CHAPTER I
INTRODUCTION

This chapter discusses the research background, problem formulation, research objectives, research scopes, and report outline.

1.1 Research Background

The growth of the bakery industry has been steadily increasing in the past several years. The bread and bakery products segment market in Indonesia is expected to grow annually by a CAGR (Compound Annual Growth Rate) of 5.6% per year during the period 2020-2023 (Statista, 2019). Statista (2019) mentions that revenue in the bread and bakery products segment in Indonesia is expected to be US$ 4,690m in 2020. The graphic of revenue in Indonesia's bread and bakery products segment can be seen in **Figure 1.1**.

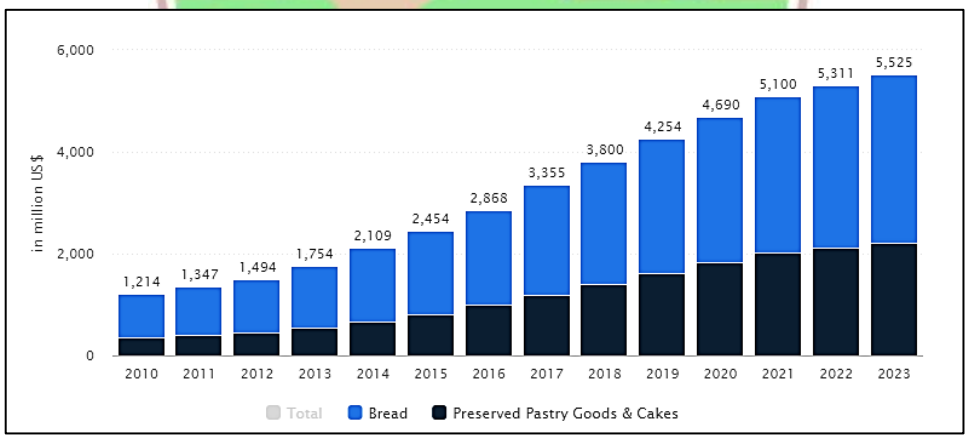

Figure 1.1 Revenue of Bread and Bakery Products Segment in Indonesia (Statista, 2019)

The bakery industry segment develops because of the rising demands of customers (EIBN, 2016) and the rapidly evolving lifestyle and consumer preferences (Mitchell, 2017). The trend of the bakery industry in Indonesia is growing continuously, followed by Indonesians changing lifestyles, urbanization,

westernization, and income improvement (EIBN, 2016). According to EIBN (2016), the popular bakery products in Indonesia mainly consist of bread (60%), traditional snacks (25%), biscuits, cookies, and wafers (10%), and cakes (5%). Although Indonesians have started to recognize bakery products as a meal choice, most of them still consume bakery products as snacks.

Mitchell (2017) mentions that four factors are considered by consumers when purchasing bread and bakery products: freshness, taste or flavor, price, and health benefits. Lakshmi (2017) suggests that taste is the most critical criteria in purchasing bread, followed by freshness, nutrient content, softness, and appearance. The baking process is one aspect that determines these factors or the quality of bread. The baking process changes the sensory properties of food, lengthen the range of tastes, textures, and aroma in foods, and improves the palatability of foods produced from similar materials (Fellows, 2000).

The baking process occurs inside the baking oven. An oven is the most important piece of equipment used in bakeries, "the workhorse" of the bakery (Gisslen, 2017). According to Manley (2011), an oven is an enclosed tunnel or cavity where batter or dough is surrounded by a hot environment and becomes baked and transformed into cookies, bread, and other products. The output of the production of a bakery is determined by the capacity of the oven based on the availability and expected working hours of the production process (Gisslen, 2017) and determines the final characteristics, i.e., flavor, shelf life, texture, color, and aroma of the products since heat and mass transfer both occur simultaneously inside the oven (Fellows, 2000). The success or failure of a bakery industry is often determined by the oven (Walker, 2016). The best results of the bakery products being produced will be obtained using an oven designed for the specific baked food type.

The bread and bakery segment market in Padang is also steadily growing in the past several years. According to *Dinas Tenaga Kerja dan Perindustrian Padang*, the number of bread and bakery industry in Padang is 126 industries with

the scale of the small and medium industrial bakery in 2018. Elliot (2019) suggests that more than two-thirds of baked goods in Indonesia are produced by small, traditional, family-owned enterprises or small and medium enterprises. These bakeries will face a competition between them. Competition among the bakery industry is based on price, quality, product differentiation, and nutritional value (Doolittle et al., 2013).

Finna Bakery is one of the bakeries in Padang, located at Jl. Ir. H. Juanda No. 43, Purus Atas, Padang Barat, Padang. Finna Bakery produces some types of bread such as white bread, wheat bread, rolls, and donuts. White bread is the most popular one among consumers and is produced more than other types of bread. Based on the interview with the owner of Finna Bakery, 80% of the products are distributed to some supermarkets in Padang, and the rest are sold at the outlet of Finna Bakery. The bread-making process consists of mixing the ingredients, kneading, cutting, and weighing the dough, leaving the dough for fermentation, baking, and packaging.

An interview is conducted with the owner of Finna Bakery, Mr. Faisal. Based on the interview and discussion, Finna Bakery wants to increase production capacity, especially for white bread, due to the rising demands of the bread products. The bakery wishes to completely fulfill the customer's demands by adding new bakery equipment, a baking oven.

Finna Bakery currently has five-deck ovens. A deck oven is a type of oven that baked the products by placing them directly at the bottom or deck of the oven without using a rack for holding the sheet pans (Gisslen, 2017). The deck ovens at Finna Bakery can be seen in **Figure 1.2**. One deck oven can contain three sheet pans with a dimension of 660 x 457 x 25 mm. One sheet pan can hold 7 Pullman pans (pans for white bread) with a dimension of 228 x 100 x 92 mm. Therefore, the capacity of one deck oven is 21 Pullman pans or 21 pieces of white bread for one batch production. The temperature of baking is usually set constant at 220^{o}C – 230^{o}C for 30-35 minutes.

Based on the discussion, the shortcoming of the baking oven in use today is the difficulty of loading and unloading the sheet pans from the oven. The operator needs to load the sheet pans from the rack (special rack for sheet pan) one at a time. The unloading process is also the same as the loading process; unload the sheet pans from the oven and place them at the rack one at a time. It means the operator needs more time for loading and unloading the sheet pans, leading to a lack of uniformity of each batch of bread. In addition, the operator needs to take the Pullman pan out of the oven and insert a stick or toothpick into the middle of the bread to check whether the bread is perfectly baked or not. This can lead to heat loss and temperature decreasing because the operator has to open the oven door. Cleaning the deck oven could be difficult sometimes because of the size and structure of the baking chamber.

Figure 1.2 Deck Ovens at Finna Bakery

The new baking oven is expected to have a bigger capacity than the existing oven at the bakery. The owner of Finna Bakery wants a baking oven with different configurations, e.g., rotary rack oven and revolving oven. The baking oven should have some aspects such as ease and efficiency in use and operation (loading and unloading, checking the bread during baking), large capacity, floor space requirement, and constrain of cost.

Finna Bakery wants a baking oven that fits with the type of products being produced, cost, size, energy sources, and capacity of the baking oven. According to Walker (2016), the cost of purchasing is often the first consideration before buying an oven rather than product suitability, lifetime utility, and maintenance cost. The average cost of residential industrial-quality baking ovens runs between $3,500 and $20,000 (Home Advisor, 2019), an expensive investment for the company. Alibaba.com (2019) mentions that the price of a commercial gas oven for industrial runs between $2,000 and $20,000. The company has to make important decisions whether or not to purchase the new baking oven. Rather than purchasing an expensive baking oven, it is much better to design and build a baking oven that is much cheaper than the commercial one. The baking oven can be designed based on the user requirements that will meet user expectations.

It is necessary to carry out a functional and technical design of a baking oven to obtain the oven design based on user requirements. The baking oven can be designed based on the type of baked products, the size of the oven, the capacity of the oven that is needed, the cost that the company can bear, and energy resources availability. The cost of producing the baking oven is expected to be lower than purchasing the commercial oven. The maintenance of the baking oven will be easier and cheaper because it is produced domestically. Furthermore, the obtained design of the baking oven can be used by the workshop, especially in Padang, to build the baking oven. This can also help the small and medium industries of the bakery segment in buying baking ovens at a lower price.

The functional and technical design will be carried out by using appropriate approaches. The previous researches related to the proposed research are explained as follows. Yusli (2017) designed a dryer for raw material of organic granular fertilizer by using Quality Function Deployment (QFD) and Function Analysis System Technique (FAST). Matzler and Hinterhuber (1998) explain how to make product development projects more successful by integrating Kano's model of customer satisfaction into Quality Function Deployment. Tontini (2007) integrated the Kano model and QFD for designing a new product, a draft

beer mug. Wu et al. (2020) propose a user requirements-oriented baby stroller functional design method developed by combining the Kano model, QFD, and FAST methodologies. The research results show that the proposed function-combining design method helps the designers to deeply understand user requirements and design baby stroller efficiently using a streamlined design process.

1.2 Problem Formulation

Based on the background described before, the problem formulation of this research is what are the functional and technical designs of a baking oven that meet the user requirements and can be produced by a workshop in Padang.

1.3 Research Objectives

The objectives of this research are described as follows:

1. To obtain the design of a baking oven (functional design and technical design of a baking oven).
2. To estimate the cost for building the baking oven.

1.4 Research Scopes

The scopes of this research are described as follows:

1. The research is done only until Phase II (Part Deployment) of Quality Function Deployment (QFD).
2. The cost of materials and parts of a baking oven is based on the websites from some reliable suppliers.

1.5 Outline of Report

The report of the final project will be presented as follows:

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This chapter discusses the research background, problem formulation, research objectives, research scopes, and report outline.

CHAPTER II LITERATURE REVIEW

This chapter describes theories and methods that are used to solve the problem. The literature review consists of the baking process, oven technologies, Kano model, and Quality Function Deployment (QFD).

CHAPTER III RESEARCH METHODOLOGY

This chapter discusses the research methodology, which contains the systematic steps to solve the problem. The process steps consist of awareness of the problem, suggestion, development, evaluation, and conclusion.

CHAPTER IV BAKING OVEN DESIGN

This chapter discusses the functional and technical design of the baking oven. The functional and technical design will be analyzed to know whether the design met the user's needs and expectations.

CHAPTER V CONCLUSION

This chapter explains the summary and the synthesis of key points of the study. It also contains suggestions related to the study for further research.