Survey of customer expectation and satisfaction: preliminary research of a modular product design approach for sheep cage design

Yuli Agusti Rochman[1,*] and *Dwi Ana Ratna* Wati[2]

[1]Industrial Engineering Department, Universitas Islam Indonesia, Indonesia
[2]Electrical Engineering Department, Universitas Islam Indonesia, Indonesia

Abstract. This study aims to produce a modular sheep cage design. Feeding, maintenance and integrated waste management are taking into account in the design. The modular and integrated product design provides advantages such as (1) easy way of making and modifying the product, (2) enabling the utilization of existing facilities such as shade, (3) giving the user a sense of convenience as the waste can be processed and not being a source of pollution. The Modular Quality Function Deployment (QFD) method is applied to identify modules associated with the customer needs of the product. A survey about customer expectation and satisfaction was conducted in order to evaluate the gap of both. The highest value of gap between customer expectation and satisfaction of products indicates that the customer needs are the focus of the problems. The most important customer needs are considered in modification and improvement of design. These are (1) the cage is not easy to fall down, (2) the sheep cage can last for long time, (3) it uses a strong frame, (4) the roof section materials is not easy to leak, and (5) It can be used even if one part of the cage is damaged.

1 Introduction

The development of technology is currently growing rapidly and precisely in creating innovative products in the future [7]. Technology is a special combination of knowledge, productive resources, input, and systematic services to produce the desired output [6]. The use of technology can help improve the efficiency and effectiveness of resource management. Quality function deployment (QFD) process is generally used as customer-oriented quality management and product development methodology in the manufacturing industry [1].

For rural communities livestock such as buffaloes, beef cattle, dairy cows, goats, sheep, ducks or domestic poultry have a strategic role because the animals can be used as life savings as well as labor source such as buffaloes and beef cattle. Livestock can also be used as a producer of organic fertilizer which is very good for increasing agricultural production. In addition, having many cattle will improve the social status. Problems related to livestock are public complaint about the adverse effects of livestock business activities because most farmers ignore the handling of waste from their business, some even dump their business waste into the river, resulting in environmental pollution. Livestock waste generated by livestock activities such as feces, urine, and feed residues cause pollution that trigger protests from nearby resident.

To overcome these problems, the role of technology used to make sheep cage. This study proposes a method of designing a modular sheep cage based on QFD. The design takes into account the integrated feeding, maintenance and waste management.

2 Research methods

This work is in the context of modular product design. In order to collect information about customer need dealing with sheep cage design, a survey was conducted. The survey includes several stages: (1) define the modularity of the sheep cage as the basis for establishing questions of the survey, (2) making and retrieving the questionnaire data, (3) processing the data with the QFD methodology. The object of this research is sheep cage. The number of respondents is 29 people. Research data was obtained from the survey to farmers in Turi, Sleman, Yogyakarta, Indonesia. The purpose of this survey is to collect information about customer expectation and satisfaction.

3 Results and discussion

3.1 Product modularity

The division of the product into an independent component raises the modularity. This independence allows companies to create variations of products and standardize components. Product modularity is frequently stated as a goal of good design practice, yet has not been as carefully studied as some other current design practices such as design-for-assembly [8]. Modularity is the focus

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Corresponding author: gusti@uii.ac.id

of the company's attention along with improvement efforts to rationalize the product line and to provide increasing varieties at a lower cost. Modularity arises from the division of a product into independent components, allowing companies to standardized components and create product variety. Product modularity is defined using two characteristics; (1) Similarity between the physical and functional architecture of the design and (2) Minimization of the degree of interaction between physical components [3].

Modular design is built on the basis of functional analysis of a product with the same function or with different functions, but has different specifications and performance. [4]. This is achieved by dividing and designing a series of general function modules, select and combine these modules to meet the requirements of the customers. Sheep cage is divided into 4 modules: sheep's house, cage roof, feeding basket, and waste basket. sheep's house is function to manage the sheep. Cage roof is function as protection from sun light and rain. Feeding basket is function as module for feeding and drinking of sheep. Waste basket is function as waste collector from the sheep such as feces and urine.

3.2 Quality Function Deployment (QFD)

Quality Function Deployment (QFD) is a method used for the planning and development of structured products that enable the development team to clearly determine the needs and wants of consumers, and evaluate each desired product or service capacity systematically provided to meet the wants and needs Consumers [2]. In general, QFD as a planning tool that is used to meet the sounds of consumers in the form of desires (expectations) and consumer needs. QFD will be used to translate the voice of consumers from the form of specific needs into the direction then engineering actions are disseminated through product planning, part, process planning, production planning, and service [5]. Customer voice are obtained by surveying the customers [4]. We measured the severity of customer's perception items/questions using likert scale (1 to 5). The customer voice of Sheep Cage are presented in Table 1. These are used to identify the customer expectation and satisfaction which then collected by survey. Result of the survey are shown by Table 2. The table has been sorted by the highest gap values. The largest gap is given by the question "The cage is not easy to fall" with a value of 0.83 while smallest gap is "The roof of the cage is made flexible to be removed or installed as needed". From this survey result, we leverage five most important customer need to be consider in the modular design of sheep cage. These are (1) the cage is not easy to fall down, (2) the sheep cage can last for long time, (3) it uses a strong frame, (4) the roof section of the cage uses materials that is not easy to leak, and (5) the cage still can be used even if one part of the cage is damaged.

Table 1. Customer voice

No	Customer requirements
1	Easy to maintain
2	Clean
3	Durable
4	Wide
5	No smell
6	Can be dismantled pairs
7	Safe
8	Strong
9	Easy to access
10	Sufficient amount of light
11	Smooth air circulation

Table 2. Survey result of customer expectations and satisfaction

No	Survey questions	Expect.	Satisfac.	Gap
1	The cage is not easy to fall down	4.59	3.76	0.83
2	The sheep cage can last for long time	3.90	3.17	0.72
3	Use a strong frame	4.34	3.72	0.62
4	The roof section of the cage uses a material that is not easy to leak	4.28	3.69	0.59
5	the cage still can be used even if one part of the cage is damaged	3.69	3.21	0.48
6	The cage is made light	2.83	3.24	0.41
7	The roof section of the cage uses a lot of material to absorb light	3.62	3.21	0.41
8	The cage is easy to clean	4.17	3.79	0.38
9	Easy when picking up solid or liquid waste	4.21	3.83	0.38
10	Solid and liquid waste can be separated automatically	4.41	4.07	0.34
11	It is easy to move (portable)	2.48	2.83	0.34
12	The roof section of the cage is made tilted	4.07	3.79	0.28
13	It is easy to unloaded as needed	2.62	2.86	0.24
14	It has good air circulation	3.97	3.72	0.24
15	It is easy to supplay water for sheep	3.24	3.00	0.24
16	The cage floor is arranged to keep the sheep from falling easily	4.00	3.76	0.24
17	The cage is made on stage	4.45	4.24	0.21
18	Material price is cheap	2.90	2.72	0.17

19	The size of the sheep cage can contain at least 4 sheeps	2.83	2.72	0.10
20	Where sheep food can be removed when they want to be cleaned	2.83	2.90	0.07
21	The roof of the cage is made flexible to be removed or installed as needed	2.69	2.69	0.00

4 Conclusion

In this paper, modular QFD is apply to developing sheep cage and to know the design parameters that are important to the customer. A sheep cage is divided into 4 modules: sheep's house, cage roof, feeding place, and waste place. The five most important customer needs are considered into modification and improvement of the design. These parameters are the cage is not easy to fall, the sheep cage can last a long time, use a strong frame, the roof section of the cage uses materials that are not easy to leak, and the cage still can be used even if one part of the cage is damaged.

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