# Analysis of Supply Chain Integration, Innovation Capability, and Competitiveness of Coffee Processing Industry

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**Abstract.** Coffee is one of the leading products in the plantation sector in South Sulawesi Province, apart from cocoa and passion fruit. A number of previous studies have found that the sustainability of the coffee processing industry is largely determined by the supply chain system, innovation capabilities and business competitiveness. This study aims to identify and analyse a number of indicators that form the variables of supply chain integration, innovation capability and business competitiveness. Apart from that, to explain and analyse the indicators that provide the greatest contribution in forming these three variables. This study took data through a survey of 106 respondents who were owners/managers of the coffee processing industry. Data were analysed using both descriptive statistical analysis and conformational factor analysis. The results of this study show that an effective supply chain system will be achieved through integration with suppliers. Product innovation is an important element in forming a company's innovation capability. Then this study also confirms the importance of product quality as an important element in shaping the competitiveness of the coffee processing industry in South Sulawesi.

## 1 Introduction

South Sulawesi is the province with the seventh largest production of coffee commodities in Indonesia with a plantation area of 73,375 ha and an average production output of 35 thousand tons every year. Arabica and Robusta coffee from South Sulawesi are well known internationally besides Gayo coffee in Aceh. North Toraja Regency and Tanah Toraja are highland areas with mountains and hills located 700-2400 meters above sea level. From the characteristics of the region, it is very suitable for the development of coffee plants. Apart from that, these two areas are the center of the coffee processing industry in South Sulawesi.

In general, primary and secondary coffee processing activities will produce added value, where the greatest added value is generated through processing activities. Processed coffee products include coffee beans, roasted coffee beans, ground coffee, instant coffee, coffee-based drinks, and other coffee-based products. The development of the coffee processing industry needs to receive important attention from all parties, especially local governments.

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Important aspects that need to be improved lie in the supply chain system, innovation capabilities and competitiveness [1]. This needs to be done so that the performance and sustainability of the coffee processing industry is maintained and its contribution to the welfare of farmers, society and national income is higher [2].

Conceptually, supply chain integration is a system that integrates data and information between suppliers, producers, distributors and customers. There are two types of supply chain integration, namely: internal integration and external integration. Several previous studies found that an integrated supply chain can increase competitiveness and business performance. The more integrated the supply chain, the better the business performance [3].

Effective supply chain management not only reduces costs but also has an impact on increasing customer satisfaction, and is directly related to company performance, especially in the aspects of profitability, productivity, liquidity and market share [4, 5]. Another important element in the strategic management literature that can influence competitiveness is innovation. Innovation capability is a comprehensive collection of characteristics of a company or organization that can be used to improve organizational performance [6]. Therefore, increasing innovation capabilities is one way to increase a company's competitiveness and performance. Innovation capability has a strong association with a company's success in improving marketing performance and competitiveness [7, 8].

The aim of this research is to identify what indicators form the variables of supply chain integration, innovation capability and business competitiveness. Apart from that, to analyse the indicators that provide the greatest contribution in forming these three variables in the coffee processing industry in South Sulawesi. This research provides data and information to owners/managers to improve supply chain systems, innovation capabilities and business competitiveness through relevant strategies, programs and activities in accordance with the available organizational resource capacity.

## 2 Methods

The research uses a quantitative design. The survey was conducted in two coffee processing industry centers in South Sulawesi Province, namely Tana Toraja Regency and North Toraja Regency. Research activities begin with a literature study to examine theories, concepts, and examine research results that are relevant to the research issue. Next, collect secondary data that has been published by related institutions such as the BPD and the Department of Industry in each district. The number of respondents was 106 owners and managers of the coffee processing industry. The supply chain integration variable is measured through 4 indicators, namely: integration with suppliers, integration with customers, functional integration, and information sharing. Then, innovation capability is also measured through 4 indicators, namely: product innovation, technological innovation, service innovation and market innovation. Meanwhile, business competitiveness variables are measured through 3 indicators, namely: cost, quality and speed of product delivery. The level of respondents' answers to indicators can be categorized into 5 levels, namely: very good/high (4.21-5.00), good/high (3.41-4.20), moderate/fair (2.61-3, 40), poor/low (1.81-2.60), not good/very low (1.00-1.80). The data analysis technique uses two types of analytical tools, namely: (1) descriptive statistical analysis, and (2) confirmatory factor analysis. Descriptive statistical analysis is used to explain the respondent profile and research variables based on percentage values (%), and averages (mean). Then confirmatory factor analysis is used to analyse the most dominant indicators in forming or reflecting a variable [9].

## 3 Result and Discussion

This research is based on a survey of 106 respondents from coffee processing industry entrepreneurs in South Sulawesi. The results of the analysis showed that the number of men was 76 people (71.6%), and there were 30 women (28.4%). The dominant educational level of respondents was high school, 55 people (52.4%), while the rest were diploma and bachelor's degrees, namely 50 people (47.6%) of the total number of respondents. Then, the results of the descriptive analysis also present the average respondents' answers to the research variables as in the following table.

**Table 1.** Results of descriptive statistics.

| Variable/ Item | N | Mean | Standard Deviation |
|---|---|---|---|
| 1. Supply chain integration: | 106 | 4.055 | 0.661 |
| a. Integration with suppliers | 106 | 4.210 | 0.662 |
| b. Integration with customers | 106 | 3.912 | 0.582 |
| c. Functional integration | 106 | 3.980 | 0.710 |
| d. Information sharing | 106 | 4.118 | 0.690 |
| 2. Innovation capability: | 106 | 3.966 | 0.667 |
| a. Product innovation, | 106 | 4.158 | 0.588 |
| b. Technological innovation | 106 | 3.760 | 0.626 |
| c. Service innovation | 106 | 4.022 | 0.744 |
| d. Market innovation | 106 | 3.924 | 0.711 |
| 3. Competitiveness: | 106 | 4.080 | 0.652 |
| a. Cost | 106 | 3.860 | 0.736 |
| b. Quality | 106 | 4.280 | 0.664 |
| c. Speed of product delivery | 106 | 4.102 | 0.556 |

The table above shows that respondents' perceptions of the supply chain integration variable are in the good/important category with an average value of 4.055. Of the four items or indicators of this variable, namely integration with suppliers, integration with customers, functional integration, and information sharing, integration with suppliers is the indicator that is considered the most important with an average value of 4.210.

The results of the analysis also show that the innovation capability variable is in the good/important category with an average value of 3.966. Of the four items or variable indicators, namely product innovation, technological innovation, service innovation and market innovation, product innovation is the indicator that is considered the most important with an average value of 4.158. Then the competitiveness variable is also in the good/important category with an average value of 4.080. Of these three variable items or indicators, namely cost, quality and speed of product delivery, quality is the indicator that is considered the most important with an average value of 4.280. The results of this research show that integration with suppliers, product innovation, and product quality are three important elements that coffee processing industry managers must pay attention to so that their business performance improves. The findings of this research are consistent or in line with [7], [10] who emphasize the importance of product quality, innovation and partnerships in winning competition in the market.

Furthermore, confirmatory factor analysis (CFA) is used to find out and analyse the dominant factors in forming a factor or variable. In summary, the results of confirmatory factor analysis are presented in the following table.

**Table 2**. Results of confirmatory factor analysis.

| Variable/ Item | Loading Factor | Critical Ratio | Probability (Prob.) |
|---|---|---|---|
| 1. Supply chain integration: | | | |
| a. Integration with suppliers | 0.842 | Fix | Fix |
| b. Integration with customers | 0.670 | 4.560 | 0.001 |
| c. Functional integration | 0.744 | 5.844 | 0.000 |
| d. Information sharing | 0.792 | 5.900 | 0.000 |
| 2. Innovation capability: | | | |
| a. Product innovation, | 0.668 | Fix | Fix |
| b. Technological innovation | 0.490 | 4.730 | 0.005 |
| c. Service innovation | 0.642 | 5.228 | 0.000 |
| d. Market innovation | 0.512 | 4.850 | 0.008 |
| 3. Competitiveness: | | | |
| a. Cost | 0.650 | Fix | Fix |
| b. Quality | 0.798 | 6.115 | 0.000 |
| c. Speed of product delivery | 0.740 | 5.980 | 0.000 |

Based on the table above, it can be concluded that the supply chain integration variable is valid and significant, formed by the four indicators, namely integration with suppliers, integration with customers, functional integration and information sharing. This can be seen from the critical ratio value > 1.980 and prob. < 0.05. Where the most dominant indicator in forming and influencing this variable is integration with suppliers with a loading factor value of 0.842.

The results of the analysis also show that the innovation capability variable is valid and significant, formed by the four indicators, namely product innovation, technological innovation, service innovation and market innovation. This can be seen from the critical ratio value > 1.980 and prob. < 0.05. Where the most dominant indicator in forming and influencing this variable is product innovation with a loading factor value of 0.668. Then, the valid and significant competitiveness variable is formed by the three indicators, namely cost, quality and speed of product delivery. This can be seen from the critical ratio value > 1.980 and prob. < 0.05. Where the most dominant indicator in forming and influencing this variable is product quality with a loading factor value of 0.798.

In the context of an integrated supply chain system, integration with suppliers becomes important for every company. The benefits of integration with suppliers include efficiency in shipping costs and the company's speed in adapting and serving fluctuations in market demand. Market demand for processed coffee products can be provided and served quickly by companies/industry [3, 4, 11]. Innovation capability is a number of abilities that a company has to innovate in all aspects of the organization including products, technology, services and markets. The coffee processing industry as an agribusiness-based company is required to always innovate its products in order to survive in the market. Product innovation is an important element that every company needs to pay attention to in order to continue to exist in the market [8]. In the coffee processing industry, the company's ability to innovate products can be seen from the number of variations in coffee products produced, such as: ground coffee, instant coffee, roasted coffee, mixed coffee and extracted coffee.

Furthermore, elements of competitiveness include costs or prices, product quality, and speed of delivery of products and services to customers. The research results show that product quality is an important element that shapes and influences the competitiveness of the coffee processing industry. The findings of this research confirm and strengthen the research results of [1] that product quality is an important element of a company's competitiveness.

Product quality can be used as a weapon to win competition in the global market [12]. The results of this research provide direction to coffee processing industry managers to prioritize efforts in building partnerships with suppliers, innovating products and services,

and continuously improving the quality of the coffee products produced. The better the partnership with suppliers, the ability to innovate products, and efforts to improve product quality will improve more business performance both in the short term, and long term.

## 4 Conclusion

This research confirms and validates 4 indicators that form the supply chain integration variable, 4 indicators that form the innovation capability variable, and 3 indicators that form the competitiveness variable. In the context of the coffee processing industry, integration with suppliers is an important element that forms an effective supply chain system. Product innovation is also an important element that shapes a company's innovation capability. Apart from that, product quality is an important element that shapes business competitiveness. In order for this business to continue to exist and be sustainable in the global market, coffee processing industry managers are expected to prioritize programs and activities that encourage increased partnerships with suppliers, increased product and service innovation, and increased quality of the coffee products.

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