**International Journal of Life Sciences**
Available online at www.sciencescholar.us
Vol. 8 No. 1, April 2024, pages: 13-24
e-ISSN: 2550-6986, p-ISSN: 2550-6994
https://doi.org/10.53730/ijls.v8n1.14792

# Supply Chain Process Structure Diagram for Processing Unit of Arabica Coffee Kintamani Bali

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*Manuscript submitted: 09 December 2023, Manuscript revised: 18 January 2024, Accepted for publication: 27 February 2024*

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***Keywords***

*information flow;*
*money flow;*
*product flow;*
*SCOR;*
*supply chain;*

**Abstract**

Supply Chain Operational Reference (SCOR) is an approach that can be used to map processes in the supply chain. Process mapping is very useful for understanding the flow of products, money and information. Process mapping can make it easier to evaluate supply chain management weaknesses. This paper aims to map the process flow using the SCOR approach at the Kintamani Bali Arabica coffee processing unit. SCOR contains a structured hierarchy of goods, money and information flow processes which are described in three levels. Level 1 in the supply chain of the Kintamani Bali Arabica coffee processing unit describes the implementation of the planning process, source, make, and delivery. Level 2 shows the process category which consists of two process categories based on stock for processing fresh coffee and based on order-based processes for processing green bean, roasted and ground coffee. Level 3 shows the stages of process elements in each category. This level starts from the entire supply chain planning process stage to the customer order delivery process stage. The results of this paper describe the structure of the SCOR model at the Kintamani Bali Arabica coffee processing unit connecting all interrelated product, money and information flow processes.



**Contents**



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## 1 Introduction

Supply chain management is the answer to current business competition. The rapid growth of the industry has led to an increase in business actors and also changes in people's tastes. The dynamics of consumer desires mean that companies are required to fulfil them. Various supply chain management strategies have been implemented. This was also expressed by Kawalla et al. (2019), who said that facing dynamic competition requires supply chain quality management that integrates internal and external supply chain quality issues.

To ensure the quality, quantity and continuity of product flow that consumers need, producers need to collaborate with many parties. Suppliers of raw materials are an important element for the smooth production process. Processing industry as a creator of added value products. Marketing institutions act as distributors of resulting products to consumers. All actors in the supply chain play a role in smoothing the flow of products from producers to consumers, ensuring the smooth flow of money from consumers to producers, and the flow of information from all actors. The internal supply chain, which includes all units in each supply chain actor, also has an important role in facilitating communication and coordination regarding the distribution of products, money and internal information (Renneboog et al., 2011; Jiang & Yuksel, 2017). According to Georgise et al. (2012), the implementation of supply chains in developing countries is more worrying than in developed countries. This is caused by weak coordination and communication between actors in the supply chain in developing countries. Weak management of information and resources is the reason for weak supply chains in developing countries. Indonesia is a developing country, where the processing industry is dominated by medium, small and micro enterprises (MSMEs) with all their limitations. Meanwhile, in developed countries, the implementation of supply chain management has been integrated with information systems, so business competitiveness is very high compared to developing countries.

Coffee is one of the commodities produced by Indonesia which has high opportunities in world trade. Based on data from the Indonesian Central Statistics Agency (2023), shows that there has been a decrease in the number of coffee production from Indonesian plantations by 1.43% from 2021. This decrease was not followed by a decrease in the number of Indonesian coffee exports in 2022. The number of Indonesian coffee exports in 2022 increased amounting to 12.99% from the previous year. This is influenced by an increase in world coffee consumption of 2.2% (ICO, 2023). This condition shows that the coffee business has opportunities to develop in the future, especially Arabica coffee.

Bali is part of a developing country, where business actors are dominated by MSMEs. Bali MSMEs are growing rapidly, especially in the downstream coffee industry. The development of the downstream coffee industry needs to be supported by the coffee processing industry. Coffee processing is categorized into two, including primary and secondary processing. Primary processing processes cherry coffee picked by farmers into Hard Skin (HS) coffee beans. Secondary processing is the continuation of processing HS coffee beans into green bean, roasted and ground coffee. Primary processing is carried out by farmers, both individually and in groups. Secondary processing is owned by private entrepreneurs. However, currently, each Arabica coffee-producing base region in Bali has established a coffee processing unit. The establishment of this coffee processing unit aims to increase the added value of the cherry coffee harvest so that farmers' welfare is better. The processing unit not only produces HS coffee but also carries out secondary processing. This research photographs the supply chain of the Kintamani Bali Arabica coffee processing unit. It is important to continue to maintain good cooperation between farmers, processing industries, marketing institutions and their customers. Starting from this, an evaluation of supply chain management needs to be carried out.

According to Kasi (2005); Huan et al. (2005); Wang et al. (2010), supply chain performance evaluation can be carried out using the SCOR (Supply Chains Operation Reference) approach. This approach has been recognized as being applicable by looking at business processes. A business process-based approach can comprehensively view all business processes and integration between internal and external business actors. Evaluation of business processes and stakeholder involvement ensures the achievement of supply chain

objectives, namely smooth product flow, money flow and information flow (Grace, 2000; Markantonatou et al., 2016). The SCOR approach is widely applied to the processing industry, but currently, SCOR can also be used to evaluate the operational efficiency of the port of Huang et al. (2021). Persson et al. (2009), using the SCOR approach in construction companies can be used to determine processes that have the potential to save costs on logistics activities.

The SCOR approach looks at business processes in five activities, including planning, sourcing, making, delivery, and returning damaged products. These five activities are the core of business processes in all types of business, especially in the processing industry. Weakness in one of the core activities in the SCOR approach will affect the business processes of the business. Therefore, ensuring that the SCOR process runs well requires continuous evaluation (Puger et al., 2022).

Before evaluating the performance of the Balinese Arabica coffee primary processing supply chain, it is necessary to first map the business process using the SCOR approach. SCOR process mapping is carried out first to ensure process activities in the internal and external supply chain for the primary processing of Balinese Arabica coffee. Each business has specific process activities, very dependent on product type and quality, target market, business scale and supporting resources. Aircraft assembly company's process activities are not the same as furniture manufacturing factories, nor are they the same as food processing companies and other manufacturing industries. Therefore, recognizing process activities in a business needs to be done to ensure that our business processes are good compared to similar businesses in the field. Mapping business processes is also important to modify processes that are being implemented if they are deemed less efficient. SCOR mapping can also be used to see the involvement of external parties in business processes so that communication and coordination can be evaluated appropriately (Delipinar & Kocaoglu, 2016; Ntabe et al., 2015; Zanon et al., 2020).

This research captures the SCOR business process pattern that occurs at the Arabila coffee primary processing unit in Bali. This approach will map primary processing planning activities, procurement of resources needed by processing units, production processes in primary Arabica coffee processing, distribution of coffee produced by processing units, and handling of products that do not meet customer demand.

The formulation of the research problem is, what is the business process pattern based on the SCOR approach applied at the Balinese Arabica coffee processing unit level? This research aims to describe business process patterns based on the SCOR approach applied at the Balinese Arabica coffee processing unit level.

## 2 Materials and Methods

The research location was carried out in Kintamani District, Bangli Regency and its upstream and downstream stakeholders. Determining the research location was determined using a purposive method considering that the research location is the center of Arabica coffee production in Bali. This research data was obtained directly from sources, namely planning activities carried out by processing units, raw material source acquisition activities, production activities (primary and secondary processing), delivery activities carried out, and activities related to product returns from customers. The secondary data used is data obtained from online data provider institutions, such as data on the amount of Indonesian coffee production and exports. The production process mechanism data is in the form of a flow chart of production activities obtained at the processing unit.

Data collection was carried out using the observation method, looking directly into the field to get an actual picture of the research object. In-depth interviews, through questions and answers with respondents according to the research object with a list of questions as an instrument. Documentation studies, collecting information through library sources and research results related to this research.

The population of this research is supply chain actors in the upstream industry, processing industry and downstream Arabica coffee industry. The number of samples was determined using the quota sampling method, with the relevant number being 25 people consisting of farmers, product processing unit managers, roasted coffee industry managers, and cafe shop managers. The sampling method is snowballing sampling, the starting point is the processing industry as the core of the supply chain (Seuring, 2013; Qrunfleh & Tarafdar, 2014). The analysis used in this research is adapted to the research objectives, namely qualitative descriptive analysis, with the following steps. Identify level 1 of the SCOR process approach, namely plan, source, make and delivery at the Kintamani Bali Arabica coffee processing unit:

a) Reduce the main SCOR processes at level 1 to process categories at level 2 and process elements at level 3.
b) Describe the processes at Level 1 of the business processes in the coffee processing unit.
c) Develop images on process categories and process elements at levels 2 and 3.
d) Interpret the resulting image.

## 3 Results and Discussions

Identifying the supply chain process of the Kintamani Bali Arabica coffee processing unit is a step that can be taken to find out the supply chain process that occurs in that business unit. Process identification is carried out using the SCOR approach. According to Zhang et al. (2021), the SCOR approach can be depicted in a classic process structure diagram consisting of four hierarchical levels. Level 1 includes five main processes, namely plan, source, make, delivery and return. Level 2 shows the configuration level that focuses on process categories in each main process at level 1. Level 3 is the level of process elements that involve specific processes at each level 2. Level 4 is the implementation level of all specific activities in each company. In this discussion, we will map out the classic supply chain processes that occur at the Kintamani Bali Arabica coffee processing unit using the SCOR approach up to level 3. Each level in the supply chain is discussed in the following separate section.

*SCOR level 1 at the Kintamani Bali Arabica Coffee processing unit*

The supply chain process studied starts from farmers to customers. Customers limited to those in the Bali area include coffee roasting companies and coffee shops. In general, the application of the SCOR process at the Kintamani Bali Arabica coffee processing unit includes four main processes consisting of plan, source, make and delivery. The return process is not carried out. Considering that the processing unit never carries out the process of returning the fresh cherry coffee brought by the farmers. The entire harvest of coffee farmers in the Kintamani Geographical Indication area is absorbed by the processing unit. Likewise in the customer return process. None of Kintamani's Arabica coffee customers returned the coffee products they ordered. The SCOR level 1 structure at the Kintamani Bali Arabica coffee processing unit can be seen in the following picture.

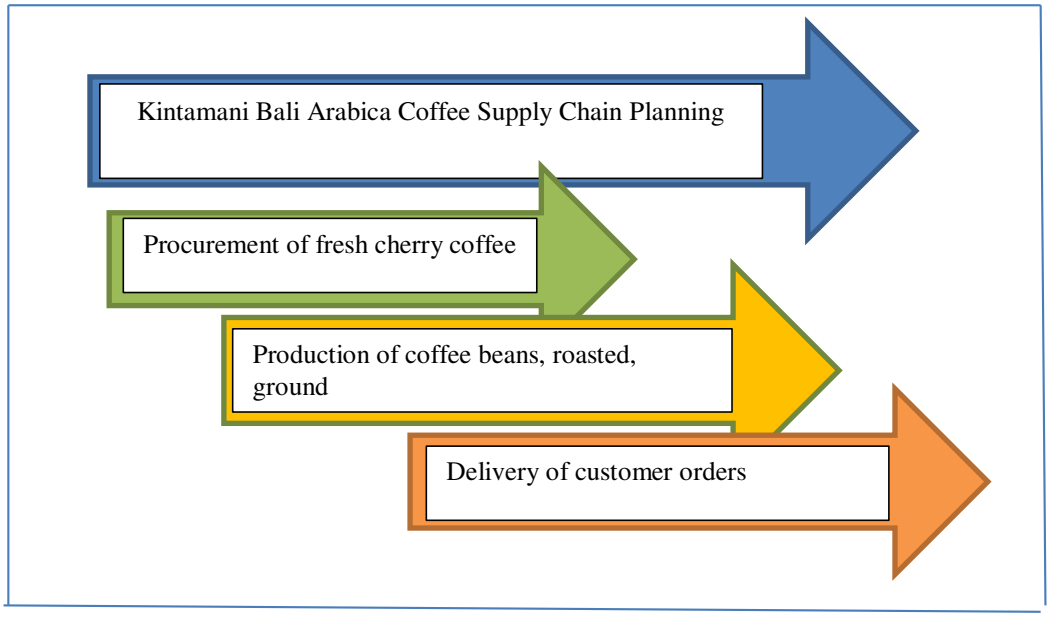


Figure 1. SCOR level 1 hierarchy at the Kintamani Bali Arabica Coffee processing unit

In this research, planning was made by the Kintamani Bali Arabica coffee processing unit as the core company in the supply chain. The planning process is carried out by the coffee processing unit before the harvest season arrives. Coffee processing units start making plans for the flowering season of coffee plants. The success of plant flowering is used as a benchmark in accepting and rejecting requests from new customers and consumers. In general, records of supply chain planning for the Kintamani Bali Arabica coffee processing unit are still low. The planning process is structured around the concept of the head of the processing unit as the business owner.

The resources (source) needed by the processing unit are raw materials for red-picked coffee, labor and packaging materials. The dominant and very important resource in this supply chain is raw materials. Raw materials are obtained directly from farmers in the nearest area. All processing units are located near sources of raw materials, to speed up the production process. Processing units can also obtain raw materials from wholesalers. These traders are marketing institutions that buy directly from farmers. In general, farmers sell to processing units, but some farmers sell to collectors. These traders have provided beneficial assistance to farmers in the form of prices that are more appropriate than the prices given by processing units. Collectors often provide production capital loans to farmers. Currently, there is competition between processing units and collectors in obtaining raw materials. Coffee processing units inevitably follow the prices set by collectors. Fresh cherry coffee raw materials purchased by collectors will be resold to processing units that need them at a higher price than the farmer's selling price. This condition is not profitable for coffee processing units.

The production process (make) is carried out when there is raw material for fresh cherry coffee from farmers. The production methods used by processing units are broadly divided into three types fullwash methods or wet processing methods. The honey method is a semi-wet method. The natural method is dry. All processing units make coffee using all three methods, only the percentages vary depending on the estimated order. There has been a change in consumer taste trends, where before 2020 the market preferred coffee with the full wash method. By 2020, the honey method is starting to become popular with consumers. Currently, consumers tend to prefer coffee using natural methods. The final product sold by processing units varies, for inter-regional traders in the archipelago, coffee is sold in the form of green beans. For the Bali market, coffee is sold in the form of green bean coffee, roasted coffee or ground coffee.

There are two types of product delivery processes to consumers. Delivery is made by the processing unit or picked up directly by the customer. The delivery process is agreed upon in advance by both coffee processing units and consumers.

*SCOR level 2 process category at the Kintamani Bali Arabica Coffee processing unit*

At level 1 in the previous section, the business scope of the Kintamani Bali Arabica coffee processing unit was briefly described. At level 2, a more detailed process diagram will be depicted that occurs in the main process of the Kintamani Bali Arabica coffee processing unit, which can be seen in Figure 2.

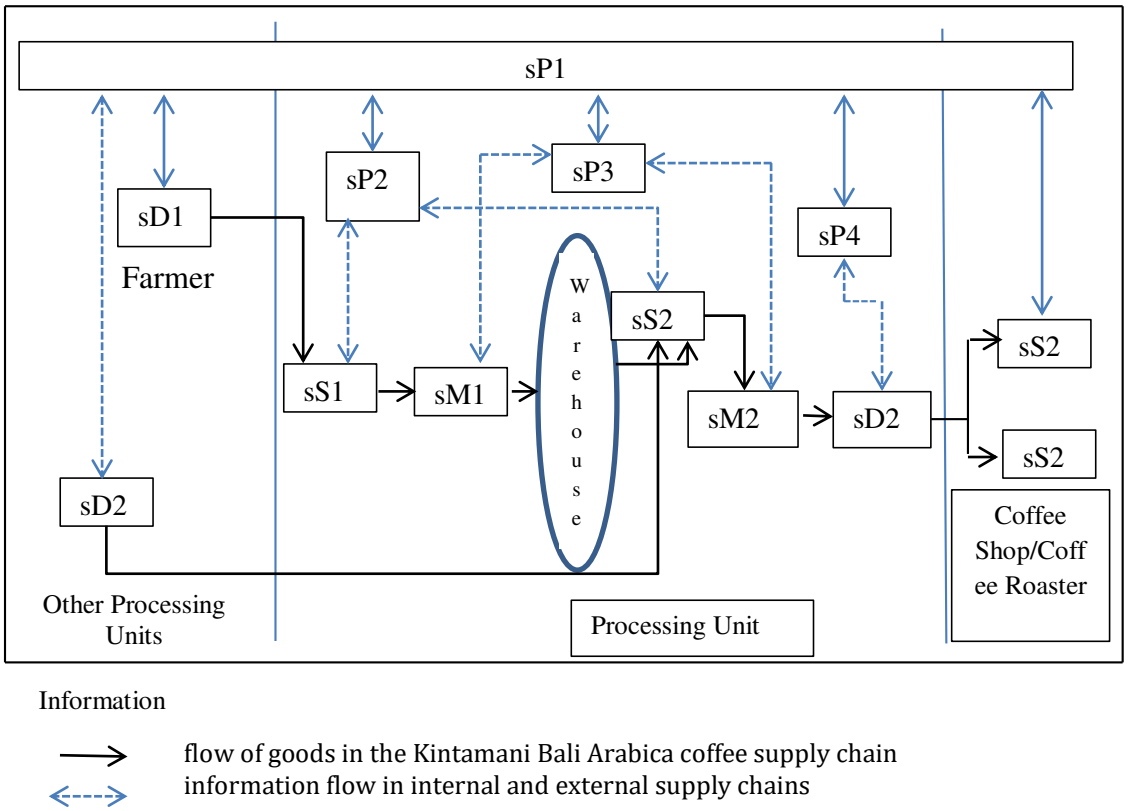


Figure 2. Process Category Model Structure (Level 2) Kintamani Bali Arabica Coffee Processing Unit

The beginning of the supply chain management process is planning. The plans made include overall planning and internal planning. Overall supply chain planning includes determining the demand and supply of Arabica coffee (sP1) from the history of business sales and coffee production of farmers in the previous period and estimates for the future period. Internal planning in the company concerns all activities to meet overall supply chain planning targets, consisting of resource requirements planning (sP2), production process planning (sP3), and distribution planning (sP4). In general, records of supply chain planning for the Kintamani Bali Arabica coffee processing unit are still low. In general, they do not keep records continuously, their plans are not written down. SP1 planning is prepared by the processing unit before the fresh coffee harvest period at the farmer level. Sp2 planning is carried out by checking the condition of farmers' crops and estimating the production that will be obtained. This plan has also not been recorded. They also do not make written SP3 planning, because in primary processing, production is carried out when raw materials come in, while in secondary processing production is carried out when orders are received. In the production process, whether in primary processing or secondary processing, the processing units have written standard operational procedures and have been put into practice for generations, but an evaluation of their determination has not been carried out. SP4 planning is also not written, delivery requirements are carried out if in the case of sales of large quantities, the customer has made a receipt payment. Meanwhile, sales of small value are subject to agreement between both parties. Plans for returning damaged products (SP5) were not made, because the experience of product returns has never occurred.

The next main process is the procurement of resources (sS) before the coffee processing unit goes into production, so every harvest season the farmers buy coffee from the harvest in the form of red-picked coffee with a mature level of 95%. Red-picked coffee is purchased every harvest season between April-July. Coffee processing units generally do not order cherry coffee from farmers, but farmers in nearby areas will offer their coffee directly to the processing unit. The price is formed from an agreement between the farmer and the processing unit and is paid after the coffee is received by the processing unit.

The Kintamani Bali (sM) Arabica coffee production process is more easily grouped based on the loading process, including primary processing, namely processing cherry coffee directly into Hard Skin (HS) coffee. Then proceed with secondary processing which is a continuation process from the previous process. The processing of HS coffee into green bean coffee, roasted coffee and ground coffee is called secondary processing. Primary processing only occurs during the harvest season, when the cherry coffee enters the processing unit, the coffee must be processed immediately. HS coffee will be stored in the warehouse. HS coffee will be periodically peeled little by little into green bean coffee so that the quality of the coffee can be sorted according to SNI standards. Coffee that complies with SNI standards is separated from others and stored in the warehouse. When an order from a customer comes in, secondary processing will continue. Coffee that does not meet SNI standards will be processed into local coffee for the nearest market stall.

Delivery of Kintamani Bali Arabica coffee to customers (sD) is adjusted to the agreement previously made between the processing unit and the customer, including quantity, quality, selling price, payment system and delivery method. Three types of delivery methods appear at the processing unit, namely the customer coming directly to the processing unit, being sent directly by the processing unit, or via an expedition service.

*Process element model structure (Level 3) in the supply chains operation reference*

In the process category (level 2) it is known that the production process at the Kintamani Bali Arabica coffee processing unit is based on fulfilling stock and customer orders. Production based on stock fulfilment is carried out in primary processing. Production based on orders is carried out in secondary processing. These two categories of production processes influence the process elements of resources and delivery at the coffee processing unit. Process elements (level 3) SCOR at the Kintamani Bali Arabica coffee processing unit can be seen in Figure 3.

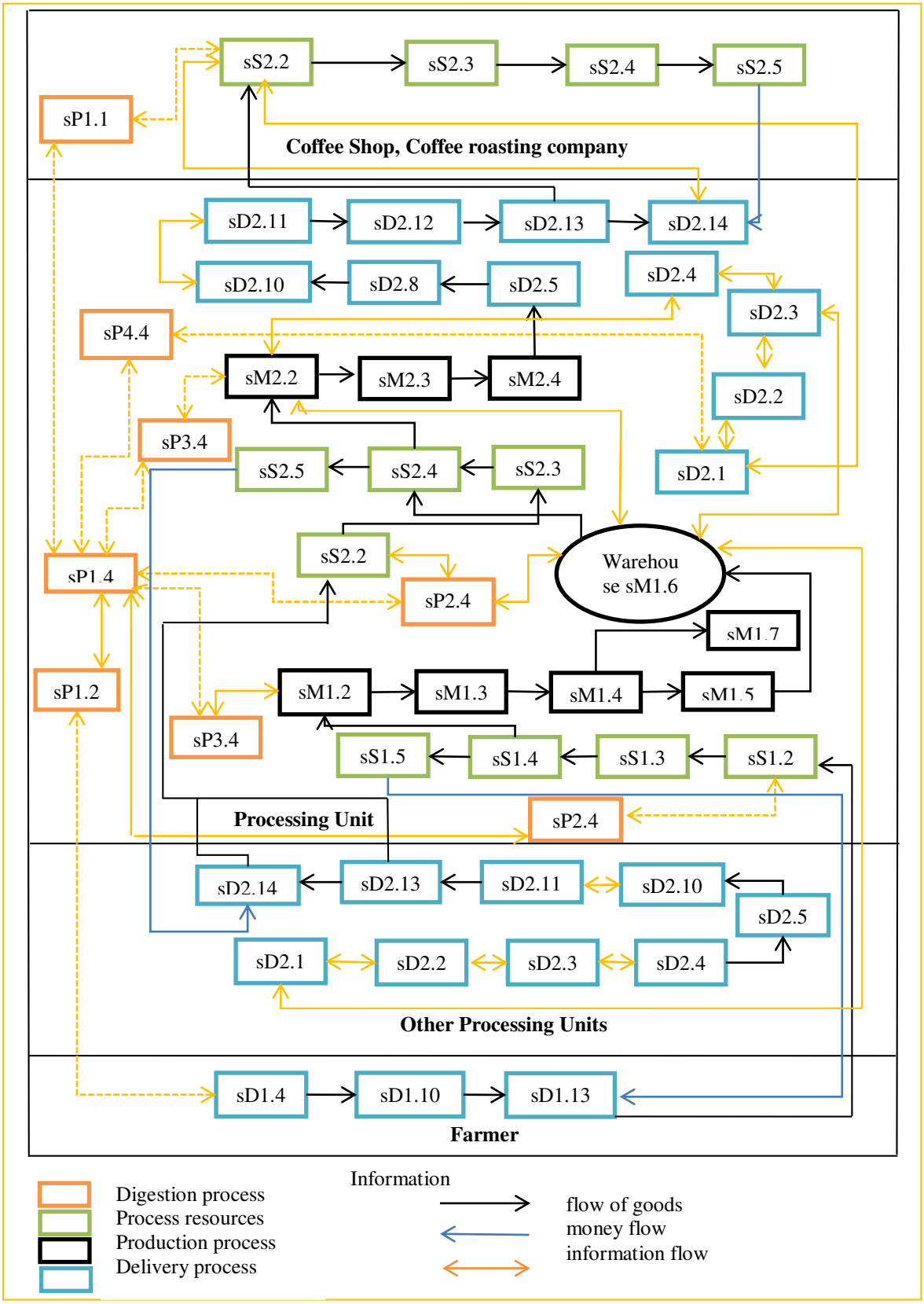


Figure 3. Process Element Model Structure (Level 3) Kintamani Bali Arabica Coffee Processing Unit

The process element model in Figure 3 begins with determining overall supply chain planning (sP1.4). Determining overall supply chain planning (sP1.4) begins with the process of determining the quantity of demand (sP1.1). The number of requests is calculated from orders that have been received before the harvest season arrives. Therefore processing units need to coordinate and communicate with their customers (sS2.2). The next process determines the amount of production capacity per year that can be worked on (sP1.2). This process is carried out by estimating the harvest yields of coffee farmers who are partners with the processing unit. The Arabica coffee processing unit coordinates and communicates with farmers providing cherry coffee to prepare coffee that has been harvested by farmers (sD1.4). The established plan (sP1.4) is communicated to all internal work units at the Kintamani Bali Arabica coffee processing unit.

The determination of overall supply chain planning (sP1.4) is coordinated and communicated internally to determine procurement planning for Cherry Coffee and HS Coffee (sP2.4). The results of these planning decisions are communicated to farmers when bringing in cherry coffee (sS1.2). Coordination and communication are also carried out in the warehouse section as a provider of raw materials for secondary processing processes. Coordination and communication of information on determining the overall supply chain plan (sP1.4) is carried out to determine production process planning (sP3.4). The results of the decisions in this planning are communicated to the production department from the time the raw materials for cherry coffee (sM1.2) and HS coffee are prepared (sM2.2). Coordination and communication of information on determining the overall supply chain plan (sP1.4) is also carried out to determine delivery planning (sP4.4) following the agreement between the processing unit and the buyer. The results of delivery planning decisions are communicated to customers during the bargaining process at the beginning of the purchase (sD2.1).

After the Arabica coffee harvest is carried out, the farmer prepares the cherry coffee which will be sent to the coffee processing unit (sD1.4). Cherry coffee to be sent is packaged by farmers in plastic sacks (sD1.10). Cherry coffee that enters the processing unit is received and verified by the production department at the processing unit (sD13). Cherry coffee raw materials enter the processing unit and are received by the production department (sS1.2). The cherry coffee received is verified and assessed for uniformity of ripeness (sS1.3). The uniformity of cherry coffee maturity levels determines the selling price of farmers. Verified cherry coffee is collected at the primary processing location (sS1.4). The processing unit makes payments after the coffee farmer collects verified cherry coffee (sS1.5).

After the raw materials are collected, the cherry coffee is prepared to enter the primary processing stage (sM1.2). The primary processing process is carried out using three processing methods according to production planning (fullwash, honey, or natural). Testing the quality of primary processing results is the achievement of a dry HS coffee water content standard of 12% (sM1.3). After the dry HS coffee reaches the standard water content of 12%, the coffee is then packaged in sacks lined with plastic to ensure the water content does not increase quickly (sM1.4). Dry HS coffee that has been packaged is stored in the warehouse (sM1.5). Dry HS coffee that enters the warehouse is recorded and stacked on wooden boards (sM1.6). The remaining waste resulting from primary processing in the form of fruit peel is further processed by composting (sM1.7).

Secondary processing is carried out based on customer orders. The process of requests from customers and bargaining occurs (sD2.1). The processing unit receives orders according to the agreement that has been made (sD.2.2). The processing unit will check the availability of secondary processing raw materials in the warehouse (sD2.3). The raw material for secondary processing in the warehouse is dry HS coffee from three types of primary processing methods (full wash, honey and natural) according to customer orders. The processing unit will prepare orders according to customer needs (sD2.4). Dry HS coffee is sent from the warehouse to the production section (sS2.4). When HS raw materials with certain types of primary processing methods run out in the warehouse even though the customer ordered them, the processing unit will order and negotiate with other processing units (sD2.1). The processing unit orders coffee in green bean form from another processing unit. Another processing unit approves the order from the processing unit (sD2.2). Another processing unit checks the inventory of green bean coffee ordered at its warehouse and agrees on a delivery date (sD2.3). Other processing units will prepare green bean coffee using certain types of methods according to the processing unit's request (sD2.4). Other processing units weigh the products to be sent according to the processing unit's request (sD2.5). Another processing unit packages the order (sD2.10). Another processing unit confirms to the processing unit that the order is complete and ready to depart (sD2.11). Another processing unit sends the order and it is accepted by the processing unit (sD2.13). Other processing units submit sales documents to the processing unit (sD2.14).

Green bean coffee orders sent by other processing units are received by the processing unit (sS2.2), then the orders received (sS2.3). Once the order matches the order received, the order is immediately sent to the production department (sS2.4). Processing units make payments to other processing units (sS2.5). Secondary processing raw materials are prepared again to suitability (sM2.2). Raw materials originating from HS warehouses need to have their water content checked again (12%). Meanwhile, raw materials originating from other processing units have been tested for water content and comply with SNI standards. The production process runs after the water content is appropriate (sM2.3). The production process begins with a pulper followed by sorting the green beans according to SNI standards. The final products requested by customers vary, in the form of green beans, roasted and ground coffee. Roasted coffee is obtained by roasting green bean coffee. Ground coffee is produced from roasting coffee. After the coffee is processed according to the order, the coffee is then packaged in aluminium foil (sM2.4) packaging.

Final products that comply with the order are weighed again before sending (sD2.5). The sales department receives products to be sent from the production department (sD2.8). The sales department will also repackage the products to be sent to customers (sD2.10). The sales department will report that the product is ready to be sent and immediately create a sales note (sD2.11). The final product that is ready to be sent complete with a sales note will be handed over to the delivery officer or courier (sD2.12). Products sent by delivery personnel/couriers will be received by customers (sD2.13). The officer/courier will give a sales note to the customer (sD2.14).

Products are received by customers at the raw material procurement section (sS2.2). Products received by customers are checked for conformity with the quantity ordered and order specifications (sS2.3). The final product of the processing unit received by the customer is immediately sent to the customer's inventory warehouse (sS2.4). Customers pay directly for the products they order at the processing unit after the products arrive at the storage warehouse (sS2.5).

## 4 Conclusion

Based on the discussion in the previous section, it can be concluded that mapping the supply chain structure using the SCOR approach is very useful for identifying all processes that occur in the supply chain. This mapping will show whether the process flow is following expectations or not or whether the Arabica coffee processing unit in the small business is better. In this flow, communication and coordination between departments and with external business actors will be seen. The current flow can be modified if it is deemed less suitable. Based on this model structure, will make it easier for management to measure supply chain performance.

The SCOR approach divides the process stages into three general levels. Level 1 is a description of the plan, source, make, delivery and return, only the Kintamani Bali Arabica coffee processing unit does not carry out the process of returning damaged products. Level 2 contains process categories based on two major activities: primary processing and secondary processing. In primary processing, the cherry coffee raw material is processed until it becomes dry HS coffee. Selender processing starts from dry HS coffee to coffee according to customer requests (green bean, roasted and ground). Primary processing is based on production based on stock, while secondary processing is based on production based on orders. Level 3 is a process element that describes in detail each process category.

*Suggestion*

Suggestions given to improve process performance in the Kintamani Bali Arabica coffee processing business are as follows.

a) It is best to always follow developments in the processes carried out by coffee makers outside Bali who are more successful.
b) Always modify the existing SCOR process model structure, if there are process improvements in SCOR.
c) Currently, the processing unit has not thought about the possibility of product returns from consumers, but the mechanism needs to be prepared, as a form of service to customers.

*Acknowledgements*
We are grateful to two anonymous reviewers for their valuable comments on the earlier version of this paper.

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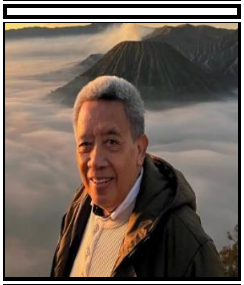

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