CHAPTER I. INTRODUCTION

A. Background

Indonesia, as a nation composed of numerous islands with a tropical climate and abundant natural resources, is underpinned by the fertility of its land. Leveraging its natural potential, the agricultural sector emerges as a promising domain. Indonesia's strategic focus on the exploitation of natural resources, particularly within the agricultural sector, presents a bright prospect for becoming a cornerstone in the national economic development. This is primarily attributed to agriculture's capacity to generate employment opportunities, boost foreign income, and catalyze the growth of various other industries (Purwanti, 2011).

Amidst the substantial potential within Indonesia's agricultural sector, the country grapples with a myriad of challenges concerning food security. Some of these challenges encompass land degradation leading to diminished agricultural productivity, issues related to crop pests and diseases, the repercussions of global climate change, and the transformation of agricultural land use into non-agricultural endeavors. Badan Pusat Statistik (BPS) reports that the expanse of agricultural land areas continues to decline. According to their records in 2018, the total area now stands at 7.1 million hectares, a decrease compared to 2017, which was still 7.75 million hectares. This decline is attributed to the vigorous conversion of land use.

As illustrated in Appendix 1, issue above also specifically happened in Padang city where the agricultural land is also consistently decreasing each year. This trend is supported by a comparison of the agricultural land area with the residential land area in Padang, revealing a continuous decline in agricultural land and a simultaneous increase in residential land. Consequently, the annual decrease in agricultural land poses a threat to the food supply for the population particularly in the city of Padang, which may face issues of food scarcity, one of them is vegetable commodity. One of the issues arising from the decline in agricultural land is the uncertain production of vegetables.

Based on Appendix 2, data obtained from Badan Pusat Statistik (2023), it is evident that the growth of vegetable production in the city of Padang exhibits significant fluctuations. This situation gives rise to uncertainties in food supply.

According to the Department of Agriculture in Padang City, the vegetable demand in the city reached 61,320 tons in 2019 (InfoPublik, 2019). However, data from the BPS indicates that the vegetable production available in Padang City is only 4,503 tons per year. This comparison shows that vegetable production in Padang City is significantly below the community's needs, as stated in the same source in the same year

In an endeavor to address the issue of diminishing agricultural land and ensure the stability and augmentation also to fulfill the demand of vegetable production in the city of Padang, the imperative lies in the development of smart city farming that are not reliant on land expansion but can still yield optimal results in a relatively short time. One innovative cultivation technology that may be adopted is hydroponics.

The hydroponic system enables agriculture without the use of soil, utilizing water as the medium for providing nutrients to plants. Fundamentally, hydroponics relies on a growing medium that supports plant roots and can retain nutrient solutions, allowing plants sufficient time to absorb them (Alviani, 2015). According to Roidah (2014), the advantages of cultivating through hydroponics include a more assured success rate in growth and production, practical maintenance with controlled pest interference, efficient fertilizer use, easier replacement of dead plants with new ones, reduced reliance on manual labor due to a more efficient working method, and standardized processes.

Disadvantages of hydroponics that need to be considered include the requirement for significant capital; in the "Closed System" (circulating nutrient) setup, if a plant is affected by pathogens, then within a very short time, the entire crop will be susceptible to the attack; in substrate culture, the water-holding capacity of the substrate medium is smaller than that of soil; meanwhile, in water culture, the water volume and nutrient quantity are very limited, leading to rapid plant wilting and serious stress (Rosliarni & Sumarni, 2019).

The shortcomings mentioned above can serve as a source of risk, leading to a decline in hydroponic production. This issue serves as a catalyst for Padang's residents to engage in hydroponic vegetable cultivation, with approximately 10 hydroponic businesses in 2019, collectively yielding around 29 kg daily. However, this production is still insufficient to meet the continuous demand, which stands at 58 kg per day (Ramahdana & Wilis, 2019).

One of the most popular commodity of hydroponics is pak choi. The pakcoy plant originated in China and has been widely cultivated after the 5th century in Southern and Central China and Taiwan. Currently pakcoy is widely developed in the Philippines, Malaysia, Thailand and Indonesia (Yogiandre et al., 2011). From an economic and business perspective, cultivating pak choi is justified to meet the substantial consumer demand and considerable international market opportunities. This is because the selling price of pak choi is higher compared to other varieties of mustard greens. (Vivonda, 2016). Pak choi in Padang City is also high-demand. It is proven based on production data from Binara Hydroponics and Arif Hidrofarm, where pak choi is the highest-producing hydroponic commodity, aligned with the high demand from consumers. Unlike traditional pak choi, which is vulnerable to natural diseases such as flooding, erosion, drought, and relies on unpredictable natural conditions and requires extensive land, hydroponic pak choi is not susceptible to these risks. It can be implemented in confined spaces such as rooftops, kitchens, or garages.

In addition to its advantages, hydroponic cultivation of pak choi also presents significant challenges, obstacles, and risks. Hydroponic farming is requiring expertise in various aspects of cultivation, including planting, nutrient-fertilization management, and harvesting (Prastio, 2015). Pests and diseases pose primary hindrances to production, often stemming from issues in the nutrient circulation system, commonly known as the closed system, and other contributing factors. The presence of pests and diseases can diminish the yield of hydroponic pak choi and impact its overall productivity. Hence, there is a need for risk management to manage and control the risks, so that be able to maintain high productivity in hydroponic pak choi cultivation (Soekartawi, 1993).

Risks are something that everyone must face. Risk management involves various methods used to handle issues arising from risks and is also a way to address problems that may arise due to uncertainty. The measurement of the likelihood of risk aims to identify which risks may occur so that their mitigation can be carried out (Kountur, 2008). The importance of risk management includes implementing good business governance, dealing with a rapidly changing business environment, assessing business risks, systematic risk management, and maximizing profits while minimizing faced risks.

Based on the above explanation, it can be concluded that there is a need for a analysis of production risk in hydroponic pak choi farming to assist farmers in risk management, ultimately minimizing production risks in farming.

B. Research Problem

The diminishing agricultural land and increasing demand for vegetable consumption have been driving factors for the growth of smart vegetable farming enterprises using hydroponic and other innovative methods. In the city of Padang, there has been a noticeable surge in the establishment of hydroponic farming businesses. There are several hydroponic vegetable businesses operating in the city of Padang. According to previous research, around 13 hydroponic businesses were found in Padang (Appendix 2)

From several hydroponic businesses in the city of Padang, Binara Hydroponic and Arif Hidrofarm, both of which incorporate the Nutrient Film Technique (NFT) hydroponic technology as a fundamental method in their operations, stand out. Established in the year 2016, these enterprises have been part of the hydroponic business for a considerable time. Notably, both businesses dominate in terms of the significant number of netpots compared to other hydroponic ventures. This dominance reflects their shared focus on intensive production, providing them with a competitive advantage in meeting market demands. Binara Hydroponic has 5,000 netpot slots, while Arif Hidrofarm boasts an even more substantial number with 10,000 netpots. Within their product portfolios, they offer a diverse range of products, including various lettuce

varieties such as Romaine, Locarno, Lollorosa, various types of spinach (red, green, richi, and Malaysian), mustard greens, mint, basil, water spinach, and basil.

Among various varieties for both businesses, pak choi stands out as the primary commodity in both hydroponic businesses with the highest production. This is evident from the larger number of netpots allocated for pak choi cultivation compared to other commodities. In Binara Hydroponic, there are 2,000 netpots out of a total of 5,000 netpots used for growing pak choi, while in Arif Hidrofarm, there are 6,000 netpots out of a total of 10,000 netpots allocated for the same commodity (Appendix 3).

In the agricultural sector, agribusiness participants confront various risks, including production, price risks financial, and institutional risks. These risks are actively mitigated by hydroponic businesses in the city of Padang. Companies may face potential losses if their pak choi crops do not thrive, which can adversely affect the quantity and quality of their products.

In the production data for Pak choi over the course of 1 year as stated in Appendix 3, there is notable variability in the quantity of production achieved. Both companies have established production targets in accordance with the capacity of their farms for each harvesting period, which are 215 kg for Binara and 660 kg for Arif Hidrofarm. The determination of these production targets involves summing the output from all planting netpots and applying a safety stock percentage of 30% for Binara and 10% for Arif Hidrofarm. However, in reality, both companies have not been able to consistently meet their production targets every month. The lowest production figures for Binara were recorded in September 2022 at 73,5 kg, showing a decrease of 65.81%. Arif Hidrofarm, the lowest production was in Aug 2023 at 550 kg, indicating a decrease of 16.67%.

According to the owners of both companies, the decline in hydroponic pak choi plant production can be attributed to various factors. These factors include unstable weather fluctuations leading to inconsistent sunlight intensity, delays in the seedling planting process, negligence by workers, and pest disease infestations in the plants. It is important to note that neither of the two companies employs pesticide use during the plant growth stage.

The decline in pak choi production, as the main commodity for both hydroponic businesses, has significant impacts. Firstly, it has the potential to reduce income from pak choi sales, affecting the profitability and sustainability of both hydroponic businesses. This also affects the welfare of hydroponic farmers, as lower income due to decrease of production can impact their daily lives and the sustainability of their farming operations. Furthermore, the impact of reduced production in both hydroponic businesses can create opportunities for other hydroponic businesses to fill the market gap. With demand remaining high but supply decreasing, there is an opportunity for other hydroponic producers to increase their production to meet the unmet market demand.

In principle, agricultural endeavors in pak choi cultivation entail inherent risks that exist within each subsystem. Therefore, it is of paramount importance to deliberate and identify these risks in business management to anticipate and mitigate potential losses. Some of the risks that manifest in agricultural enterprises involve production risks. In this study, the primary focus lies on the analysis of production risks within the context of hydroponic pak choi cultivation in the city of Padang. Production risks have the potential to lead to crop failures or lower yields than previously anticipated.

To address the issue of hydroponic pak choi production targets not being met due to factors such as production failures, it is imperative to identify the sources and causes of risks associated with various stages of the process, including seeding, planting, maintenance, harvesting, and packaging. Therefore, there is a need for research titled **" Analysis of production risk of hydroponic pak choi (Brassica rapa L.) in Padang City (case study in Binara Hydroponic and Arif Hidrofarm)."**

1. What are the causes of risk that can occur in the hydroponic pak choi production process in Binara Hydroponic and Arif Hidrofarm?
2. How do the results of risk identification measurement in the hydroponic pak choi production process in Binara Hydroponic and Arif Hidrofarm appear?
3. What is the risk management strategy in the hydroponic pak choi production process in Binara Hydroponic and Arif Hidrofarm?

C. Research Objective

Based on the problem statement, the objectives of this research are as follows:

1. Identifying and analyzing causes of the risk in the hydroponic pak choi production process in Binara Hydroponic and Arif Hidrofarm.
2. Measuring risks in the hydroponic pak choi production process in Binara Hydroponic and Arif Hidrofarm.
3. Determining the risk management strategy that can be employed in the hydroponic pak choi production process in Binara Hydroponic and Arif Hidrofarm.

D. Benefit of Research

The expected benefits of this research are as follows:

1. For business stakeholders, this research is expected to provide recommendations regarding the production risks they face. It will serve as an evaluation tool and a valuable consideration for their hydroponic activities in Binara Hydroponic and Arif Hidrofarm.
2. In the academic realm, this research is anticipated to offer important insights, serving as a reference for future research and a knowledge source for interested parties.
3. For the general readership, this research is expected to be a valuable source of information about the agribusiness aspects related to production risks in hydroponic crop cultivation.