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Design of Ergonomic Paddy Harvesting Machine

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Abstract. The process of harvesting paddy with a sickle is still done by the absence of a paddy harvesting machine in accordance with the existing agricultural land in Indonesia at a low price, where agricultural land in Indonesia is narrowly averaged with a bumpy topography condition. Combine harvester engines are not yet possible for use on these lands. Therefore it is necessary to research the design of an ergonomic paddy harvesting machine. The purpose of this research is to design an ergonomic paddy harvester. This research uses the method of Quality Function Deployment (QFD) because the method is very suitable to be used in product development in accordance with consumer expectation and desire. The results of this research indicate that there are nine attribute consumer needs in designing paddy harvesting machine that is; portable, cheap, multifunctional, lightweight, ergonomic, maximum speed, easy to disassemble, easy to maintain, and spare parts easily available. From the nine attributes of consumer needs, a discussion with experts in the field of rice harvesting machine that produces some technical requirements are; material type, blade, motor drive, unloading slot, wheel, long handle of a knife. This paddy harvesting machine can help farmers to harvest paddy and increase paddy harvesting capacity.

1. Introduction

Indonesia is an agrarian country where the livelihood of the majority of its population is by planting crops. Indonesia high agricultural potential is one of them due to the territory of Indonesia which has a land area of one-third of the total area is passed through the ranks of the worlds mountains. This causes the land area of Indonesia is very fertile. The majority of the population of Indonesia is a farmer, but not equipped with available land and the value of rice production is minimal, especially in terms of quantity [1], [2]. Most farmers in East Java, still doing the process of harvesting by manual, especially on the process of threshing grains of rice from the stalk. This manual way, besides causing ergonomic problems for farmers, also results in relatively low productivity [2]–[4].

The process of harvesting rice with a sickle is still done because of the absence of a rice harvesting machine in accordance with the existing agricultural land in Indonesia, where the agricultural land in Indonesia on average narrow with the wavy topography conditions. Combine harvester engines are not yet possible for use on these lands. Therefore it is necessary to design an ergonomic paddy harvester using the Quality Function Deployment method. It is hoped that this rice harvesting machine can help farmers to harvest rice and increase rice harvesting capacity. QFD is an effective method of developing a product that uses a structured approach involving customers [5]. QFD method aims to

increase customer satisfaction by identifying customer needs [6]. In other words, QFD is meted that is used to transform customer needs into the design of a product [7]. QFD method has four phases, namely phase product planning, product design, process planning, and process control [8]–[10].

2. Method

This research uses the method of Quality Function Deployment (QFD) because the method is very suitable to be used in product development in accordance with consumer expectation and desire [7][5][6]. Data collection techniques used in this study can be divided into three, namely interviews, questionnaires and literature studies. What is meant by the interview is to conduct the direct question and answer with the respondents. Interviews were conducted to obtain data on consumer needs attributes, technical requirements, value of relationships between technical requirements and attributes of consumer needs, as well as linkages between technical requirements. A questionnaire is to distribute the questionnaire to the respondent to answer each question. Questionnaires were conducted to obtain data on the level of consumer interest. What is meant by literature study is looking for theories from various references and previous research results. The literature study was conducted to obtain theories and the results of previous research on QFD method and paddy harvesting machine. The identification of customer needs was done by spreading the questionnaire to 30 respondents to determine the attributes of the needs of consumers [11]. The attribute of consumer needs will be discussed with the expert to determine the technical requirements. The technical requirements are comparative matrix correlation and trade off the matrix and determine the priority value requirements analyzed in House of Quality.
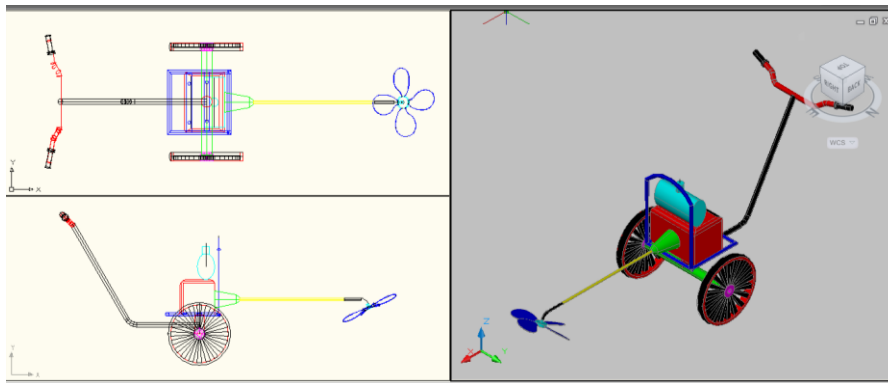
3. Result and Discussions

Engineering design is an entire activity for building and defining solutions to existing unresolved problems or new solutions to problems that have previously been solved but in different ways. The design activity cannot be finished before the final product can be used with acceptable performance levels and with clearly defined working methods. Selection of product design process concepts is based on several considerations, among others; product type to be developed, product user segment, time limit, and cost [Ulrich]. The results of distributing questionnaires to 30 respondents obtained nine attributes of consumer needs in designing the rice harvest machine namely; portable, cheap, multifunctional, lightweight, ergonomic, maximum speed, easy to disassemble, easy to maintain, and spare parts easily available. From the nine attributes of consumer needs, a discussion with experts in the field of paddy harvesting machine that produces some technical requirements are; material type, blade, motor drive, unloading slot, wheel, long handle of a knife.

Making the correlation matrix aims to know the relation between technical requirement and attribute of consumer requirement. Assessment of this relationship using values 1, 3, 9 which means 1 is a weak relationship, 3 medium relationships, and 9 strong relationships. Making a trade off matrix aims to determine the relationship between the technical requirements of the paddy harvesting machine. The assessment of this relationship uses the same range of values as the correlation matrix of numbers 1, 3, 9. The following correlation matrix values between technical requirements, trade off, and design of paddy harvesting machine.

Figure 1. House of quality.

Figure 2. Design of paddy harvesting machine.

4. Conclusion

The results of this research indicate that there are nine attribute consumer needs in designing paddy harvesting machine that is; portable, cheap, multifunctional, lightweight, ergonomic, maximum speed, easy to disassemble, easy to maintain, and spare parts easily available. From the nine attributes of consumer needs, a discussion with experts in the field of rice harvesting machine that produces some technical requirements are; material type, blade, motor drive, unloading slot, wheel, long handle of a knife. This paddy harvesting machine can help farmers to harvest paddy and increase paddy harvesting capacity.

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