Supply chain support factors for brown sugar business optimality using analytical hierarchy process

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Abstract. The sustainability of business activity is determined by the existence of all elements involved in business activity. Alignment of each component included in business activities can be determined by identifying supporting factors based on movements in each business chain that occurs. This study aims to determine the supporting factors for the optimality of supply chain performance of brown sugar business activities using the supply chain management approach and supported by the analytical hierarchy process method in determining criteria that support brown sugar business activities. Based on the results of research on the supply chain of brown sugar business activities, to promote the sustainability and optimality of supply chain performance the brown sugar business on the elements involved in the brown sugar business consists of several factors including product quality, the cost of purchasing brown sugar raw materials, and accuracy and the suitability of the number of shipments that are in accordance with the request.

1. Introduction
Optimality of business activities is primarily determined by the role of all the elements involved in it [1] to minimize the risk of cooperation inconsistencies that occur in all aspects involved in a supply chain system [2]. Unconformity in a supply chain system can be reduced through structuring configuration, coordination, and relations between the elements involved [3]. Structuring the supply chain system can be done well if the factors that support the value chain system can be determined precisely and fulfill the desires of all the elements involved in the supply chain system. Structuring the supply chain system can be done through mutually beneficial cooperation guaranteeing sustainability and improving the optimality of overall activities [4]. Furthermore, the business carried out through the creation of a supply chain in general to determine the factors that can support the cooperation and business continuity [5] such as the amount of supply, distribution location, and cost efficiency [6] as well as to integrate business activities between suppliers, manufacturing, sellers, and consumers [7,8]. Business optimization involving cooperation ranging from the supply of raw materials, processing raw materials, manufacturing, to consumers is an activity integrated with the supply chain management system [9].

Supply chain analysis, especially in agriculture, is explained in various perspectives including supply chain management in coffee commodities [10], supply chain distribution models for vegetables and fruits [11], and levels in the supply chain system [12]. Brown sugar business is a business that involves various parties, including farmers as raw material producers who have a role in providing guarantees regarding the availability of raw materials distributed to collectors or sell directly to the processing of
raw materials for brown sugar (manufacturing). Furthermore, the processed brown sugar is distributed to consumers by retailers or agents who have worked with the packaged brown sugar producers. The problem that often occurs in brown sugar business activities is the lack of coordination and communication regarding the quality and standard of brown sugar raw materials that can be accepted by sugar processors to become packaged sugars. This makes the cooperation between parties involved in the brown sugar business less optimal so that agreement and commitment are needed regarding the standards and quality of raw materials for brown sugar to support the sustainability of cooperation. In general, supporting factors in the value chain system specifically regarding food product standards [13] which consist of product quality [14], price or cost [15], cost, delivery time, and timeliness of delivery as well as shipping or transportation [16].

In this study aims to determine the factors that support the optimal supply chain generality and are used to form the red sugar supply chain so that it can support the optimality of the brown sugar business and can provide certainty for all parties involved in brown sugar business activities so that business sustainability can be guaranteed well.

2. Methodology
This study uses a quantitative approach accompanied by descriptive explanations based on the main concepts of supply chain management by involving two main actors, namely raw material distributors and producers. The method used to determine the decision to use the analytical hierarchical process method involves factors that are supporting elements in maintaining the sustainability of the brown sugar business system and improving the optimal performance of the brown sugar business. The factors used to support the supply chain of the brown sugar business consist of quality of raw materials, raw material prices, and timeliness of delivery. Furthermore, the research begins by recognizing and analyzing the business processes that occur in the brown sugar business, especially the brown sugar business group that has partnerships with producers of packaged sugar products.

Furthermore, identifies the brown sugar supply chain and determines the supporting factors to provide guarantees for the sustainability of the brown sugar business and offers optimal value for all parties involved in the brown sugar business, especially farmers, collectors, and producers of packaging sugar. The stages of this research are explained in figure 1 below.

![Figure 1. Stages of research.](image1)

3. Result and discussion
The supply chain in the red sugar business consists of three main parts, namely Upstream, Internal, and Down Stream, which are illustrated in Figure 2 below.
Based on Figure 1 regarding the supply chain of brown sugar, there are various problems, among others, the optimal availability of supply of the primary raw materials of brown sugar determined by the company, so that the amount of raw material for brown sugar is needed for companies from farmers or collectors. To determine the amount of availability, it can be determined by involving three main factors, namely: quality, price, and delivery [17,18]. Supply chain management is expected to be able to form supply chain management concepts that include configuration, relationship, and coordination [19,20].

Based on the results of the study, it was found that to improve the optimality of supply chain management for the brown sugar business, several things were needed, namely: 1) Configuration; This configuration is done to regulate the flow of raw sugar from suppliers to factories (packaging sugar producers), so that information about quality, price, and delivery is obtained with certainty. This configuration is essential to design from downstream to manufacturing. The findings in the field where supplier control with the company has been controlled can be seen from the company's desire for sugar raw materials fulfilled by suppliers such as the quality and availability of raw materials and vice versa. The wishes of farmers are met by companies such as prices and consumer desires fulfilled by companies such as quality comparable to reasonable prices. 2) Relationship; This relationship is carried out to produce the company's needs for farmers so that a structured relationship is established, the relationship is carried out by the company to the farmer and vice versa to get good quality arena sugar. Relationships made by manufacturers to suppliers such as specifications of sugar content, moisture content, colour, granules, and price conditions. While the relationship formed by suppliers to manufacturers such as the desired quantity, price provisions. The findings in the field regarding the relationship between suppliers and companies are quite good, this can be seen from the cooperation that has been established for a long time in the sense of suppliers who now supply sugar to companies, and 3) Coordination; This coordination is an ease in the flow of raw materials from suppliers to manufactures which includes shipping distance, shipping schedules, sending capacity. This coordination is essential for running operational supply chains of palm sugar to support production in the company if the lack of coordination in the supply chain will result in the cessation of production flow.

Furthermore, based on the results of the study, it was found that in order to support the optimal supply chain for the brown sugar business, various important factors for sustainability and optimal business achievement for all elements involved in the business activities are: 1) Quality of Raw Materials (57.45%), 2) Price of Raw Materials (28.83%), and 3) Timeliness of Delivery (13.72%).

4. Conclusions
Based on the results of the study, to support business sustainability and improve the optimal performance of business in brown sugar business activities the factors that must be considered are: 1) building a system that is in accordance with the capacity and capacity of each element involved in the brown sugar supply chain and 2) paying attention several factors, especially the quality of raw materials produced by the supplier of raw materials and pay attention to the stability of the price of raw materials determined by the recipient of raw materials and the timeliness of delivery.

Acknowledgments
Thanks to Sekolah Tinggi Teknologi Garut which inspiring support the publication of this article.
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