CHAPTER I
INTRODUCTION

This chapter contains the background, problem formulation, objectives, scope, and outline final project.

1.1 Background

Environmental issues are currently a widely discussed topic across various countries, including Indonesia, which actively supports the achievement of Sustainable Development Goals (SDGs) (Haryanti, Tohawi, and Purnomo, 2022). This program aims to ensure the sustainability of life for future generations. Sustainability is emphasized in all aspects, including various sectors, by not only considering the effectiveness of each sector's functions but also the environmental impacts generated by each process. This step is taken to accelerate Indonesia's sustainable economic growth.

The primary goal of implementing the SDGs is to achieve sustainable social, economic, and environmental welfare (Haida and Wahyuningsih, 2024). SDGs must be applied in various sectors due to increasingly complex global challenges, such as climate change, poverty, inequality, and environmental degradation, which require holistic attention and integrated actions. Globally, SDGs encourage all sectors to collaborate in reducing social disparities and improving people's quality of life without depleting natural resources (Haida and Wahyuningsih, 2024). Additionally, SDGs drive innovation in key sectors, such as renewable energy, quality education, and more efficient healthcare systems, all of which are interconnected to create a better future for humanity.

Global warming and air pollution are among the environmental issues the world currently faces. In recent years, the Earth has experienced a significant temperature rise (1–3 °C), known as global warming. This phenomenon also

impacts extreme climate changes, disrupting processes in forest ecosystems and other ecosystems (Cyntia Fauzi, 2019). Meanwhile, air pollution is marked by a decline in air quality that affects human health. The primary causes of these two phenomena are identified as greenhouse gas emissions and air pollution resulting from human activities (Haryanti, Tohawi, and Purnomo, 2022).

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The greenhouse gases released into the atmosphere from human activities contributing to global warming include CO2, CH4, and N2O (Wangi *et al.*, 2016). en combined, these gases are referred to as CO2e, a standard international metric for determining the environmental impact of greenhouse gases. Meanwhile, air pollution caused by human activities comes from transportation, industry, and waste disposal, producing pollutants such as particles, gases, and energy (Muhammadiyah et al., 2023).

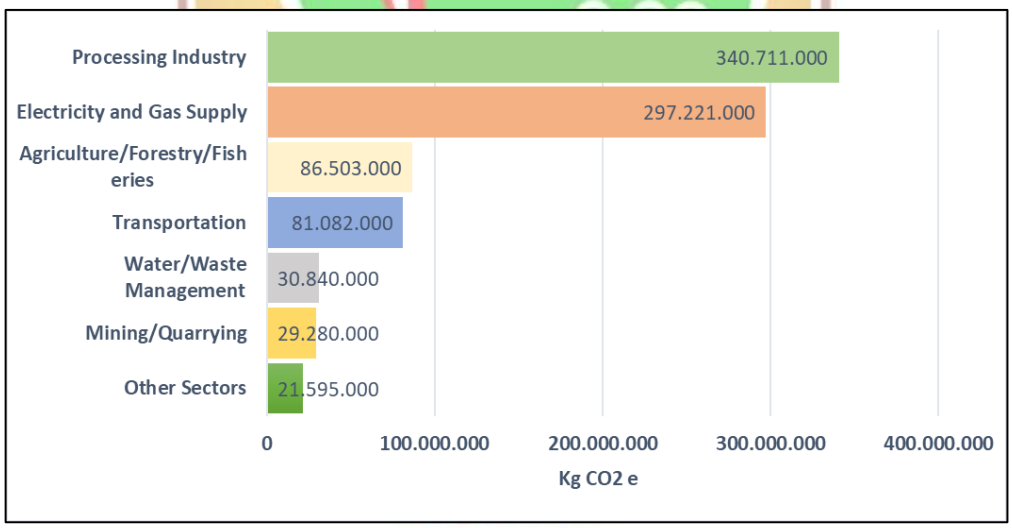

Figure 1. 1 The Industrial Sectors Contributing to Greenhouses in Indonesia (2022)

According to data from the Badan Pusat Statistik (BPS) 2022, as shown in **Figure 1.1**, the manufacturing sector was the largest contributor to CO2e emissions in 2022 compared to other sectors. The manufacturing sector produced 340.71 million tons of CO2e, accounting for around 40% of the total emissions. This data indicates that the manufacturing sector plays a significant role in contributing to greenhouse gas emissions in Indonesia.

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Indonesia has a vast and diverse processing industry, including the yellow noodle industry, which processes wheat into food products. Yellow noodles are a popular alternative to rice in society, made from wheat flour. Yellow noodles are made by mixing flour and eggs, which are then processed into long dough. After that, the noodles undergo a drying process, reducing their moisture content to 8-10%. The production of yellow noodles requires strict quality control to ensure good texture and taste. The yellow noodle industry continues to grow in response to increasing consumer demand for convenient and quick meals (Sudiarta, 2022)

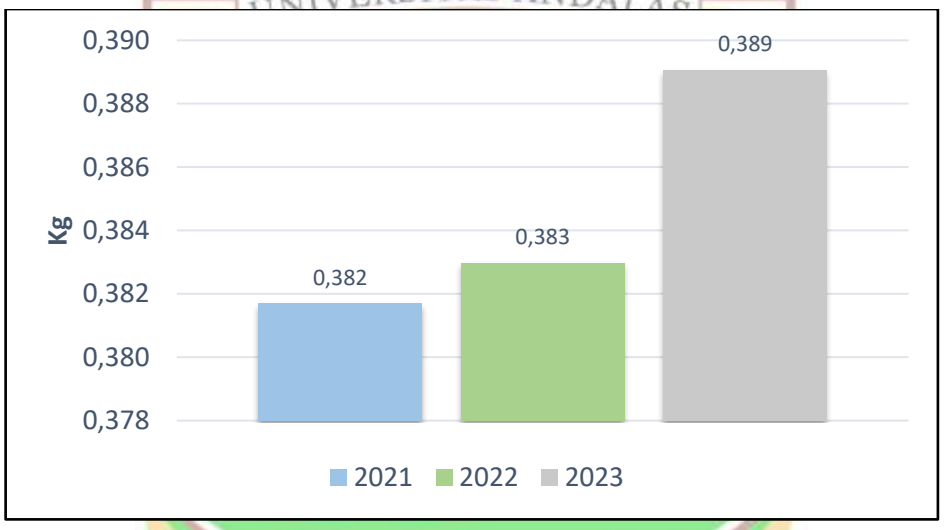

Figure 1. 2 The Increase in Yellow Noodle Consumption in Indonesia

Based on data from the Badan Pusat Statistik (BPS), from **Figure 1.2** there has been a trend of increasing average yellow noodle consumption per person in Indonesia from 2021 to 2023. In 2021, the average consumption reached around 0.382 kg per person, then saw a slight increase in 2022 to 0.384 kg per person, and grew more significantly in 2023, nearing 0.39 kg per person. This data reflects the growing popularity of yellow noodles as a staple food in Indonesia, which could be influenced by lifestyle changes, affordable prices, and the rising market demand post-pandemic.

Based on the data in **Figure 1.2**, there is a trend of increasing yellow noodle consumption in Indonesia. According to data from the Central Statistics Agency

(BPS), the population of Indonesia in 2023 is 278.696.130 people. Based on this population number and per capita consumption, the total yellow noodle consumption in Indonesia in 2023 is estimated to reach 109.562.688,67 kg. Fu rthermore, according to data from the official CarbonCloud database, every 1 kg of yellow noodles consumed will generate 3.44 kg of CO2-e emissions, which consists of 69% of the agricultural process, 2% of the transport process, and 28% of the processing process. Therefore, the total carbon emissions from yellow noodle consumption in 2023 are estimated to be 373.003.879,21 kg CO2-e. This figure indicates the significant potential environmental impact of increasing yellow noodle consumption, highlighting the need for efforts to reduce the carbon footprint through innovations in more environmentally friendly production processes.

The significant consumption of noodles in Indonesia not only highlights tremendous market potential but also poses considerable environmental challenges in terms of production. The manufacturing process involves stages such as mixing, rolling, steaming, and frying, requiring substantial resources like energy, water, and supporting raw materials (Prayoga Aditia *et al.*, 2021). Additionally, the waste generated both liquid, solid, and carbon emissions from energy use can exert pressure on the environment. With increasing production scales to meet market demand, measures are needed to ensure that the production process is efficient and environmentally friendly, minimizing negative impacts on ecosystems without hindering the growth of the food industry in Indonesia.

One small and medium sized enterprise (SME) engaged in noodle production and significantly affected by environmental impacts is UD Tani Mulia, a business specializing in the production of yellow noodles. Established in 2011, UD Tani Mulia operates as a sole proprietorship within the food processing sector. Over the years, the business has grown substantially, both in terms of production capacity and market reach. Its main facility is located on Pampangan Street, Lubuk Begalung District, in the city of Padang, West Sumatra. Initially serving a smaller, localized market, the enterprise has expanded its operations to a larger scale, distributing its products not only within Padang City and nearby areas but also to

regions outside West Sumatra Province. These include Sungai Penuh, Muko-Muko, and North Bengkulu, showcasing its significant presence in the market.

To sustain its growing production demands, UD Tani Mulia employs a workforce of 18 individuals, each contributing to specific aspects of the noodle production process. The team is divided into several workstations: 10 workers handle the rolling process, 4 workers are responsible for drying the noodles, 2 operate the machinery, and the remaining 2 focus on marketing and distribution efforts. This structured allocation of labor ensures the smooth running of daily operations, enabling the enterprise to meet market demands effectively. With its growth trajectory, UD Tani Mulia has become a notable player in the regional noodle production industry, yet it remains aware of the environmental challenges associated with its production processes.

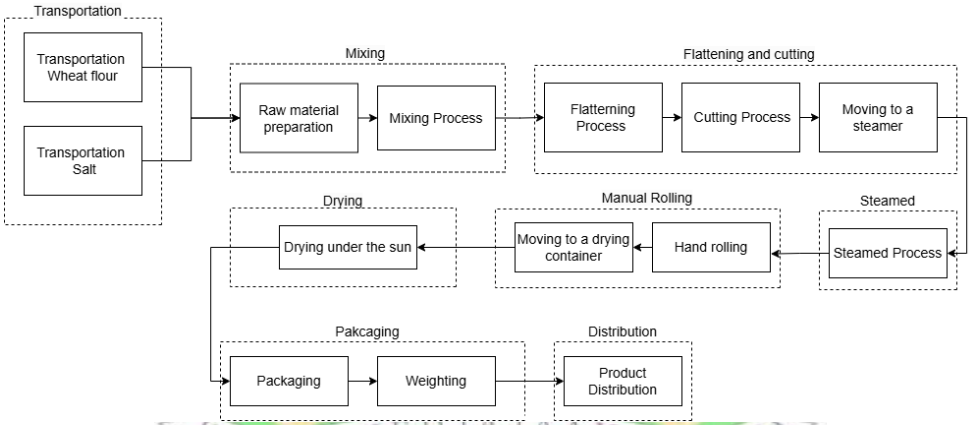

Figure 1. 3 Yellow Noodle Production Process at UD Tani Mulia

The factory has not previously conducted a systematic environmental impact assessment, so its production process has not given much consideration to environmental impacts and may potentially leave a greater negative impact. From **Figure 1.3**, the yellow noodle production process at UD Tani Mulia consists of several stages, starting with the transportation of raw materials. Wheat flour, the main ingredient, is transported using an L300 box truck, which can generate greenhouse gas (GHG) emissions that contribute to climate change. Next, ingredients such as wheat flour, salt, and water are mixed using a mixer machine

that requires electricity sourced from fossil fuel-based power plants. The mixing process also produces residual waste, which, if not properly managed, could contaminate the environment. After mixing, the dough is ground and cut using mechanical tools that also require electricity. The dough is then steamed using used oil as fuel, which, according to the 2017 Yogyakarta City Greenhouse Gas Emissions Inventory report, generates more CO2 emissions from combustion compared to gasoline, leading to adverse health effects and increasing air pollution around the production area. After steaming, the noodles are rolled by workers and sun-dried. The final stage is packaging, which could generate plastic waste if non-environmentally friendly packaging materials are used, exacerbating the waste problem in the environment.

UD Tani Mulia has never conducted a systematic environmental impact assessment, so the production process has not considered the extent of its impact on the environment as a whole. Without an assessment such as a Life Cycle Assessment (LCA), the environmental risks resulting from the production process, such as greenhouse gas emissions from the use of used fuel oil, inefficient use of electrical energy, and production waste, may continue to increase without an appropriate solution. In the long run, this could lead to pollution of the surrounding environment, worsen air quality, and even threaten public health and the sustainability of the business itself as environmental regulations become more stringent in the future.

Considering the above challenges, evaluating the potential environmental impacts during the yellow noodle production process at UD Tani Mulia is necessary. This evaluation aims to measure the contribution of each production stage to the environment and identify steps to minimize emissions. The Life Cycle Assessment (LCA) method can be used for this evaluation. LCA is a method for analyzing the total potential environmental impact of a product throughout its life cycle, from raw material preparation and production processes to transportation and product disposal ISO 14040.

The main objective of the Life Cycle Assessment (LCA) process is to identify the key environmental impact categories of a product, such as yellow noodle. This stage begins with the collection of all inputs and outputs during the product's life cycle, from raw material and energy use to emissions and waste generation. These impacts are then grouped into different categories, such as global warming potential, water pollution and air pollution. Each category is then quantitatively analyzed using the characterization method to determine the contribution of each impact. The category with the highest characterization value is considered to be the category with the highest environmental impact contribution. Therefore, it is this category that needs to be the main concern in the overall environmental impact reduction efforts. Based on the LCA results, improvement recommendations can be provided to reduce the environmental impact of yellow noodle production at UD Tani Mulia. These corrective measures will enable the company to minimize emissions and establish a more sustainable and environmentally friendly production process.

1.2 Problem Formulation

Global attention to environmental issues such as global warming and air pollution highlights the significant role of human activities in contributing to these problems. In Indonesia, the manufacturing sector has been identified as one of the major sources of greenhouse gas emissions, underscoring the urgency of implementing sustainable practices. In this context, the yellow noodle industry, as part of the manufacturing sector, has the potential to have an environmental impact along with the increasing consumption of yellow noodles in Indonesia.UD Tani Mulia, a micro, small, and medium enterprise (MSME) located in Padang City, is engaged in the production of yellow noodles. However, to date, no systematic assessment has been conducted to measure the environmental impact of its production activities. This suggests the need for a comprehensive analysis to determine the extent to which the production process contributes to environmental

impacts, and to formulate improvement strategies that are in line with the principles of sustainable production processes.

1.3 Objectives

The objectives of this study are as follows:

1. Identifying the environmental impacts caused at each stage of the noodle production process at UD Tani Mulia.
2. Identifying the parts of the production process that contribute the most significant environmental impact.
3. Providing improvement recommendations to reduce the environmental impacts caused.
4. Identifying recommendations that impacts to efficiency or productivity of the production process.

1.4 Scope

The scope limitations of this final project are as follows:

1. The scope is gate to gate, covering the transportation process of raw materials, and the production process of the noodles.
2. The functional unit used to identify environmental impacts is 100 kg of yellow noodles.

1.5 Outline

CHAPTER I INTRODUCTION

This chapter contains the background of the final procject, problem formulation, objectives, issues, and the systematic structure of the final procject report.

CHAPTER II LITERATUR REVIEW

This chapter provides theories as the foundation and support for the final project, sourced from books, articles, theses, and journals.

BAB III METHODOLOGY

This chapter describes the stages undertaken to complete the Final project. The stages include preliminary study, problem identification, problem formulation, method selection, data collection, data processing, analysis, and conclusion.

BAB VI RESULT AND DISCUSSION

This chapter outlines the steps involved in conducting a Life Cycle Assessment (LCA) of yellow noodle production at UD Tani Mulia, as well as the selection of alternative solutions to the identified problems.

BAB V CONCLUSION

This chapter presents a summary of the research results and recommendations for future research.