

CHAPTER I

INTRODUCTION

This chapter consists of background of the problem, problem formulation, research objective, research scope, and outline of report.

1.1 Background

Reverse logistics refers to the movement of scrapped goods backward from the point of origin to the point of disposal or remanufacturing. One of step that is involved in reverse logistic is waste management that may increase the effectiveness of recycling network, lower the pollution produced by waste, and encourage green, sustainable development (Gao & Ye, 2021). Roggers and Tibben-Lembke (1999) states that one form of activity in reverse logistics is the process of planning, implementing, and efficiently controlling the flow of raw materials.

Coal has been known for years as the most important fuel material for the production process in cement industry. PT Semen Padang has used coal as fuel in large quantities, which requires approximately 3500 tons per day (Sawir, 2016). Considering that coal is a non-renewable materials and produced from geological processes that take long time, coal utilization needs to be used wisely and optimally. Moreover, quoted from CNBC Indonesia, ministry of energy and mineral resources mentioned that demand of coal has been soared since 2021 and out of balance with the availability of supply (Adinda, 2022). Because of this imbalance issue between demand and supply, coal costs are also affected and made government issues policies to limit coal prices. Cost for material fuel takes 30% - 40% of the total production cost (Yuliarningsih, Goembira, & Komala, 2018). Referring to this issue, head of Indonesia Cement Association also stated that cement industry should have net-zero carbon by 2060. Hence, industry

strategic must be taken for cement industry, such as using biomass, waste pellets, B3 waste, and others as alternative fuels.

PT Semen Padang as the state-owned company of PT Semen Indonesia is demanded for continuing to develop alternative raw materials to be used as alternative fuels under the Alternative Fuel and Raw Materials (AFR) unit. Alternative materials that have been used by PT Semen Padang, such as copper slag, fly ash, bottom ash, etc. For past one year, PT Semen Padang also started to develop biomass where waste as one of the alternative materials as stated by head of Indonesia Cement Association, Proportion of waste that is needed from the whole alternative raw materials is 15%. The processing of solid waste into solid fuel used in a thermal process is known as Refuse Derived Fuel (RDF) technology. In the cement industry, the type of RDF used is Densified RDF (RDF-5) which converts solid waste into pellets, cubes or briquettes (Yuliarningsih, Goembira, & Komala, 2018). There are five types of waste that PT Semen Padang needs as alternative materials for coal, namely cooking oil, plastic, paper, dry leaves and twigs, and textiles.

In 2022, Padang City has already produced waste as much 643.76 tons/day. **Figure 1.1** shows the composition of waste resource in Padang City where household waste dominates with 72.26% or 465.15 tons per day and that number has been increasing. Hence, the availability of waste in Padang City should be able to meet the required numbers of coal alternative fuel in PT Semen Padang, especially waste from household that produce cooking oil, paper, plastic, etc.

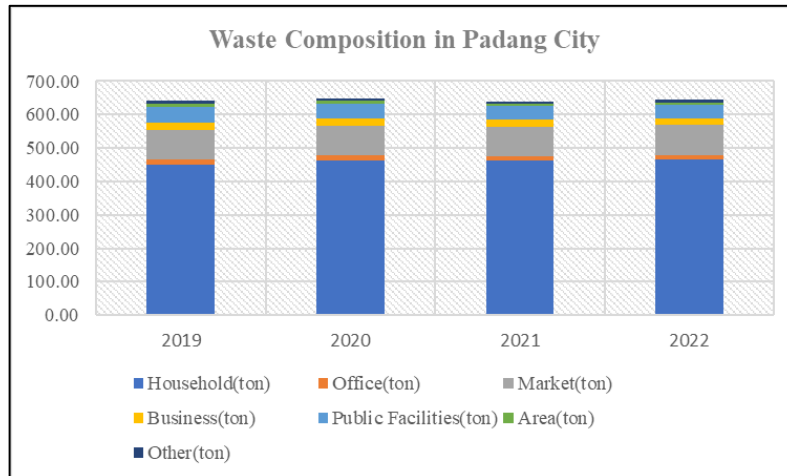


Figure 1. 1 Waste Composition in Padang City from 2019 to 2022
 (Source: <https://sipsn.menlhk.go.id/>)

Seeing increasing of waste produced in Padang City, PT Semen Padang under Alternative Fuel and Raw Materials (AFR) unit propose a program called “Nabuang Sarok”. This program was developed not only to meet the needs of AFR, but also as a form of implication of PT Semen Padang's responsibility for environmental sustainability. With Nabuang Sarok Program, PT Semen Padang tries to optimize the use of waste as alternative fuel. PT Semen Padang introduced this program in July 2022 and started to socialize how this program is, particularly to community around PT Semen Padang.

Today, individual partner has to bring their waste to deposit point *Gedung Serba Guna* (GSG) of PT Semen Padang. Then, the waste will be sent to shredder point every Tuesday and Thursday. Partner of Nabuang Sarok also include Semen Padang Hospital and several government institutions such as bank, BPJS office, KKSK, etc. Individual and independent waste deposits by the surrounding community to PT Semen Padang can be said to be inefficient because direct transportation by each individual impact high in cost. Moreover, for individual who deposit their waste by motorcycle, they only can bring small capacity of waste. Head of AFR unit mentioned that target of waste that can be collected is around 0.5 ton until 1 ton per day. Meanwhile, as seen in **Figure 1.2**, number of

average waste per day that were collected from January 2023 until June 2023 were still below 500 kg.

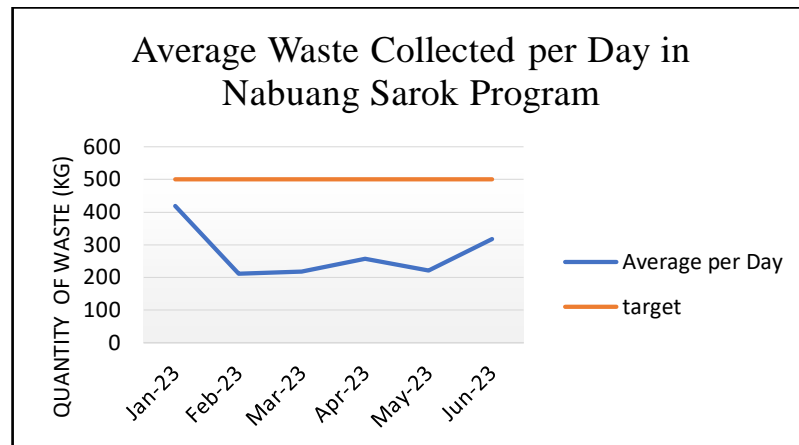


Figure 1. 2 Average Waste Collected per Day in Nabuang Sarok Program from January 2023 to June 2023

From **Table 1.1**, the composition of waste that was collected from January 2023 until June 2023 was dominated by dry leaves and twigs that came from PT Semen Padang area itself. The number of dry leaves and twigs is significantly higher than other waste that Nabuang Sarok Program accepted. With the change in the waste collection system in this program, other types of waste that are more common in the community such as plastic and paper can be optimally collected. The new way of waste collecting may affect the increase in the total Quantity of Waste collected.

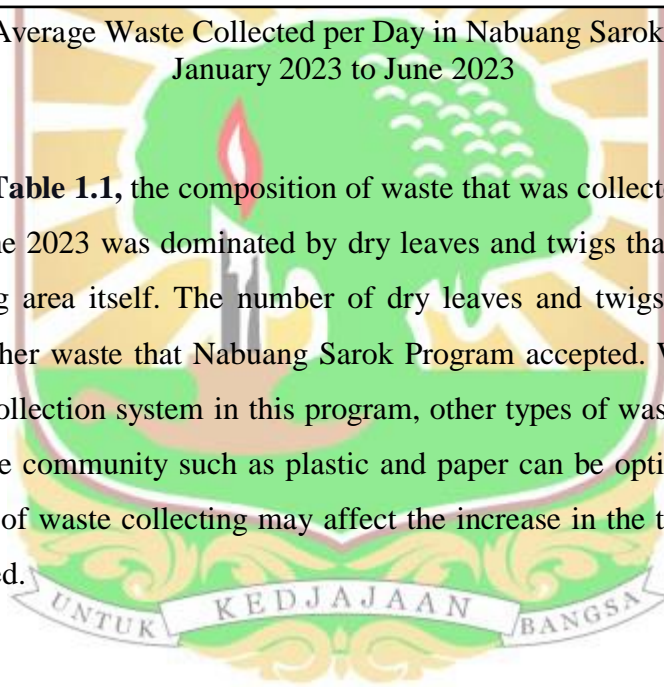


Table 1. 1 Waste Composition from January 2023 to June 2023

	Type of Waste	Amount (kg)		Type of Waste	Amount (kg)
Jan-23	Plastic	505	Apr-23	Plastic	1694
	Paper	1691		Paper	733
	Dry Leaves and Twigs	10738		Dry Leaves and Twigs	4585
	Used Cooking Oil	43		Used Cooking Oil	23
	Textile	105		Textile	696
Feb-23	Plastic	2372	May-23	Plastic	491
	Paper	601		Paper	765
	Dry Leaves and Twigs	3439		Dry Leaves and Twigs	4773
	Used Cooking Oil	71		Used Cooking Oil	49
	Textile	57		Textile	102
Mar-23	Plastic	638	Jun-23	Plastic	2825
	Paper	511		Paper	918
	Dry Leaves and Twigs	5230		Dry Leaves and Twigs	3305
	Used Cooking Oil	33		Used Cooking Oil	41
	Textile	320		Textile	970

Instead of direct collect to GSG, PT Semen Padang propose the waste will be collected at several points before being transported to shredder point. The pilot project will be implemented in Lubuk Kilangan District, with elementary schools and village offices as collecting points. Lubuk Kilangan District consists of 7 urban villages with 18 units of elementary school. So, the total pick-up points are 25. Distribution of collecting points can be seen in **Figure 1.3** below.

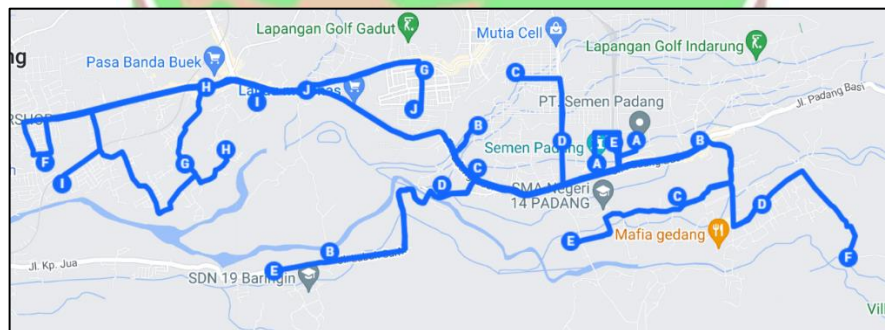


Figure 1. 3 Collecting Points Map

(Source: Google Maps)

PT Semen Padang will take in charge to coordinate the transportation from each collecting points. Hence it is necessary to design transportation routes considering vehicle capacity, number of vehicles, number of waste that are various, distance between collecting points, and time windows. With this way of collecting system, PT Semen Padang will incur costs because the company

provides transportation to facilitate waste pickup at each collection point. Moreover, inefficient transportation routes will result in long distances and times that can impact transportation cost. Therefore, it is anticipated that the new transportation route will provide the optimal route with the lowest transportation cost.

1.2 Problem Formulation

This research's problem formulation is the route of waste transportation for Nabuang Sarok Program in Lubuk Kilangan Sub-district that can minimize the transportation cost.

1.3 Research Objective

The propose of this research is to determine the route of waste transportation for Nabuang Sarok Program in Lubuk Kilangan Sub-district that can minimize transportation cost.

1.4 Research Scopes and Assumptions

In order to direct author so that the research keeps in line with topic and purpose of the research, author provides problem scopes which are stated below.

1. The scope of the waste picking area are elementary schools and village head offices in Lubuk Kilangan Sub-district.
2. The picking time is in accordance with the work hour of Nabuang Sarok Program and collecting points
3. Transportation cost that is calculated only fuel costs.
4. The waste are classified into single item.

1.5 Outline of Report

The outline of the proposal report are:

CHAPTER I INTRODUCTION

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

CHAPTER II LITERATURE REVIEW

This chapter consists of literatures that are used to support the research, namely supply chain management, logistics, reverse logistics, distribution and transportation, transportation route, vehicle routing problem, Lingo, previous research.

CHAPTER III RESEARCH METHODOLOGY

This chapter explains the stages of research in systematic way which consists of system description, data collection, data processing, conclusion and recommendation.

CHAPTER IV DATA COLLECTING AND DATA PROCESSING

This chapter consists of data collecting and data processing.

CHAPTER V ANALYSIS

This chapter discusses the analysis of data processing.

CHAPTER VI CONCLUSION AND RECOMMENDATION

This chapter consists of conclusion of the research and recommendations for the next research.