An analytical hierarchy process for tofu micro and medium enterprises product plan

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Abstract. In micro and medium enterprises of Tofu, there is an activity that is done repeatedly and traditionally, namely the cutting process. The cutting process is done by using a kitchen knife so that it is not efficient and able to cause fatigue for the operator. Additionally, there is also the possibility of different cut sizes of tofu because cutting is done without using a measurement tool. The operator just follows the mild flow on the tofu. The purpose of this study is to plan a manufacture of tofu cutting tools. This study used The Analytical Hierarchy Process method in which this method begins by conducting interviews regarding the choices in level 1, 2 and 3 actions to several respondents. The result from a variety of alternative solutions based on requirements specifications showed that the products of tofu cutters were selected with materials, such as pine wood, strings, handles, naples and naple bolts. This tool will produce tofu whose size is 52 x 52 cm². The product design is carried out based on the specifications of materials and tools to produce a simple design so that the tofu cutter tool is easy to use and low cost.

1. Introduction

Analytical Hierarchy Process is a process in the form of one model for weighting decision-makings in which the input data can be either quantitative or qualitative [1]. This study was conducted based on the perception of human needs in carrying out activities in daily life. From the perception of human needs comes the thought that forms a concept of the creation of products that can help and facilitate human activities [2]. As for the product research this time, it is also inseparable from the existence of human needs of a tool that can alleviate and accelerate their activities in work. In Micro and Medium Enterprises if tofu, there is an activity carried out repeatedly and traditionally, namely the cutting process [3]. The cutting process is done by using a kitchen knife. However, this process allows different cut sizes of tofu because cutting is done without using a measurement tool. Operators just follow the flow of the mold on the tofu. Based on these conditions, we need a tool that can help speed up the process of cutting tofu with a fixed size.

Previously, there were several studies on Analytical Hierarchy Process which will be mentioned in this research. The first one is in the Process of Designing Employee Performance Evaluations [4], The second study is called an investigation on lean-green implementation practices in Indian SMEs using analytical hierarchy process (AHP) approach [5], The next one is Research on Packaging Evaluation
System of Fast Moving Consumer Goods Based on Analytical Hierarchy Process Method [6]. The third one is Selection of management option for solid waste from olive oil industry using the analytical hierarchy process [7]. The fourth one is entitled Analytic hierarchy process (AHP) model for evaluating sustainable manufacturing practices in Indian electrical panel industries [8]. The fifth one is Multi-criteria for Selection of Smartphone Brands Product using AHP-TOPSIS Method [9], the next one is Analysis of Business Development on Organic Products at Muslim SMEs (MSMEs) in Malang, Indonesia [10], The last study mentioned in this research is called Developing weighting system for refurbishment building assessment scheme in Malaysia through analytic hierarchy process (AHP) approach [11].

The difference between this research and the studies mentioned above is that this research deals with a design of tofu cutter tool that can help tofu production process to be faster and consistent. Planning and designing are carried out from the appropriate stages of brainstorming [12], good equipment specifications, clear and detailed design, adequate budget, and correct product development in accordance with the functions and specifications that have been designed. The purpose of this study is to plan a manufacture of tofu cutting tools.

2. Methodology

The method used in this study is the Analytical Hierarchy Process. Analytical Hierarchy Process is a decision-making method that describes a complex problem in a hierarchical structure with many levels consisting of goals, criteria, and alternatives [11]. The figure below is a product flow plans and development diagram:

![Figure 1. Flow plan of product and development.](image-url)

The steps for product plans and development are as follows:

- Conducting management requirements with a systematic approach to obtain, organize, and document survey results regarding the work system of MSMEs that are not yet optimal, especially in the process
• Brainstorming which is the initial activity to collect and determine ideas used in the planning and product designing process. Ideas can come from consumers when conducting surveys, as well as from designers [13]. The data in the descriptive tabulation taken from brainstorming will be categorized into 3 action levels of category. The categories consist of level 1 which is the most common, level 2 and level 3 which are more specific. Furthermore, it is presented into a tree diagram to describe the branching of ideas from the product specifications.

• The data that have been categorized into action levels are processed by using the AHP method. This method begins with conducting interviews regarding the choices in action level 1, 2 and 3 to several respondents in which they must choose and give an assessment on a scale of 1 to 9. If an assessment has been obtained, then the weighting is done. The data will be put in the form of hierarchy diagram.

• Based on the weighted hierarchy diagram, the final specifications of the product will be obtained.

3. Result

3.1. Requirement management

The results of the survey were conducted to find out the machines and assistive devices to produce low-consuming time of process in the production activities while the explanation is as follow:

• Soybeans washing and soaking
  In this process, the washing and immersion time is not so accelerated to produce hygienic soybeans.

• Soybean milling
  The grinding process actually takes time because the engine used is still classified as an old engine. Therefore, it is advisable to choose a new engine or add a machine to produce fast and plenty of soybean porridge.

• Boiling the mill
  This stage uses medium fire so that the tofu mixture is cooked perfectly.

• Squeeze / filter soybean porridge
  The squeeze process requires enough energy so that all starch extracts are taken and the disposal process in the form of tofu pulp. This process is not taken as a tool because the tools used are already supporting.

• Give spices to the tofu liquid
  After the extortion process is carried out, the next step is to give a taste to the tofu so that it is not tasteless. This process is the stirring process which must be evenly distributed.

• Put the liquid out on the mold

• Cutting tofu
  This process is a part that is used in the research. The results of the tofu that has been cut by a knife manually are uneven. Therefore, a tool is needed in this process.

• Giving turmeric to tofu
  Tofu that has been cut is given natural coloring with turmeric. The waste from the coloring is water that has been used continuously.

• Tofu Storaging
  After the tofu is colored, it is lifted by using a special captor one by one.

3.2. Brainstorming

Brainstorming was conducted on 18 people who know MSMEs in Garut. The 18 people were given a briefing first about the purpose and objectives of the data taker and provided a little understanding of the brainstorming method. Later, each person is given a piece of paper to write down their ideas about the product in question, namely a tofu cut tool [13].
The following is a description of the product that will be designed from both the designers' and the consumers' wishes:

- Low costs and budget
- Produce many tofu
- Speed up the cutting process

3.3. Product development indicators

There are several indicators which make this product needs to be developed, including:

**Table 1. Action level.**

| Level 1 | Level 2                          | Level 3                                      |
|---------|----------------------------------|----------------------------------------------|
| Costs   | Cheap                            | Affordable, not too expensive                |
|         | High-quality                      | Durable                                      |
|         | Interesting                       | Not boring, according to needs               |
|         | design                            |                                              |
| Efficient| Easy to carry                    | Fixed size                                  |
|         | Light                            | From sharp and thin materials                |
|         | Flexible                         | Changeable based on needs                   |
|         | Safe                             | There is a protector for the tool            |
|         | Comfortable                      | Have ergonomic handles                       |
|         | Dynamic                          | Can be used faster                          |

3.4. Tool specifications

The following is a specification of the tools needed in the manufacturing process:

**Table 2. Tool specifications on the tofu cutting tool.**

| No | Needs                      | Technical Specifications                                      | Alternative Solution |
|----|----------------------------|----------------------------------------------------------------|----------------------|
| 1  | Able to cut tofu          | the tool can be close to the material wanted                  | Cutting tools        |
|    |                            | Durable, strong, and light materials                          | 1. Stainless steel   |
|    |                            |                                                                | 2. Woods             |
| 2  | Can be durable            | Not easily breakable                                          | 1. String/senar      |
|    |                            |                                                                | 2. Tuning Machine    |
| 3  | Able to save time and energy | Installation by using tuning                                   |                      |
|    |                            | the installation is not permanent                              |                      |
| 4  | Can be assembled          | Fixed the string can be tightened up                          |                      |
| 5  |                            |                                                                |                      |
| 6  | Easy to be fixed          |                                                                | There are pullers and rollers in each string                  |

3.5. 3-dimensional design

The following is a 3-dimensional design made at AutoCAD, regarding tofu cutting tool used in Tofu MSMEs. The size of this cutting tool has been adjusted to the original size of the cutting tool. Below is the cutting tool in the form of 3D figure.
The picture above is made on a 1:1 scale and the size of this cutting tool has been adjusted to its original size, the product of this tofu cutting tool is chosen with materials made of pine wood, strings, handles, naples and naple bolts whereas the tofu produced will be 52 x 52 cm² in size.

3.6. Working principle
The working principle of this cutting tool is to press the cutting tool on the tofu. This tool is equipped with small strings that function as cutters with shaped boxes that have been adjusted according to the shape of the tofu in general.

3.7. The function of the product
The above product is a tofu cutting tool with a design consisting of cutting components in the form of guitar strings that are made crossed so as to produce a square shape according to the shape of the tofu. Based on the product design that has been made, there are four main functions of the product, such as:

- Cutting tofu
- Speeding up the cutting process of tofu
- Producing the same size of tofu
- Making the cutting process easier

4. Conclusion
The result from a variety of alternative solutions based on requirements specifications showed that the products of tofu cutters were selected with materials, such as pine wood, strings, handles, naples and naple bolts. The specifications of product requirements are adjusted to consumers' demand and are regulated with efficiency both according to the price and time of product development. From a variety of alternative solutions based on requirements specifications, the product of this tofu cutting tool is chosen with materials made of pine wood, strings, handles, naples and naple bolts whereas the tofu produced will be 52 x 52 cm² in size.

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