Designing a Storage Facility Using the Value Engineering Method for the Semi-Finished Leather Shoe Product: A Case Study on Small Leather Shoes Industry in Indonesia

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Abstract

This research focuses on the leather shoes' semi-finished product storage facility designing in the rural small industry, Magetan, East Java, Indonesia. The workstation of this industry needs to be improved, due to the lack of storage space for the semi-finished product of leather shoes. Besides limited space, the material arrangement was also unstructured. This condition impacted the process inefficiency, among others the production operator take more time for searching the semi-finished material to process become finished leather shoes. Therefore, this research resolves that problem by designing a storage facility using the Value Engineering method. Using this method, the SIMILAR stages on the system and process design were utilized to generate several alternative facility design solutions. A systematic analysis was conducted for two design facility alternatives, with criteria achieving the desired function, fulfilling the industry requirement such as appearance, quality, ease of maintenance, and acceptable cost. Alternative 1 of the semi-finished product storage facility was chosen, with the circle shape design using Aluminium material, installed underside wheels to easily moved, and the storage facility could be rotated. This design was expected could support the industry to produce leather shoes more efficiently.

Keywords
leather shoe industry, product design, product storage, production tools, value engineering

1. Introduction

The growth of the leather shoe industry is closely related to the rise in shoe demand. By boosting productivity, Magetan Leather Shoe IKM tries to match this demand. Based on observations made in the Magetan Leather Shoes and Sandals Industry, problems were found, namely that there were goods scattered around the production site, especially semi-finished products of leather shoes. The semi-finished product is made up of numerous shoe patterns that have been cut and assembled before being given soles and other finishing touches to make a finished shoe. The workstation of this industry needs to be improved, due to the lack of storage space for the semi-finished product of leather shoes. Besides limited space, the material arrangement was also unstructured. This condition impacted the process inefficiency, among others the production operator take more time for searching the semi-finished material to process become finished leather shoes. Therefore, this research resolves that problem by designing a storage facility using the Value Engineering method by proposing design for storage of semi-finished products for IKM Shoes Leather Magetan to organize or arranged according to the type and size of the shoe of the semi-finished products so that they are not scattered and easy to carry to the next work station so it would be more efficient.

2. Literature Review

2.1 Leather Shoes

Leather shoes are one type of shoe that has been around for a long time. ie. since 5000 years ago. At first, leather shoes were made from pieces of leather, which were quite difficult to design. Leather shoes are less concerned with their physical appearance and more oriented to their function, namely for protection in hazardous areas or surfaces as well as at high temperatures. However, as technology advances, leather shoes are increasingly being used in a variety of daily activities, and their appearance has become more modern. Leather shoes become less thick and multi-layered than in the beginning. Leather shoes are becoming more and more popular as one of the outfits in various daily activities. (Rochman 2016).

2.2 Value Engineering Methods

Value Engineering in general is a technique management that uses a systematic, creative and effortless approach organized activities which are directed to analyze the function of a system the goal of achieving the required functionality at the lowest possible cost. Value Engineering is a methods used in development a product taking into account cost without compromising on function and quality product to be designed (Hendrawan et al. 2019). This method has advantages with analyze the value of its function and maintain high quality and reliability of consumers wants. Based on the research of Maryani et al. 2019, in designing tools cashew peeler using value engineering method, there are several steps that must be done to design a product, one of the stages what is applied is the information stage, namely: the stage to find out the needs and specifications of the product to be designed. The value engineering method is used in the design of shoe rack products from planning to producing suitable design. This method has five stages, namely the information stage, the analysis stage, creative stage, evaluation stage, and development (Younker 2003).

Value engineering consists of stages, namely Information Stage, Creative stage, Evaluation Stage, Development Stage, and Recommendation Stage (Rochmanhadi 1992).

a. Information Stage
   The information stage here is the stage of data collection which is used to make alternative proposals. In this project, the information stage was carried out by collecting data about the problems that occurred in the Magetan Leather Shoe IKM.
b. Creative Stage
   The creative stage is a step to bring up several alternative designs that are expected to achieve the expected function or goal.
c. Evaluation Stage
   The evaluation stage is the stage for evaluating alternative proposals in order to obtain the best proposed results. The analysis phase includes analysis related to the proposed alternative design and the costs incurred so that the proposed alternative function can be achieved.
d. Development Stage
   The development stage is the stage for developing based on the results of the analysis that has been carried out. Development is aimed at obtaining the best alternative proposals.
e. Recommendation Stage
   The recommendation stage is the stage to provide recommendations for improvement of proposed alternatives.

Methods

This research resolves that problem by designing a storage facility using the Value Engineering method. Using this method, the similar stages on the system and process design were utilized to generate several alternative facility design solutions. A systematic analysis was conducted for two design facility alternatives, with criteria achieving the desired function, fulfilling the industry requirement such as appearance, quality, ease of maintenance, and acceptable cost.

a. Alternative 1
   The proposed design of semi-finished product storage equipment for alternative 1 is in the form of a wheeled pole with branches (if it can be compared to a clothes hanger). It is using Aluminium material. This material was chosen because it is waterproof, termite and rust resistant, odorless and anti-mildew, modern design, lightweight and easy to move. The features offered are adjustable pole, pole branch that can be folded, pole branch that can be rotated, installed underside wheels to easily moved, and the storage facility could be rotated. The following is an image of the proposed draft.

Figure 1. Storage facility design (alternative 1)

b. Alternative 2
   The proposed design of semi-finished product storage equipment for alternative 2 is in the form of a wheeled swivel rack with a cover or cover on each shelf. Each of these shelves will separate semi-finished goods based on the types of shoes to be produced. This will make it easier for operators to pick up and carry semi-finished goods to the next production process. The feature of alternative 2 is that the shelves can be closed and can rotate. In addition, the shelves are also made in layers to accommodate more.

Figure 2. Storage facility design (alternative 2)

Data Collection

Data collection was carried out by direct observation to the leather shoe industry in Magetan. The data obtained are in the form of the type or type of leather shoes produced, the types of shoe sizes produced. There are up to 5 types and size of shoes that produced by the leather shoes industry in Magetan. Besides, another data collection was carried out through searching the internet for the type of material and the amount of material used. So based on this, it can be estimated the costs required to produce the storage area. The following are the data compiled for the material needed and the price for each of the alternatives.

a. Alternative 1
Below is the list of materials and specification needed or required to produce the storage facility for alternative 1.

Table 1. Materials required for alternative 1 storage facility design

Materials	Specification Needed	Price (Rp)
Blank Hollow Carbon	180cm, 10-20lb (1)	165.000
Blank Hollow Carbon	150cm, 8-10lb (1)	120.000
Pole Branches	2 pack (2)	60.000
Swivel Wheel	4cm (diameter) (4)	64.000
Etc	Additional tools (1)	250.000

b. Alternative 2
Below is the list of materials and specification needed or required to produce the storage facility for alternative 2.

Table 2. Materials required for alternative 2 storage facility design

Materials	Specification Needed	Price (Rp)
Meranti Wooden Board	60cm x 28 cm x 2,5 cm (2)	150.000
Acrylic Box	30 cm x 30 cm x 30 cm (4)	968.000

Swivel Wheel	4 cm (diameter) (4)	64.000
etc	Additional tools (1)	250.000

Results and Discussion

The results of the analysis showed that the proposed alternative 1 is the best alternative. This is supported by the functions and costs that can be achieved by the proposed alternative. Based on the function analysis, alternative proposal 1 fulfills the objective function to be achieved, which can be used as a storage place for semi-finished products. Based on the cost analysis, the production cost incurred for alternative 1 is cheaper than the proposal 2. Proposal 1 has a production cost of Rp659,000 while alternative 2 is Rp1,432,000.

The development stage and recommendations were obtained from feedback from the owner of the Magetan leather shoe industry. The owner gave suggestions that the proposed alternative should pay attention to the size to be made so that it is not too big because the Magetan leather shoe production site is also a place to live for the owner of the company. Information regarding the used of semi-finished product storage areas based on product type and size will be listed in each pole branch in alternative 1 where an aluminum plate will be given with the shoe size written on and colored to distinguish each type of shoe.

This project has both positive and negative risks from the planned implementation of the results.

a. Positive risks
   The Magetan Leather Shoe IKM will find solutions to problems related to storage of semi-finished products. The product will not be trampled and will not mix with each other between the types and sizes of shoes that have been made, then the product can be stored easily and does not require a lot of space and the product can be moved easily.
b. Negative risks
   The Magetan Leather Shoe IKM needs to pay special costs in the manufacture of this product and if there is already a product, the worker must use the right tool and need additional space so that the tool can be used optimally.

3. Conclusion

The semi-finished product is made up of numerous shoe patterns that have been cut and assembled before being given soles and other finishing touches to make a finished shoe. The workstation in leather shoe industry needs to be improved, due to the lack of storage space for the semi-finished product of leather shoes. Besides limited space, the material arrangement was also unstructured. This condition impacted the process inefficiency. A systematic analysis was conducted for two design facility alternatives, with criteria achieving the desired function, fulfilling the industry requirement such as appearance, quality, ease of maintenance, and acceptable cost. Alternative 1 of the semi-finished product storage facility was chosen, with the circle shape design using Aluminium material, installed underside wheels to easily moved, and the storage facility could be rotated. This design was expected could support the industry to produce leather shoes more efficiently.

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