



OPTIMIZATION OF APPLE COMMODITY DISTRIBUTORS IN THE SUPPLY CHAIN USING THE *ANALYTICAL HIERARCY PROCESS* (AHP) METHOD IN THE NONGKOJAJAR APPLE JUICE SME

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ABSTRACT

Sari Apel small and medium enterprises Nongkojajar is one of the companies that produces apples. In order for the advanced company and develop it well, proper planning is needed in determining the amount of apple supply by selecting the supplier and determining the number of apples supply for the company that will lead to the amount of production and sale of apple cider that uses apples to get optimal profit through the supply of main raw materials to fulfill consumer demand with the Analytical Hierarchy Process method. The theory used in this research is the selection of optimal suppliers which is analyzed using the Analytical Hierarchy method. The steps used to solve the problem by determining the supplier criteria and the optimal amount of apple supply. Data collection of this research is obtained from the direct observation using Analytical Hierarchy Process. The steps that need to be done in this research are supplier data and the number of supply data. In order to solve this problem, the researcher used Analytical Hierarchy Process method assisted by expert choice software.



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1. Introduction

Availability of raw materials is a vital aspect in the continuity of the production process, both on a large industrial scale and small and medium enterprises (SMEs). Suboptimal management of raw material supply can cause various problems, such as excess inventory which causes storage costs, risk of damage, and decreased quality. On the other hand, a shortage of raw material supply can hamper the production process, which ultimately has an impact on decreasing profits and customer satisfaction.

UKM Sari Buah Apel Nongkojajar is one of the apple juice drink producers that faces challenges in managing the supply of its main raw material, namely apples. Based on shipping data for the past month, there was a discrepancy between the amount of supply and the desired production capacity. This is influenced by fluctuations in apple farmers' harvests, limited agricultural land, and competition with other companies that use similar raw materials.

This problem shows the importance of selecting the right supplier and determining the optimal amount of supply. One method that can be used to help decision making in supplier selection is *the Analytical Hierarchy Process* (AHP). This method allows decision makers to determine priorities based on various criteria that have been set systematically and logically.

The purpose of this study is to identify the most suitable apple supplier using the *Analytical Hierarchy Process* (AHP) method and determine the priority order of criteria that influence supplier selection in Nongkojajar Apple Juice SMEs. This study is expected to provide benefits for academics by increasing scientific insight in the field of industrial engineering, especially related to supply chain management and decision making in selecting raw material suppliers, as well as for practitioners in providing practical recommendations on more efficient and effective raw material supply strategies, and as a reference for similar companies in managing apple supply. The limitations of this study are focused on the analysis of apple supply in Nongkojajar Apple Juice SMEs using raw material delivery data in January as the basis for evaluation.

2. Review Literature

Although there has been no specific research on optimizing apple juice commodity distributors, various previous studies have discussed optimization in other contexts, especially in supplier evaluation and selection using the *Analytical Hierarchy Process* (AHP) method. Limasantoso (2013) revealed that PT. Buana Tirta Utama faced obstacles in the smooth flow of raw materials due to inappropriate supplier evaluation, so it is recommended to use the AHP method in supplier selection.

Studies by Khoir (2017) and Taufik (2014) also showed similar problems at PT. Sumber Berkah Melimpah and PT. Merak Jaya Beton Malang, which indicated the need for supplier selection based on relevant criteria using AHP. Assyakuur (2016) added that in the automotive industry, supplier selection is crucial for material fulfillment. Meanwhile, Chauliah (2012) emphasized the importance of assessing suppliers of packaging raw materials through *quality*, *cost*, *quantity*, and *delivery indicators*, where the AHP method gives the highest weight to quality.

Analytical Hierarchy Process (AHP)

AHP is a multicriteria decision-making method used to break down complex problems into simpler hierarchical structures. This process involves subjective judgment and pairwise comparisons to determine priorities between elements in the hierarchy (Saaty, 1995). AHP allows for logical and systematic analysis based on the decision maker's perception.

The advantages of AHP include its ability to handle hierarchical structures, take into account preference inconsistencies, and its robustness in sensitivity analysis. The main principles in AHP include hierarchical arrangement, priority setting, and logical consistency. Comparison matrices and priority scales are used to calculate the relative weight of each element.

The main problem in this study is the uncertain supply of raw materials from suppliers. The variables studied include criteria in selecting apple juice suppliers. The proposed solution is to use the AHP method to determine the best supplier to optimize the supply of raw materials.

3. Methodology

The research stages are the initial steps in preparing the thesis. This research was carried out at the Nongkojajar apple cider SME, by taking the distributor object for the supply of the main raw material, namely the apple fruit commodity. Research is the beginning of the process by means of observation and signing. This step is aimed at looking at the issues that can previously be used as a form of mobile research. After having found something up to date, the next step is to find out how to do it. The interview was conducted with SME owners and suppliers of Nongkojajar apple cider to find out the constraints that exist in the company's raw materials.

Based on observation and knowledge of ways that have been carried out, the adequacy of the plan is based on the form of the question. The questions were aimed at company owners and suppliers to provide an understanding of how to overcome the obstacles that occur in the procurement of raw materials.

focus in this research can run systematically and directed Research methodology is the initial step in compiling a research. research methodology is compiled with the aim of explaining the sequence of steps taken in conducting a research. research methodology is created so that the resolution of the problems that become.

Data collection is carried out by direct observation at the research location, while the data collection is:

1. Observation

A way to obtain data information by observing activities with direct research on the object being studied, namely all company activities or containing information about the research background in UKM fruit juice. apple hang out .

2. Document

Documents are records of past events. Documents are usually in the form of writings, pictures or monumental works from the party being studied. The results of research from observations or interviews will be more credible or trustworthy if supported by concrete histories in the form of writings or pictures of something being studied.

3. Interview

It is a data collection technique by conducting direct interviews with authorized parties, so that direct data or information can be obtained regarding the data to be collected.

4. Results and Discussion

This study uses the Analytical Hierarchy Process (AHP) method to assess and determine the best supplier for Nongkojajar Apple Juice SMEs. This method was chosen because it is able to describe complex problems into a hierarchical structure and assess the relative importance of each criterion and alternative systematically.

Hierarchy and Criteria Arrangement

Supplier selection is done by compiling a hierarchy consisting of three levels:

- Level 0: Objective – Selecting the best supplier - Level 1: Criteria – Price, Quality, Service, Delivery Timeliness, and Quantity Timeliness - Level 2: Alternative – Suppliers 1, 2, 3, and 4

Through a questionnaire given to the SME management, the weight of each criterion is obtained using the paired comparison method.

Table 4.1 Priority Criteria
 Source : Data Processing

The main priority falls on price and quality, indicating that efficiency and quality are the main emphasis in supplier decision making in this SME.

Criteria	Weight	Ranking
Price	290	I
Quality	288	II
Service	207	III
Delivery Accuracy	108	IV
Accuracy of Quantity	108	IV

Alternative Supplier Evaluation

Each supplier is assessed on all five criteria, and the results are summarized in local weights. Here are some key findings:

- a. Price: Supplier 3 is superior (503)
- b. Quality: Supplier 1 is the highest (374)
- c. Service: Supplier 2 is the highest (415)
- d. Delivery Timeliness: Supplier 1 is dominant (455)
- e. Quantity Timeliness: Supplier 1 is again superior (477)

Table 4.2 Global Synthesis Results

Supplier	Global Weight	Priority
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Supplier 1	365	I
Supplier 2	254	II
Supplier 3	238	III
Supplier 4	143	IV

Source : Data Processing

In conclusion, Supplier 1 is the best alternative because it obtains the highest overall weight value.

Consistency Validation

The consistency ratio (CR) obtained from the assessment was 0.03, indicating that the respondents' assessment input was within an acceptable level of consistency (<0.1).

Research GAP

This research is here to fill the research gap in previous literature. Here is the identification of the research GAP:

Aspect	Previous Research	This research
Research Object	Large companies and the public sector	UKM apple juice agro-industry sector
Focus on the Problem	General supplier evaluation	Selection of the best supplier based on AHP
Assessment criteria	Limited by quality and price	Price, quality, service, delivery, quantity
Methodological Approach	Descriptive or quantitative usual	AHP based on Expert Choice software
Local Context	Not many local SMEs have been promoted	Focus on Apple Juice SMEs in Nongkojajar
Follow-up Results	Not explicitly specifying the best supplier	Providing optimal supplier recommendations

This research GAP shows that this study provides a new contribution by expanding the context of AHP application into strategic decision making at the SME level, which has previously received less attention in previous studies.

5. Conclusion

Based on the results of the analysis using the AHP method assisted by *Expert Choice software*, this study concludes that Supplier 1 is the best choice to be a partner in procuring apple raw materials for the Nongkojajar Apple Juice SME with the highest global weight of 365, followed by Supplier 2, Supplier 3, and Supplier 4. Supplier 1 excels in several important criteria such as quality, delivery accuracy, and quantity accuracy, while Supplier 3 stands out in the price criteria, and Supplier 2 excels in the service aspect. Therefore, it is recommended that companies carefully consider the weight of each criterion in selecting suppliers so that the decisions taken are truly in line with the company's operational needs and business strategies. In addition, companies can adjust the criteria or sub-criteria in the future according to the development of internal policies and market dynamics. This AHP

method can also be applied to other multi-criteria decisions in the company. In order for raw material procurement to be more optimal, companies are advised to pay attention to the distance and shipping costs from each supplier for the sake of efficient logistics costs and smooth supply chain.

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