The effectiveness of rice flow in large-scale rice refineries in Bireuen Regency

S Kasimin*, N Desparita and Zakiah

Magister of Agribusiness Department, Agriculture Faculty, University of Syiah Kuala, Banda Aceh, Indonesia

*E-mail: suyantikasimin@unsyiah.ac.id

Abstract. Effective rice supply chains are needed to continuously increase activity in customer service including fulfilment of demand, punctuality in delivery, and rate of return of goods by consumers for certain reasons (return). The purpose of this study was to determine the effectiveness of rice supply chains in large-scale rice refineries in Bireuen Regency. The descriptive qualitative method was used to identify effectiveness of rice flow using the Food Supply Chain Networking (FSCN) framework. The results showed that the characteristics of the rice procurement process at large-scale rice refineries will be more efficient in producing and distributing rice if each party within the supply chain is a member of the procurement process, including farmers, collectors, wholesalers, and retailers. These parties should rely on a formal partnership contract so that the financial flow can be completed quickly to reduce late payments which are detrimental to the large-scale rice refineries in Bireuen Regency.

1. Introduction

What are the characteristics the logistical flow of rice distribution in large scale refineries in Bireuen Regency. The effectiveness of rice supply chains involves all activities that cover a number of processes from the preparation to the distribution process. The implementation of well-directed procurement can determine the success rate availability of rice flow performance not just the performance of a company alone [1].

In 2018, the rice harvest area in Bireuen Regency increased significantly to 40,955 Ha with a total production yield of 261,812 tons of rice. However, in 2019 the rice harvest area declined, to only 38,837 hectares with a total rice production of 252,927 tons of rice [2]. Meeting the needs of consumers is highly dependent on the rice supplier's rice milling yield, meanwhile, the current effectiveness of thercine supply chains is often sub-optimal, with delays in the information flow between farmers, traders, and rice refineries that delays the rice procurement process.

Large-scale rice refineries do not yet have the capacity of integrated and complex networks of oversight, and instead large-scale rice refineries often rely on activities are controlled simply by the owner of a rice refineries with the help of several machines. The production process in large-scale rice refineries must be managed well in order to produce good quality rice.

The research objective of this study is to determine the effectiveness of rice production and supply chains at large-scale rice refineries in Bireuen Regency. The researchers hope to understand the structure of
rice flow in Bireuen Regency, and give recommendations about the effectiveness of rice flow chains in large scale refineries in Bireuen Regency. The effectiveness of rice flow is very important because rice is a staple food for people in a region. Bireuen regency is the largest contributor to Gross Domestic Regional Product (33.1%) Aceh’s food crop sub-sector. Tight competition in today’s global market, shorter product life cycles, and increasing customer expectations around products and services forces companies to streamline their procurement processes to be competitive to ensure the continuity of its effort. Effective rice supply chains will increase the competitiveness of a network through the emphasis of production and distribution costs, on time with the perfect product quality. Minimal costs, on time, and good quality to increase the effectiveness of the rice distribution channels between the three rice refineries in Bireuen district

2. Materials and methods
This research was carried out at large-scale rice refineries in Bireuen Regency, Aceh, Indonesia. The parties involved include farmers, pickers, 3 rice refineries, large and small scale traders, and consumers. The scope of this study involved the effectiveness of rice flow in large-scale rice refineries in Bireuen Regency, Aceh. The study was conducted from December 2019 to February 2020.

The sampling technique used in this research was non probability sampling, namely snowball sampling [3]. The sample consisted of farmers, collectors and workers, or refineries owners in Bireuen Regency. Qualitative research often relies on snowball sampling for access purposes or as an auxiliary means to assist researchers in enriching sampling clusters [4].

Primary data were obtained from interviews using questionnaires with large-scale rice refineries, farmers, collectors, traders, and retailers. Member of the supply chain in 3 locations, there are Kutablang District, Gandapura District and Juli District was sampled with 8 samples, however, at the rice refineries only 2 people were sampled 1 rice factory owner and 1 worker. The secondary data were obtained from literature studies, journals, and previous research related to this research [5].

The qualitative method was applied in this research. The qualitative method was analyzed descriptively using the Food Supply Chain Networking (FSCN) framework. The rice refineries supply chains explained descriptively using the Food Supply Chain Networking (FSCN) framework from Lambert and Cooper modified by Van der Vorst [6]. The FSCN framework consists of procurement structure, procurement resources, procurement supervision, procurement effort, procurement processes, procurement objectives, and procurement performance. Every aspect of the rice supply chain was descriptively analyzed.

3. Results and discussion
Bireuen Regency consists of 17 districts. Each district has a number of diverse rice refineries with a total of 367 rice refineries in Bireuen Regency. Among those there are 134 permanent rice mills and 233 rolling rice mills. The rice refineries can also be divided based on daily rice production capacity, as the production capacity of fixed rice refineries in Bireuen Regency includes small-scale 0.5–5 ton rice refineries, medium-scale 5-10 ton rice refineries, and large-scale rice refineries reaching 10-27 tons per day. Conversely, traveling rice mills provide small-scale grain milling services to the surrounding communities who need grinding services. These are simple mills that do not function as rice suppliers or processors, therefore this type of rice refineries cannot be measured due to its function and size and is not included in this study.

The rice procurement flow at large-scale rice refineries in Bireuen Regency generally has the same procurement network as in large scale refineries there are rice refineries 1, rice refineries 2, and rice refineries 3. However, there are differences in several processes implemented by each rice refineries. The effectiveness of rice supply chains at rice refineries in Bireuen Regency are presented in the following table:
**Table 1.** The effectiveness of rice supply chains in rice refineries in Bireuen Regency.

| No | **Food Supply Chain Networking (FSCN) Framework** | **Descriptive Analysis** |
|----|---------------------------------------------------|--------------------------|
| 1. | **Procurement objectives**                        | Rice refineries 1 and 3 target local and regional markets such as Medan while rice refineries 2 targets Aceh Tengah, BenerMeriah, Gayo Lues, Aceh Tenggara, and Medan districts. |
|    | - **Target market**                               | Development includes the use of machine power such as in the drying process using a dryer (oven), using a skin crusher and a policy machine, a counselor (sensor). |
|    | - **Development goals**                            |                                                                       |
| 2. | **Procurement structure**                         | There are 8 sample farmers.                                           |
|    | - **Farm**                                         | Traders who collect samples of 8 people.                              |
|    | - **Gathering traders**                            | There are only 2 rice refineries, namely 1 owner and 1 worker.         |
|    | - **Rice Refineries**                              | Sample wholesalers are 8 people.                                      |
|    | - **Wholesalers**                                  | There are 8 sample retailers.                                         |
|    | - **Retailer**                                     | The sample consumers are 8 people.                                    |
|    | - **Consumers**                                    |                                                                       |
| 3. | **Procurement supervision**                        | Supply chain networks are based on trust between the rice refineries and other supply chains. |
|    | - **Selection of partners**                        | Cash and debt transaction system with maturity date.                  |
|    | - **Transaction system**                           | The cost of goods sold policy is implemented when the price of raw materials is too expensive, and the price of rice is too expensive. |
|    | - **Cost of goods sold policy**                     | The cooperation involves sharing information on prices, quantity and quality of raw materials and rice as finished products. |
|    | - **Cooperation between members of the supply chain** |                                                                       |
| 4. | **Procurement resources**                          | The physical resources of farmers consist of paddy fields, hoe machetes, sprays and motorbikes, while collectors, and wholesalers are transportation cars, and scales, while rice refineries consist of modern machines powered through electricity. |
|    | - **Physical resources**                           | The human resources used by farmers to paying laborers with a daily wage of up to Rp. 70,000-Rp. 80,000 per laborer per day, while collector traders are only able to pay Rp. 65,000 per day per labor, and the three rice refineries pay daily wages of up to Rp. 100,000 per worker. |
|    | - **Human Resources**                              | The technological resources applied by the three rice refineries are machines for processing un hulled rice into grains of rice. |
|    | - **Technology resources**                         |                                                                       |
| 5. | **Procurement process**                            | There are 2 perspectives of cycle view and push or pull view.         |
|    | - **Effort relationships built between members of the supply chain** | Distribution patterns include product flow, financial flow and information flow. |

*Source: Primary Data (processed), 2020*
3.1. **Procurement target.**
Market targets include the fulfillment of consumer orders both locally and regionally in Northern Sumatra. The product produced is rice measuring 10 kg and 15 kg. Rice refineries 2 are only target market for rice sales in the Aceh region are Benermeriah Regency, Central Aceh, Gayo Lues, and Southeast Aceh.

The development targets in the three rice refineries including the use of modern machinery, as 85% of the rice production process is completed using mechanical power such as the drying process using a drying machine (oven), the use of a skin breaking device to husk the rice, a policy engine, and a counselor (sensor). The use of modern machinery applied in the three rice refineries is expected to increase the quality and quantity of rice in large scale rice refineries in Bireuen Regency.

3.2. **Procurement structure.**
Members of the rice supply chain at rice refineries 1, 2, and 3 consist of farmers, collector traders, rice refineries, wholesalers, and retailers. Farmers sell the harvested unhusked rice directly without drying beforehand to the refineries [7]. Farmers do not want to spend time to dry the grain to be sold in the form of milled unhusked rice because the difference in price obtained is only around 500 Idr per kg. Farmers can sell grain directly to rice refineries and collecting agents (middlemen), depending on what agreement is reached by the farmers. The role of the traders in rice refineries is to meet the stock of raw materials for rice production because the stock offered by collectors generally reaches 10–30 tons pershipment.

Large traders who buy the rice owned by refineries 1 are supermarkets, wholesale stores with a price selection offered by large traders with rice refineries 1 around IDR 2,000–4,000 per barrel. While the large traders who receive rice from rice refineries 2 are agents and sellers who will re-sell the rice to small retailers with a different selling price of IDR 4,000–4,500 per barrel. While the big traders who buy rice from rice refineries 3 are generally from the wholesalers at the sub-district level both in Bireuen Regency and outside the Regency who will re-sell the rice to retail establishments.

Competition between rice retailers occurs when not all retailers sell rice from the three refineries simultaneously, each rice refineries has subscriptions both wholesalers and retailers. Price competition and low and high sales on the retail level depend on the strategic location of the store, the number of interested customers, and the services and quality of the retailer. Another similarity, traded goods are various kinds of household needs including daily needs [8].

3.3. **Procurement supervision.**
Rice refineries used label rice consists of planning, supervision and implementation. The factors that need to be examined include the selection of partners or supply chain members, the transaction system, government support, and cooperation between procurement parties. The selection of rice supply chain members, which is applied to the selection of large traders who buy rice in large capacities, must be supported and based on mutual trust. Considering not all big traders carry out a cash payment transaction system, there has to be mutual trust and understanding to ensure the distribution process run smoothly. There are 2 types of transactions implemented by the 3rice refineries, namely cash payments and temporary debt. Whereas the transaction system between the farmers and collectors supplying the grain is primarily a cash-based system.

3.4. **Rice Procurement Process.**
The rice procurement process describes the supply chain relationships, distribution patterns, institutions supporting the procurement process, and guarantees of the rice brand. There are 2 ways of looking at effort process relationships applied to the three rice refineries including cycle view and push or pull view [9]. The cycle view consists of 4 cycles are procurement, ordering raw materials from farmers, secondary manufacturing, processing raw materials of grain into rice, replenishment of remodeling
products from the beginning due to the addition of orders, and customer orders. These 4 cycles occur during rice procurement in rice refineries 1, 2, and 3.

This procurement process is carried out for the members of the first supply chain, namely farmers and traders of grain collectors, through the sale grain (unhusked rice) that is purchased before processing. During the manufacturing process of the rice refineries 1, rice refineries 2, and rice refineries 3 independently process grain into ready-to-sell rice without going through the division of labor with other refineries. Replenishment often occurs during the harvest season when orders received by the three rice refineries come from large traders both within and outside the region while the customer orders are carried out directly by consumers and retailers at large traders and rice refineries but the capacity is ordered at rice refineries with direct purchase with small capacity [10].

3.4.1. Product flow.
The product flow at the three rice refineries involved 5 procurement institutions that formed 5 rice distribution channels. Farmers primarily sell their yields to rice refineries with 75% allocated to the refineries and 25% to collectors. Rice refineries 1 sell 80% of their rice to large traders, 15% to retailers, and 5% directly to consumers. While the rice refineries 2 involves 5 suppliers in institutions that form 5 rice distribution channels. Rice refineries 2 sell 75% of their rice to wholesalers, 15% to retailers, and 10% to consumers. Whereas the flow of rice products in rice refineries 3 involved 5 procurement institutions that formed 5 rice distribution channels. Rice refineries 3 sell 85% of their rice to wholesalers, 10% to retailers, and 5% to consumers. The flow of products in the rice procurement network begins with production inputs in the form of grain at the farm level that is processed to form rice [11]. The 5 channels contained in 3 large scale rice refineries are as follows:

1. Farmers-Traders Collectors - Rice Mill - Wholesalers - Retailers - Consumers
2. Farmers - traders - Rice Mill - big traders - Consumers
3. Farmers - Rice Mill - Large traders - Retailers - Consumers
4. Farmers - rice mills - retailers - consumers
5. Farmers - rice mill - consumers

3.4.2. Financial flow.
Financial flow is related to the flow of money in exchange for goods or products obtained. Farmers directly receive payments from rice refineries on the day of purchase. Conversely, farmers must wait 1-2 days before receiving payment from the traders because the traders must sell the rice to the other parties, including rice refineries 1. Rice refineries 1 receive payments from large traders within a period of 1-10 days. Large traders receive periodic payments from retailers, while consumers pay the retailers in cash.

Refineries 1 typically buy grain for between Rp5,100–5,200 per kg. Next the rice refineries process the grain into rice which is sold at a premium price of Rp12,000 per kg and super rice for Rp10,500 per kg, then large traders sell the premium rice at a price of Rp13,000 per kg and super rice forRp11,000 per kg to retailers then retailers sell at premium rice for Rp13,000 per kg and super rice for Rp11,500.

Whereas in the financial flow of rice refineries 2, cash is paid directly to farmers and collectors while rice refineries 2 receives payments from big traders, retailers, and consumers in 2 ways, first directly and secondly through credit with a maximum term of 2 weeks. The price of grain purchased by rice refineries ranges from Rp4,800-5,200 per kg. The refineries then sell the premium rice for Rp12,000 per kg and super rice for Rp10,000 per kg.

The financial flow of rice refineries 3 includes payments to the collecting traders 2-3 days after purchase, at which point the farmer receives their payment because the collecting trader must resell to outside parties, for example rice refineries 3. Grain is bought by collectors ranging from Rp4,800–5,300 per kg and then the rice refineries process it into rice that is sold at a premium price of Rp12,000 per kg and super rice for Rp10,000 per kg. Then large traders sell the premium rice at a price of Rp13,000 per kg and super rice for Rp11,000 per kg to retailers who sell premium rice for Rp13,500 and super rice
for Rp11,500. The supply chain might become interrupted when the payment process of a major trader is delayed. For example, rice refineries in Bireuen Regency often experience income fluctuations when large traders or retailers make payments via credit or debt, if the wholesalers and retailers fail to pay within the period set by the rice refineries, the rice refineries is unable to manage their cash flow and the production and distribution process is interrupted.

3.4.3. Information flow.
The flow of information about rice procurement in the three rice refineries is simply intertwined and has a reciprocal relationship between fellow procurement institutions that starts from the initial procurement, farmers, to the final procurement, consumers. Farmers supply predictions about the rice harvest timeline and quality of the grain. This benefits the farmers because it will encourage traders and rice refineries to buy their grain.

Collector traders and rice mills inform the sale price of grain to be purchased from farmers per kg, this supports mutual involvement amongst supply chain members. Simultaneously, wholesalers and retailers inform consumers about rice quality and prices, as wholesalers and retailers receive information from rice refineries about rice quality. Each member of the procurement freely shares information about price, quality, and rice demand. However, information received by the rice refineries is not always accurate. For instance, if the amount of grain available to farmers is lower than promised, this can be detrimental to the rice refineries as they incur operational costs based on the farmer’s initial information.

3.5. Procurement resources.
The resources owned by the procurement party differ between each chain, physical resources, human resources, and technology. Each resource affects the level of performance of the members of the procurement [12-14]. Farmers need human resources when planting and harvesting rice. Collector traders use human resources to transport the grain to transport cars at a labor cost of Rp65,000 per day per worker. Rice refineries 1 use 5 workers with a wage of Rp100,000 per day per worker. While the rice refineries 2 still employs 8 permanent workers of Rp100,000 per day per worker. The use of this workforce is to assist with the production process in the rice refineries 2. The rice refineries 3 factory uses 10 workers with a wage of Rp100,000 per day of labor. Rice refineries in Bireuen Regency generally still need human labor to assist in the production process, however, the amount of labor used varies depending on the needs of each rice refineries.

The technology used by the three sample rice refineries aims to accelerate the processing of grain into rice. The application of sophisticated technology has been used in three rice refineries, but some work is still manual. The machines used include an oven (dryer), 1 set of milling machine, a lesator machine, a polish machine, and a digital scale with a capacity of 30 tons.

4. Conclusion
The rice procurement process and at large-scale rice refineries will be more efficient if each party within the supply chain is involved in the procurement including farmers, collectors, wholesalers, and retailers. These parties should rely on formal partnership contracts so that the financial flow can be completed quickly, eliminating late payments which are detrimental to the large-scale rice refineries in Bireuen Regency.

Reference
[1] Naik G D and N Suresh 2018 Challenges of creating sustainable agri – retail supply chains IIMB Supervision Review 30 270-282.
[2] Badan Pusat Statistik 2019 Bireuen Dalam Angka Tahun 2020 ISSN/ISBN: 2442-8507
[3] Heckathorn D D 2015 Sociol Methodol. 41 352-366
[4] Hendricks V M, Blanken P, and Adriaans N 1992 Snowball sampling: A pilot study on cocaine use (Rotterdam: IVO)
[5] Sugiyono 2016 *Metode Penelitian Kuantitatif Kualitatif dan Kombinasi (mixed methods)* (Bandung: Alfabeta)

[6] Van der Vorst 2006 *Performance measurement in agri-food supply chain networks* (Belanda (NL): Waginengen Academic Publishers)

[7] Sobichin N 2012 *Economics Development Analysis Journal* 1 2-11

[8] Utomo T J 2011 *Fokus Ekonomi* 6 122-133

[9] Hayati E N 2014 *Jurnal Dinamika Teknik*. 8 24-34

[10] Chopra S and Meindl P 2004 *Supply chain management strategi, planning, and operation. Prentice* (Hall: New jersey)

[11] Ridwan A, Y Mubassiran and Syafiq S 2015 *Jurnal Rekayasa Sistem & Industri* 2 28-34

[12] Saragih A E 2016 *Rantai pasok beras di Kecamatan Cibeber Kabupaten Cianjur* (Bogor: Institut Pertanian Bogor)

[13] Agussabti, Rahmadiansyah, Satriyo P, Munawar AA. *Data Br*. 2020 Apr 1:29.

[14] Saputri Y, Yusriana, Munawar AA. *In: IOP Conference Series: Earth and Environmental Science. Institute of Physics Publishing*; 2019: 365.