal mechanism
5. Storage mechanism for washing

b . Setting Requirement and Determining Charateristic

At this stage will describe the criteria - what criteria should dicapat to get the purpose of the tool will be designed along with the target specification of tools designed .

Table 2 Target Performance Specification of gallons washing tool

No	Purpose	Criteria	Target of Performance Specification
1	Cleaning both sides	Tools have space to enter the entire framework gallon inside	Dimensional space to insert gallons framework tool diameter < 380 mm ; length of 640-680 mm
		Tools have to wash the inside of the trunk	Dimensions rod length 330 - 350mm ; stem diameter < 10mm
3	Easy on operation	Tool has simple operation steps	Step workmanship < 12 Steps
4	mechanism irrigation	Tool has a hole for water to be used in flushing	Dimension hole < 50 mm
5	Disposal mechanism	Tool has a hole for water to be discharged after flushing	Dimension hole < 50 mm
6	Storage mechanism for washing	Tools have a storage area appropriate for the purposes of washing	Dimensional storage area 230 x 100 x 50 mm - 250 x 150 x 8 mm

c . Establisihing Function and Generate Alternative

At this stage do the restrictions on product development function . there are :

1. Cleaning both sides
2. Disposal mechanism
3. mechanism irrigation
4. The mechanism of the body frame layout
5. Mechanism side cover
6. Entering gallons into the framework of the body
7. Storage mechanism for washing
8. Enabling the engine to the driving source
9. Uniting gear box with centrifuges
10. set the pace

Furthermore, using morphological chart where the objective was to instil some alternatives - alternatives which could bring some solutions to solve the problem in the

cases examined. Morphological chart can be seen in the table below:

Table 3 Morphological Chart

Function \ Concept	Idea 1	Idea 2
Cleaning both sides	Brush	fishing line
Disposal mechanism	Hole	
mechanism irrigation	Shower	Tap Water
The mechanism of the body frame layout	Stand	extends to the side
Mechanism side cover	Hinge	
Entering gallons into the framework of the body	Tube	Beam
Storage mechanism for washing	Beam	
Enabling the engine to the driving source	Plug	
Uniting gear box with centrifuges	Fan Belt	
set the pace	Regulator	

Based on the above table is obtained as much as 16 alternative alternative combinations . From several alternatives - alternatives will have a concept that will be developed as a concept that answers the problem of this research .

d . Evaluate Alternative

At this stage the concept of screening against 16 concepts will be developed , having acquired several concepts that will be developed, followed by scoring concept . Once the concept Scoring it will get a concept which will be developed further. The following picture results from screening and concept scoring concept .

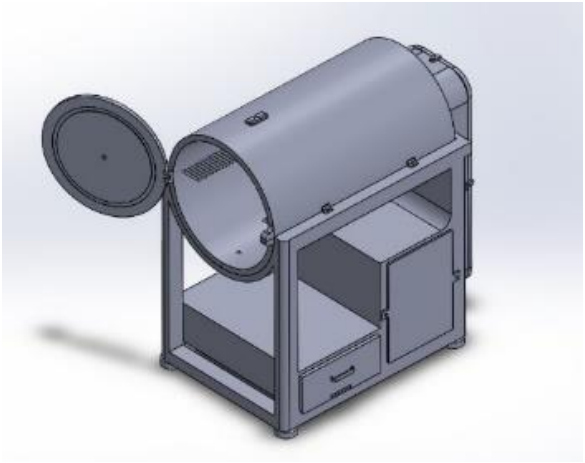

Figure 4 Overview Concept H

5. CONCLUSION

By using a prototype washing gallon that has been made , it is used motors ½ PK p (327.85 watts) to rotate gallon when processing . By using these motors , the company consumes electrical energy about 39.42 KWH per month

On the other hand, the calculation of standard time using Westinghouse, acquired new standard time of 24 seconds . The new actual time is faster than the standard time in the early observations and also from the target of the company wanted. So it can be said that research of making concept design of washing Gallon using Method Using Rational Product Design succeeded in reducing the processing time on the washing operation gallon . The following is shown in the table below :

Table 4 Comparison Time of Washing Gallon Process

Operation	Standard Time	Actual time	Using the concept
Flushing of HCl	5	9	9
Washing outside	10	29	24
Washing inside	20	25	
Sterilization	40	42	42
Filling Water	25	27	27
Sealing Gallon	4	4	4
Total	104	136	106

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