# CHAPTER I
# INTRODUCTION

This section contains background, problem formulation, research objective, problem scope and assumptions, and outline of the proposal.

## 1.1 Background

The agricultural sector has an important role in economic growth in Indonesia, it could be seen from its contribution to the gross domestic product in 2023 of 12.53% or the equivalent of IDR 2.62 trillion (Pusat Data dan Sistem Informasi Pertanian, 2024). The agricultural sector contributes 28.21% of employment in Indonesia (BPS, 2023a). The agricultural sector also plays an important role in maintaining food security, which is a strategic issue to ensure the availability, affordability, and quality of food for all people. Sugarcane as an agricultural commodity can be processed into sugar, which is one of the nine essential needs of society (Pusat Data dan Sistem Informasi Pertanian, 2024). Indonesia is in the second position in Southeast Asia's largest sugarcane producer with a total sugarcane production during 2023 of 27,158,830 tons, as shown in **Figure 1.1** (Kaggle, 2023).

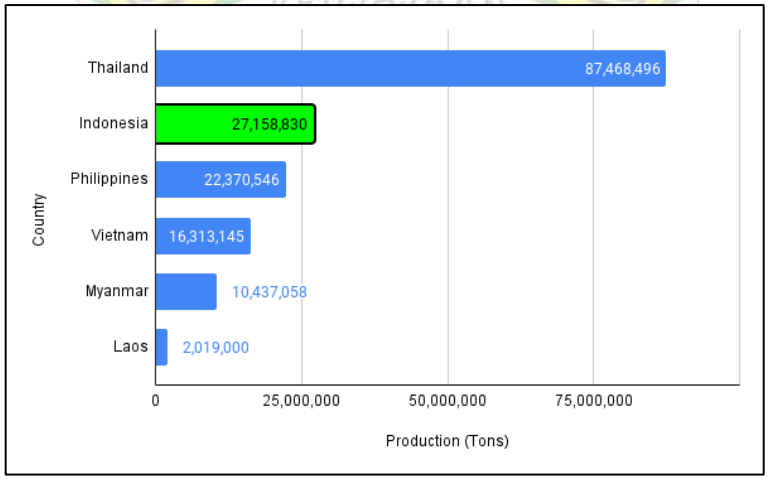


**Figure 1. 1** Southeast Asia Sugarcane Production 2023
(Source: Kaggle, 2023)

Indonesia still has a high dependence on sugar imports even though its sugar production is quite large compared to other countries in Southeast Asia. The results of the Import Dependency Ratio (IDR) analysis show that Indonesia is still dependent on sugar imports around 64.79% to 75.01% (Pusat Data dan Sistem Informasi Pertanian, 2024). It means that three-fourths of Indonesia's sugar demands are met through imports. The dependence on imports makes Indonesia vulnerable to the economic conditions and international sugar trade, especially the country of origin of sugar imports (Widi, 2024).

The country of origin of Indonesia's sugar imports is shown in **Figure 1.2**. Thailand is the largest country of origin for sugar imports from 2017 until 2023. Brazil as the world's largest sugar producer also contributes significantly to Indonesia's sugar imports. India, the largest sugar producer country in Asia along with Australia is also still the country of origin of Indonesia's sugar imports with a larger amount compared to other countries such as South Korea, United Arab Emirates, Germany, and others (BPS, 2024a). This implicitly states that the condition of the sugar industry in Thailand, Brazil, India, and Australia will influence the fulfilment of Indonesia's sugar needs. Therefore, any changes in sugar production policies or export regulations in these countries could impact the stability of sugar supplies in Indonesia.

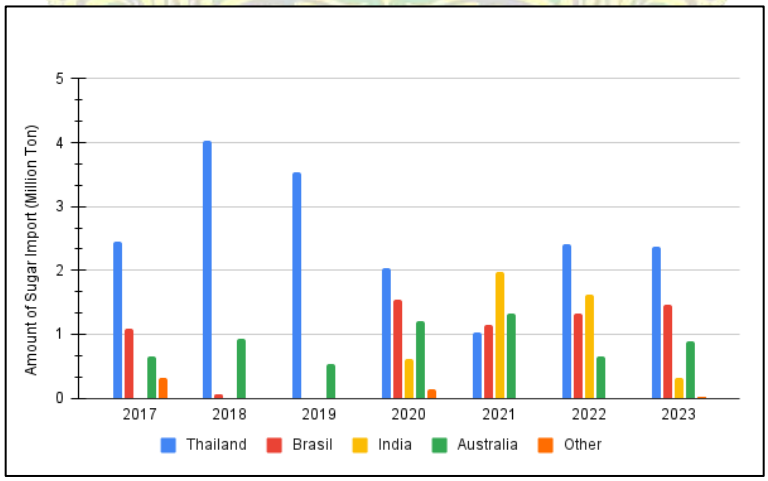


**Figure 1. 2** Indonesian Import Sugar by Country
(Source: BPS, 2024)

The trend of world sugar prices has continued to increase in recent years. World sugar price data was released by the World Bank Group from September 2019 until September 2024 as shown in **Figure 1.3** (World Bank Group, 2024). The main factor influencing prices is the imbalance of demand and supply. High demand for sugar without sufficient supply will cause sugar prices to rise. In addition, global economic conditions, consumption preferences, and other factors also determine the increase in sugar prices (Samosir et al., 2023).

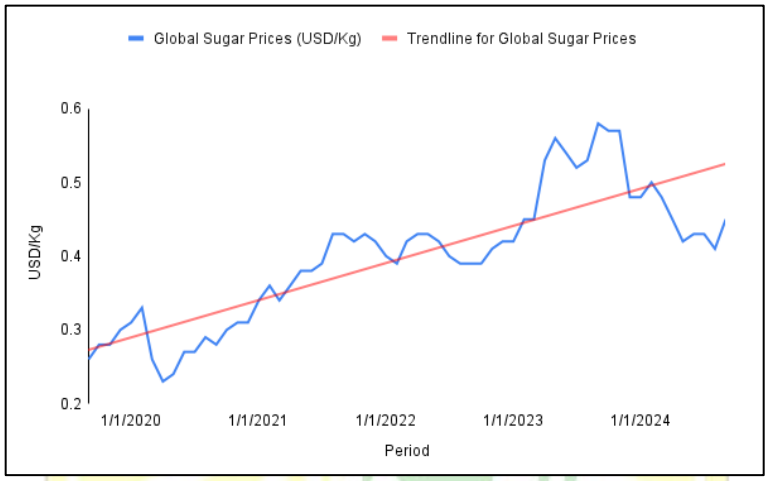


**Figure 1. 3** Global Sugar Prices Trend
(Source: World Bank Group, 2024)

The recent increase in global sugar prices was driven by the negative market perception of sugar conditions in Brazil and India, the world's largest sugar producing countries. Prospects for sugarcane harvest and sugar production in Brazil deteriorated due to drought and fires that damaged sugarcane fields in late August 2024. India's policy of limiting exports and increasing sugarcane juice-based ethanol production from November 2024 will also add to the scarcity of sugar in the global market (FAO, 2024). This condition will affect Indonesia due to its high dependence on sugar imports from Brazil and India (Widi, 2024).

The global food price index increased sharply in September 2024. The commodity that experienced the highest increase was sugar, at 10.4% monthly (Widi, 2024). The food price index is a monthly indicator developed by the Food and Agriculture Organization (FAO) to measure changes in the average

international prices of a group of major foods relative to the average price in the base year. The base year is the year used as a reference in the price index of a food commodity. The base year commonly used is 2014 to 2016 because the average price is stable and relevant to reflect global market conditions before global disruptions or fluctuations in the world economy. The index value as a reference is 100 (FAO, 2024). For instance, in August 2024, the sugar price index of 113.9 means that the sugar price in that period was 13.9% higher than the sugar price in the base year. During 2024, the sugar price index is higher than the reference value, with the highest increase occurring from August to September 2024, from 113.9 to 125.7 (Widi, 2024). The latest sugar price index released by FAO on October 4th, 2024 is shown in **Figure 1.4**.

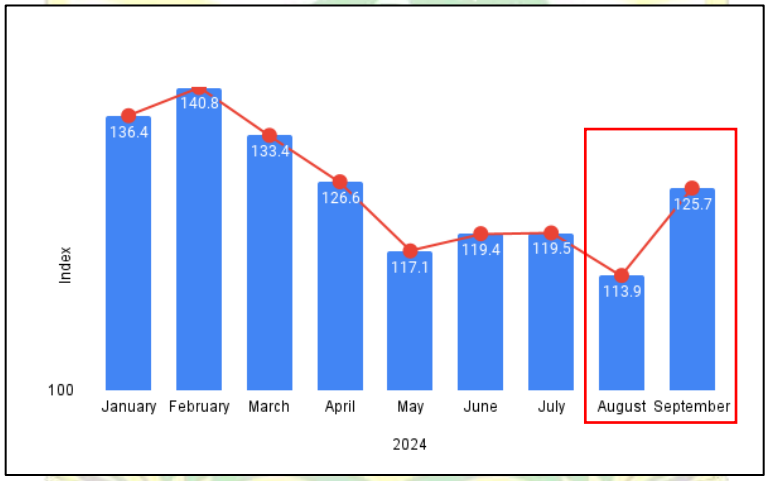


**Figure 1. 4** Sugar Price Index 2024
(Source: FAO, 2024)

The disturbance in the global sugar industry requires Indonesia to address its own sugar needs. Sugar self-sufficiency is a must for Indonesia to reduce dependence on imports. Indonesia's sugar self-sufficiency ratio (SSR) is still very low, around 27.94% to 35.27% by 2023. The self-sufficiency ratio is the percentage ratio between sugar production and the total demand (Pusat Data dan Sistem Informasi Pertanian, 2024). In order to increase the SSR value, sugar production must be increased. However, increasing sugar production is not a simple matter. It is complicated because there are many factors to be considered.

Sugar is derived from sugarcane that is milled, refined, and crystallized. Sugar production is highly dependent on sugarcane production (Gunawan et al., 2020). Sugarcane production is influenced by the area of sugarcane plantations and their productivity. Sugarcane plantations in Indonesia are divided into 3 based on their cultivators, namely state-owned plantations managed by the government, private-owned plantations, and smallholder plantations. The proportion of their respective contributions over the past ten years is 16.09% state-owned plantation, 27.49% private-owned plantation, and 56.42% smallholder plantation. The total plantation area is 504.8 thousand hectares in 2023 (Pusat Data dan Sistem Informasi Pertanian, 2023). Therefore, one of the ways to increase sugarcane production is by increasing the area of sugarcane plantations. However, this additional land area must also take into account the land available for conversion.

Productivity is the ratio between the amount of sugarcane produced and the area of land cultivated. Productivity is influenced by many factors such as rainfall, fertilizer, variety, cultivation techniques, and harvesting maturity (Atikasari et al., 2023). Besides affecting productivity, these factors also affect sugar content. Sugar content is the ratio of the amount of sugar that can be produced from milled sugarcane. The average sugar content in Indonesia is only 7% (Pusat Data dan Sistem Informasi Pertanian, 2022). It means, that from 1 ton of sugarcane processed, only 70 kg of sugar can be produced. This is lower than the global average sugar content of 12%-16%. (Makur et al., 2019).

The need for sugar consumption continues to increase along with the increase in population. Household sugar consumption in 2022 is around 6.5 kg/capita/year (Sri Wahyuni et al., 2022). Furthermore, Indonesia's population continues to increase with a population growth rate of 1.17% (BPS, 2024b). In addition, sugar consumption is also increasing along with the increase in food and beverage businesses. The number of food and beverage providers in 2022 is 10,900 businesses, growing 20.76% compared to 2021 (BPS, 2023c). It will increase the gap between sugar needs and national sugar stock.

The causal relationships in the sugar supply system form a balancing loop. National sugar stock is derived from domestic sugar production and sugar import. The difference between the available sugar stock and the required sugar need, known as the sugar deficit, is a critical factor in determining the necessary volume of sugar imports. Determination of sugar import volume must be done through an inter-ministerial coordination meeting with consideration of the sugar deficit (Menteri Perdagangan RI, 2020). The overall depiction of the causal relationships within the sugar supply system can be seen in **Figure 1.5.**

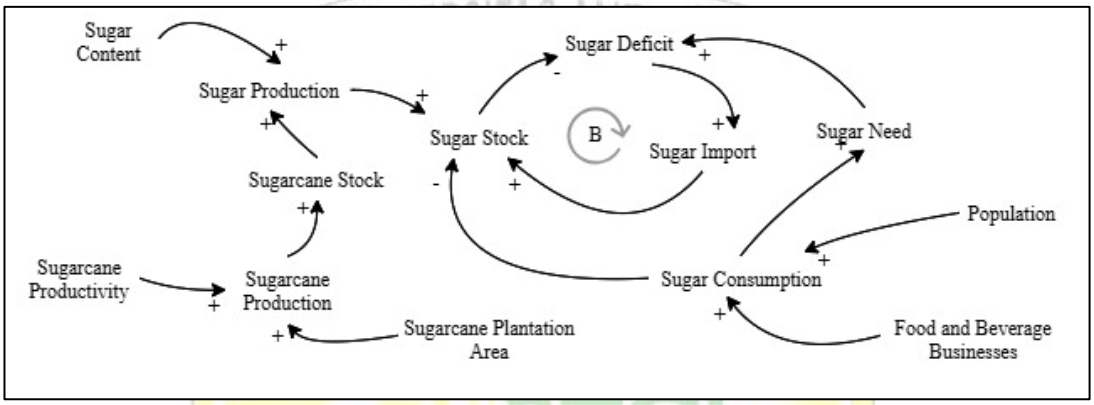


**Figure 1. 5** Influence Diagram

Indonesia is still dependent on sugar imports because domestic sugar production has not yet been able to meet demand. In 2023, national sugar production reached only 2.3 million tons, while sugar consumption needs for that year were recorded at 3.65 million tons, resulting in a shortfall that had to be met through imports (Andri, 2024). The dependence on sugar imports makes Indonesia vulnerable to the global sugar trade conditions, even though Indonesia is the second largest sugarcane producer in Southeast Asia. Disturbances in sugar importing countries such as Brazil and India require Indonesia to immediately escape from dependence on imports to maintain food security, especially sugar as one of the essential needs. The effort to increase sugar production is a complex problem and requires a comprehensive strategy. It requires holistic analysis and the recommendation of appropriate policies to reduce import dependence and achieve Indonesia's sugar self-sufficiency.

## 1.2 Problem Formulation

The research problem is how to propose policies for achieving sugar self-sufficiency in Indonesia by 2030.

## 1.3 Research Objective

The objective of this research is to propose policies for achieving sugar self-sufficiency in Indonesia by 2030.

## 1.4 Problem Scope and Assumptions

The scope of the problem discussed in this research is as follows:

1. The sugar stocks discussed in this study include only sugar for household consumption, not refined sugar or sugar from other sources except sugarcane.
2. This study does not consider inputs other than sugarcane and raw sugar in the sugar production process.
3. The model does not include climatic factors and pests that cause sugarcane crop failure.

The assumptions used in this research are:

1. The average sugar content value uses the assumptions of the Directorate General of Plantations, Ministry of Agriculture in 2022 as stated in the "Sugarcane Plantation Commodity Outlook, 2022" which is 7% (Pusat Data dan Sistem Informasi Pertanian, 2022).
2. It is assumed that Indonesia only imports sugar in the form of raw sugar.
3. The distribution of sugarcane and sugar is assumed to be always straightforward, with no one blocking the distribution.

## 1.5 Outline of The Report

The final project report is presented as follows.

CHAPTER I INTRODUCTION

This section contains the background of the problems discussed, the formulation of the problem, research objectives, problem scope and assumptions, and an outline of the proposal.

CHAPTER II LITERATURE REVIEW

This section contains related theoretical foundations that will help understand the subject of the research, such as food self-sufficiency, supply chain, sugar production, types of sugar, system dynamic, and previous related studies.

CHAPTER III RESEARCH METHODOLOGY

This section contains the stages of research starting from preliminary study, problem identification, method selection, data collection, model conceptualization, model building, verification, simulation, validation, scenario planning, analysis, and conclusion.

CHAPTER IV SYSTEM MODELING AND COMPUTATION

This section contains a system overview, causal loop diagram development, stock flow diagram construction, parameter estimation, model input in Powersim, model verification, and model validation.

CHAPTER V ANALYSIS

This section contains the current system analysis, sensitivity analysis, scenario design, scenario selection, and policy strategy.

CHAPTER VI CONCLUSION

This section contains conclusion and recommendation.