



## SUPPLY CHAIN MANAGEMENT AND QUALITY MANAGEMENT TOWARDS COFFEE WASTE BRIQUETTE INNOVATION AS AN ALTERNATIVE FUEL SOLUTION IN INDONESIA

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### Abstrak

*Coffee grounds waste briquettes are charcoal blocks, lumps, or sticks that can be burned, manufactured from coffee grounds waste that has been printed in such a shape and size with a certain pressure strength and mixed with a fuel adhesive such as tapioca flour. Coffee grounds waste as biomass waste has the potential to be used as a raw material in the production of bio briquettes due to its calorific value of 5,764 kcal/kg, which is higher than that of medium-rank coal (5,141 kcal/kg). PT. Energia Kopi Kreasindo is a biofuel briquette manufacturer that processes biomass.*

*The surplus of coffee grounds produced by the instant coffee processing industry and their underutilization in 2022 inspired the conception of this product. This study will examine how the coffee dregs briquettes market can attain its full potential by preserving its supply chain and quality management.*

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## INTRODUCTION

The industrial sector is one of the most important sectors for economic growth and job creation in Indonesia; consequently, continued development and high performance and competitiveness are required. Currently, the market has begun to value industries that implement resource- and waste-saving best practices within their operations. As required by Industry Law No. 3 of 2014, the development of a green industry is also intended to create a green industry. Green Industry is an industry that prioritizes efficiency and efficacy in the use of resources in a sustainable manner in its production process in order to align industrial development with the preservation of environmental functions and to provide societal benefits.

Regulation number 54 of 2020 issued by the Minister of Industry of the Republic of Indonesia regarding green industry standards for the instant coffee processing industry compelled the entire instant coffee industry in Indonesia to become a green industry. In accordance with the

provisions of law number 3 of 2014, the government mandates in this regulation that the instant coffee processing industry, which uses substantial amounts of water and energy, must implement strict technical and managerial requirements to create a green industry. The government defines the green industry as one in which the production process prioritizes the efficiency and efficacy of the sustainable use of resources. The green industry not only encourages industrial companies to make continuous improvements on all fronts to increase production efficiency and efficacy but also demonstrates that even a low-cost or no-cost approach can have a significant impact on industrial companies. Not only financial benefits through savings and increased productivity, but also a new image for businesses as a green industry, enhanced competitiveness, and contribution to sustainable development. PT. Energia Kopi Kreasindo is a biomass processing enterprise that manufactures alternative fuel briquettes. This idea arose in 2022 due to the surplus of coffee grounds produced by the instant coffee processing industry that was not being utilized to their maximum potential. Coffee waste has a significant impact on the environment; therefore, it must be treated so as not to imperil human health (Sumadewi et al., 2020).

PT. Energia Kopi Kreasindo has formed a partnership with a company that processes instant coffee to process the recycling of coffee refuse to result from production activities into a new product, namely coffee grounds briquettes. This corporation was formally founded in 2022, with its first factory located in the Balaraja neighbourhood of Tangerang, Banten. There are numerous suppliers from which PT. Energia Kopi Kresindo can obtain the primary raw material for the production of briquettes, namely coffee grounds refuse. According to the information provided in the introduction, Indonesia's coffee production has increased over the past five years, making usable coffee grounds more accessible and abundant. In consideration of this condition, the weight rating becomes 0.06 with an index of 1 (one). In addition, the results of agreements with coffee companies in Indonesia to obtain the primary raw material from coffee refuse waste will determine the price of fuel for coffee companies. A ton of coffee refuses briquettes cost approximately IDR 1,824,000. Due to the fact that coffee grounds waste is a waste material, the price of raw materials from suppliers is not a major concern for the coffee company.

## **RESEARCH METHOD**

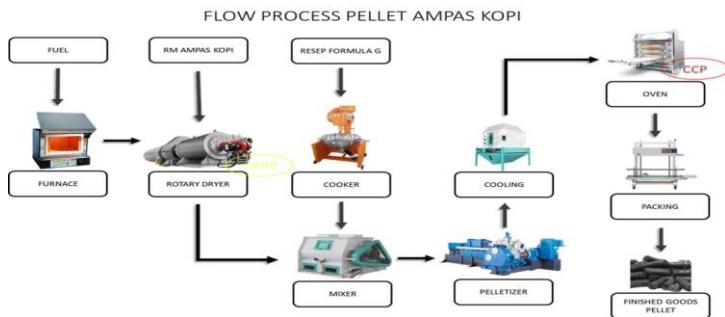
The stages of this research included data acquisition, procedures, and data processing analysis. At PT Energia Kopi Kreasindo, the phases of data processing procedures and analysis include supply chain identification and quality management, as well as added value analysis, measurement, and assessment of sustainable supply chain performance indices. PT Energia Kopi Kresindo's managerial level also influenced the qualitative research methodology employed in this study. This investigation was conducted to collect data in the form of information about each company unit and department involved in the production of coffee grounds briquettes.

## **RESULT AND DISCUSSION**

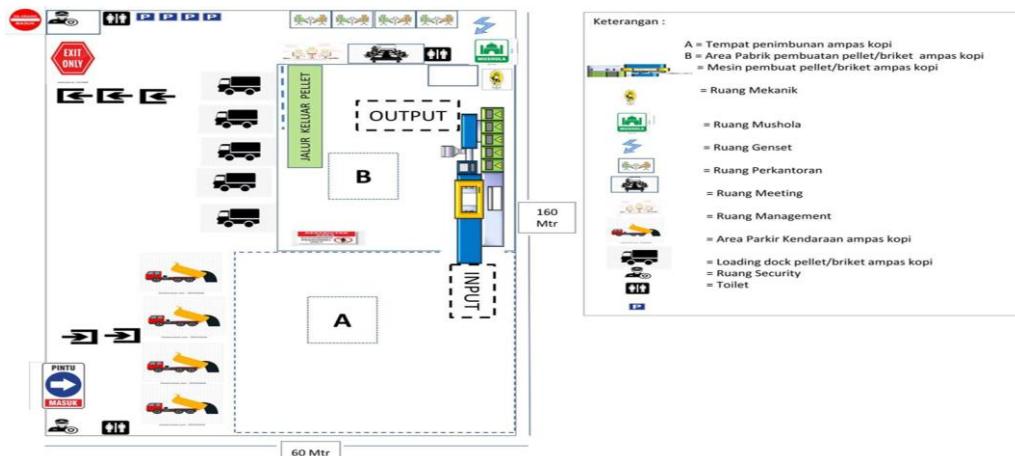
### **Supply Chain**

Before engaging in supply chain management, it is essential to understand that PT Energia Kopi Kreasindo's operational design is geared toward achieving production results in accordance with customer specifications and an efficient and optimal process flow.

1. Briquettes in the shape of small tubes with a diameter of 2cm and a length of 8cm and a maximum relative humidity of 10% are the specified product design. This design is non-binding in accordance with consumer preferences. The benefits of this design include :
  - a) No modifications to the instant coffee factory kiln are necessary
  - b) If the dimension is smaller, the briquettes will be destroyed during the process of cutting.
2. The production of coffee grounds briquettes from unprocessed coffee grounds processed with automatic machine tools under wet conditions can be described using the following production process flow:



Picture 1. Flow process Pellet Ampas Kopi



Picture 2. Layout of Process

The first process is finding all the raw material (RM) for moist coffee grounds with a relative humidity of less than 65%. Next, the coffee grounds are conveyed to the drying machine (rotary dryer) using heated air from a fireplace machine to obtain coffee grounds with a maximum moisture content of 10%. The second process is the result of drying the coffee grounds with a rotary dryer, which are then combined with the recipe formula G (tapioca flour + water) that has been cooked evenly (cooker) using a mixer machine to produce coffee grounds with a maximum moisture content of 20%.

The formula G-mixed coffee grounds will then enter the briquette-making machine (palletizer), where they will be set on a shelf prior to entering the oven for the heating process. After the oven procedure is complete, the finished briquettes will be cooled to produce briquettes with 10% relative humidity. The fourth step is packaging, in which the completed product in the form of coffee grounds briquettes is packaged to facilitate the subsequent steps of stockpiling and distribution until the product reaches consumers. Additional information in the production process is that for the production of coffee grounds with a maximum relative humidity of 60% weighing 30 tons, it is possible to produce coffee grounds briquettes with a maximum relative humidity of 10% weighing 12 tons, or approximately 40% of the input coffee grounds. This is a result of the decreased water content resulting from the production process.

### Layout of Goods and Services.

Attached is a factory layout that will be used by PT Energia Kopi Kreasindo to be able to support the operational activities of collecting coffee waste and making coffee grounds briquettes.

## Technology

Technological support in the production of coffee grounds briquettes determines PT Energia Kopi Kreasindo's ability to satisfy the briquette needs of its customers. The following production machines aid in the production of coffee grounds briquettes:



Picture 3. Production

Explanations :

1. Furnace Machines
2. Rotary Dryer Machine
3. Cooker Machine
4. Mixer Machine
5. Palletizer Machine
6. Engine Cooling (Blower Fan)
7. Oven Machine
8. Packing Machine

## SIPOC PT Energia Kopi Kreasindo

The following is an overview of PT Energia Kopi Kreasindo's Suppliers, Inputs, Processes, Outputs and Customers

Picture 4. SIPOC of PT Energia Kopi Kreasindo

S Supplier	I Input	P Process	O Output	C Customer
Industri Pabrik Kopi Instant	Ampas kopi Tepung tapioka+air	Drying Mixing Palletizing Cooling Heating Packaging	Briket Biomass Ampas Kopi	Industri Pabrik Kopi Instant

### 1. Suppliers

PT Energia Kopi Kreasindo supplier is the Instant Coffee Factory industry

### 2. Inputs.

The primary raw material is coffee grounds derived from industrial residue of the instant coffee factory, which are combined with a non-chemical adhesive made from a mixture of tapioca flour and water.

3. Process

Is a process carried out by PT Energia Kopi Kreasindo to create new products from coffee grounds waste into biomass briquette fuel products via the processes of Drying, Mixing, Palletizing, Cooling, Heating, and Packaging

4. Output

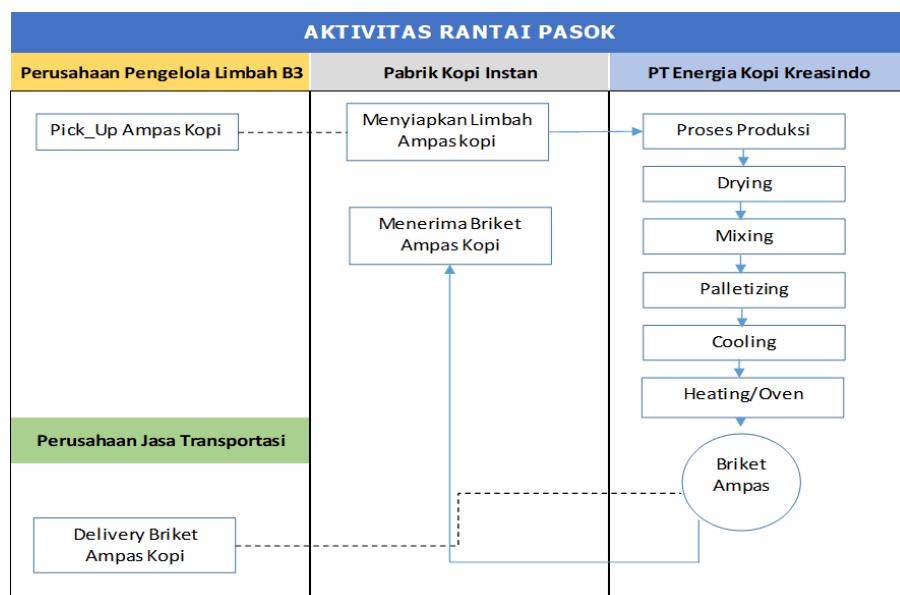
Output Product of coffee grounds briquettes with a calorific value of 5,764 cal/g that are ready to be used as an alternative fuel that is environmentally friendly and renewable.

5. Customers

Customers of PT Energia Kopi Kreasindo are instant coffee manufacturing industries that have donated their coffee grounds to be processed into coffee grounds briquettes in a pattern of B2B cooperation that is mutually advantageous for both parties.

In terms of supply chain management, PT Energia Coffee Kreasindo will appoint a third-party logistics (3rd PL) company that already has a partnership with a Waste Management Company. These two companies work together to provide modes of transportation and pick-up and delivery services for the supply chain. This is done so that costs associated with supply chain activities can become variable and directly proportional to production activities. In addition, as per the Minister of Environment and Forestry Regulation No. P.4/MENLHK/SETJEN/KUM.1/1/2020. The activities of the supply chain are depicted in the diagram below.

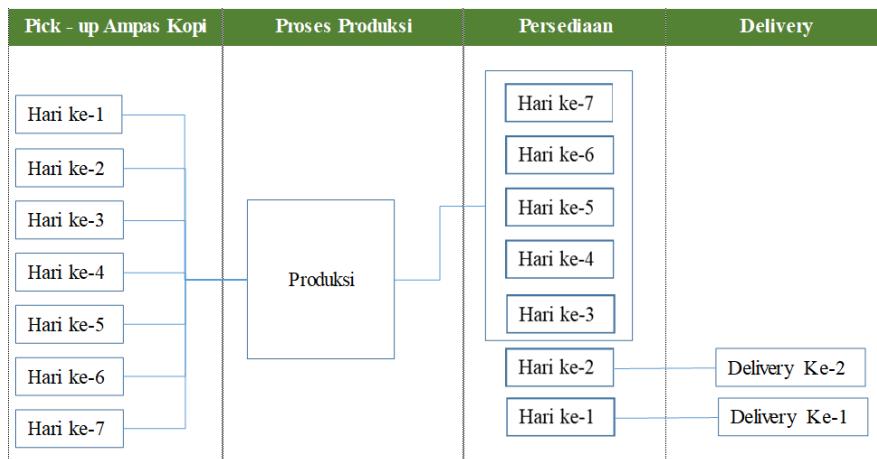
Picture 5. Supply Chain



The presence of substances such as alkaloids, tannins, and polyphenolics in coffee residue makes it more difficult for the environment to degrade organic matter biologically (Sumadewi et al., 2020). According to Juwita et al. (2017), the impact of coffee refuse organic pollution on the environment is greatest in waters where coffee effluent is discharged. This is because this waste's organic material is difficult to dissolve in water, resulting in anaerobic conditions. Therefore, coffee residue must be treated, as it has a significant negative impact on human health and the environment (Sumadewi et al., 2010).

PT Energia Kopi Kreasindo implements a FIFO (First In, First Out) inventory control system in order to be sustainable and meet consumer requirements, particularly for B2B consumers. The resultant product will be shipped directly to the consumer. Because the supply of raw materials is dependent on the consumers themselves, and to construct a sustainable production mechanism, the following flow diagram illustrates inventory planning and control:

Picture 6. Inventory Planning



## B. Quality Management

To preserve quality, Coffee Energia Kreasindo executes the following procedures:

1. Instant coffee factory :
  - a. Conduct active communication with the coffee facility for the process of picking up coffee grounds and delivering briquettes for 7x24 hours.
  - b. Establish positive relationships with parties within the coffee factory, beginning with security officers, warehousing, and travel document preparation.
  - c. Coffee grounds are collected and coffee grounds briquettes are delivered on business days. Monday through Sunday, operating hours are 08:30 to 17:00
  - d. Comply with local regulations at the instant coffee factory's location.
2. Transport Service Provider
  - a. The company is required to have a valid operating license, and the vehicle must comply with the requirements of Minister of Environment and Forestry Regulation No. P.4/MENLHK/SETJEN/KUM.1/1/2020 Concerning Transportation of Hazardous and Toxic Wastes.
  - b. Provide a schedule of coffee grounds removal procedures.
  - c. Prepare a fleet of eight-ton-capacity closed containers.
  - d. The fleet used cannot be older than five years from an economic standpoint.
  - e. The used fleet has been inspected and deemed roadworthy.
  - f. Drivers and clerks must pass a medical exam certifying their excellent health.
  - g. Officer drivers are required to possess a valid SIM (Driving License) in accordance with statutory requirements.
  - h. Drivers and employees are familiar with SOP (standard operating procedures) and adhere to traffic regulations when picking up and delivering coffee grounds briquettes.
3. Production Units
  - a. Perform consistent and scheduled machine maintenance Carry out production duties in a fluctuating work pattern
  - b. Ensure that employees have received training and understand and adhere to the company's standard operating procedures.
  - c. Maintaining the quality of coffee grounds briquettes requires a predetermined dimension and product design specification, namely a small tube-shaped briquette with a diameter of 2cm and a length of 8cm, and a maximum moisture content of 10%.
  - d. Implement work procedures in accordance with ISO 9001-2000 requirements for Quality Management Systems
4. Maintenance Unit
  - a. Perform periodic factory machine maintenance as required by the manufacturer of the production machine
  - b. Have a supply of frequently damaged spare parts

c. Comply with company SOPs when performing duties.

5. Quality Units

- a. Prior to sending production results to consumers, the quality assurance team will monitor production results.
- b. Evaluate the efficacy of each department to ensure everything is operating in accordance with the established standard operating procedures.

## **CONCLUSION AND SUGGESTIONS**

In terms of supply chain management, PT Energia Coffee Kreasindo will appoint a third-party logistics (3rd PL) company that already has a partnership with a Waste Management Company. These two companies work together to provide modes of transportation and pick-up and delivery services for the supply chain. PT Energia Kopi Kreasindo implements a FIFO (First In, First Out) inventory control system in order to be sustainable and meet consumer requirements, particularly for B2B consumers.

The resultant product will be shipped directly to the consumer. According to the quality management perspective, Coffee Energia Kreasindo must establish quality standards for its product that are suitable for distribution by all parties. In this instance, several supply chains, including instant coffee factories, transportation service providers, production units, quality units, and maintenance units, will be involved in maintaining quality.

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