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Performance analysis and traceability system using SCOR method in the orange fruit supply chain of Citrus reticulata Blanco (Case study in Batu City, East Java)

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Abstract. Orange Fruit Batu 55 is a typical plant from the Batu City East Java in addition to apple plants. This orange has the advantage of sweet, fresh and harvest times 3 times a year. The level of competition is quite high in the market, making the Batu 55 tangerine fruit must be able to survive especially in facing the competition with imported products. Increasing the level of dependence and complexity of the current supply chain network makes supply chains as a whole more vulnerable to disruption. This study aims to describe the supply chain using the framework of the Food Supply Chain Network, measure supply chain performance, and identify the implementation of traceability systems of specific strain of Citrus reticulata Blanco namely Keprok Batu 55.

1. Introduction

Indonesia is a country with abundant potential of crops which may improve the level of livelihood. Agricultural and plantation products have very high economic value; thus, many people cultivate various agricultural and plantation products as business potential. One of the most cultivated plantation commodities is citrus. The high economic value that this fruit has makes farmers in various regions cultivate citrus plants.

One of the citrus producing areas in East Java is Batu City. Batu City has different kinds of citrus varieties. One of the best citrus varieties is Batu 55 Tangerine, specific strain of Citrus reticulata Blanco released by BALITJESTRO Batu, Malang, Indonesia. This tangerine is a typical plant in Batu city and becomes a superior product of Batu City besides apples. This tangerine fruit has several advantages, i.e. sweet, easy to breed, and harvestable for 3 times a year.

The supply chain of agricultural or food commodities has a uniqueness from the characteristics of production and product flow [1]. In general, it is different from other commodities because it comes from biological processes, the characteristics of which are that the products are perishable, the cultivation and harvesting are very dependent on climate and season, the quality varies, and some of the products are difficult to transport and manage due to the size and complexity of the products. Furthermore, after harvesting, the short age of the use of products makes agricultural products require a special process in their transportation and distribution to maintain the product quality until they reach the final customers.

The process of distributing agricultural or food commodities in the agribusiness system is related to the concept of Supply Chain Management (SCM). The difference between these two concepts is only in the core commodity [2]. Generally, the model of supply chain management applies while the agribusiness system only applies to agricultural products that are more complex than other industrial product supply chains by taking the inherent characteristics of these agricultural products into account. This is because agricultural products can experience damage or loss functions from the start of harvesting from the agricultural land until they are obtained by the final customers.
One of the supply chain performances is used to evaluate the overall activities in each chain that has been performed to date, especially in regard to the uncertainty along the supply chain in providing the best supply for customers in order to improve the conditions and maximise the supply chain resources that still have problems [3-4]. The objectives of performance measurement are (1) to guide the decision making, (2) to assess the commodity performance, (3) to evaluate the effectiveness of marketing decisions, (4) to track commodity stability, and (5) to set the financial values of a commodity [5-6].

Along with the development of science, another thing in the supply chain which is also often debated today is how to increase activities by implementing traceability to answer the future challenges of the business world, especially regarding agricultural products (fruits). Strengthening the potential of the product supply chain is more important than the condition of the returned products, likewise in understanding the organization of the supply chain efficiency, so that the traceability has become an essential thing to adopt in global business [7]. In order to adopt this traceability system, it’s needed several preliminary studies, combining institution, technology, and human resources as well as financial resources of the company.

Traceability refers to the development of practices to improve a supply chain after an evaluation of activities related to its two functions, i.e. tracing and tracking. These functions are closely related to the flow of products integrated through the flow of information. It especially applies for fresh vegetables that generally, every final customer wants products that are guaranteed to have the quality of “from farm to table”. Regarding the existence of these two functions, there are several achievable benefits, among which are (a) identification and traceability procedures of the products from the stages of production, distribution and installation; (b) availability of information about the parts in the product process, product specifications, product status, and other sections; (c) availability of information about the exact contents of the product, and (d) support towards achieving supervision activities (process control) [7].

This research was conducted to describe the supply chain performance of Batu 55 Tangerine and to know the description of the traceability system that is carried out in order to increase the competitiveness of local products.

2. Research Method

Research procedure is a workflow that is organised systematically. Research procedure is determined before the researcher perform the problem solving that will discussed. In detail, the research procedure is as the following:

2.1. Preliminary survey

On preliminary survey, the researchers performed a field survey and an initial interview on the research location in Selorejo Village Dau District Batu City, East Java and Karangploso Market in Malang City, East Java. This preliminary survey was carried out to understand the conception of the flow of Batu 55 Tangerine chain supply. Preliminary survey is useful to obtain the description of information about the encountered problems.

2.2. Literature studies

Literature studies was performed by looking for information from various sources that can be used as references for supporting the research implementation. The sources of literature used were books, journals, thesis, proceedings, and information from the internet that supported and assisted the research. The literature studies should be relevant with the issues raised. The literature taken was used to measure the performance of chain supply and supply chain traceability system of Batu 55 Tangerine.

2.3. Identification and formulation of problems

This stage of research identification problem was used for directing the researcher in determining the steps that had to be executed next.

2.4. Determination of respondents and experts

In this research, there were respondents and experts who would help complete the questionnaire or become the interviewees in interview session. The respondents and expert in research included two farmers (suppliers), two distributors, and two retailers of Batu 55 Tangerine. The experts in this research were the people from Batu Agriculture Office and BALITJESTRO (Research Institute for Citrus and Subtropical Fruit) Office.
2.5. Questionnaire design
The questionnaire design was used for obtaining information needed from every person on the supply chain of Batu 55 Tangerine. The questionnaire used in this research contained five types of questionnaire used for identifying the supply chain performance and the development of traceability system. The supply chain measurement method according to SCOR Metrics proposed by Van Der Vorst [8].

2.6. Data collection
The data source on this research were two types, which were:

2.6.1. Primary data
Primary data was the field data obtained through observation, interview, and questionnaire. On this research, the primary data was the data obtained from respondents who were farmers, distributors, and retailers who filled up the questionnaire and did the interview.

2.6.2. Secondary data
Secondary data was the source of data obtained indirectly. The secondary data on this research was the data originating from books, journals, and the internet.

2.6.3. Data collection methods
The data collection methods were as follows:

a. Questionnaire
   Questionnaire was a data collection technique carried out by giving a set of questions and written statement to respondents.

b. Interview
   Interview was the questioning and answering session performed to respondents as the person involved in the supply chain, including farmers, distributors, and retailers for obtaining information about the problems.

c. Observation
   Observation was a research directly conducted in order to understand the existing condition and situation on the field.

d. Documentation
   Documentation was carried out to obtain the secondary data in research by taking pictures regarding the condition of the object under study.

3. Results and Discussion
The supply chain for Batu 55 tangerine products flows the material from the suppliers (farmers) to distributors and from the retailers to the consumers.

3.1. Supply chain targets
The supply chain targets are the goals that need to be achieved by all members in a supply chain network. There are two parts of the supply chain targets, namely the market target and development target that is explained based on supply chain management activities. The conditions of supply chain management that are manifested in supply chain targets are an important aspect to underlie the assessment of whether the achievement of supply chain activities and sustainability in the existing system is good or not.

3.1.1. Market target
The marketing models that are applied include the marketing model directly into the hands of customers and the one through middlemen [4]. The direct market model by farmers is carried out by selling the tangerines directly around the planting areas. The price applied is around IDR. 10,000 to IDR. 15,000 per kilogram. On the other hand, if it is sold to the middlemen, it costs around IDR. 5,000 to IDR. 8,000 per kilogram. By the middlemen, the oranges will be marketed again in the centre of souvenirs around Batu area or in Karangploso market. The selling price of tangerines in the tourist areas can be around IDR. 25,000.

The market target can be viewed from market segmentation efforts, integrated quality, and supply chain optimization. Other things that also become the priority in meeting the market objectives of the supply chain network are related to the brand identity and partnership system of the supply chain itself,
as well as the safety guarantee of the food products, which become the main desires of customers today. There is a guarantee that the citrus products have good quality and the planting systems are in accordance with the directives of the relevant agencies [2].

3.1.2. Development target
The development targets in the supply chain are long-term goals that the entire stakeholders are keen to achieve together [8]. Network potential by developing the integration of existing resources is in the form of the creation of coordination, collaboration, and the use of technology that can improve supply chain performance [6]. Stipulation of development targets can be achieved by growing and developing the spirit of young Indonesian farmers and creating appropriate technology and value-added agribusiness-oriented agricultural products [2].

3.2. Structure of supply chain network
The description of the structure of the supply chain network aims to classify the roles and functions of the members in the FSCN so that they can explain the differences between the actors involved in the chain network. The structure of the supply chain network of Batu 55 Tangerine is formed based on the whole activities according to the activities carried out by each member. Members of the supply chain network of Batu 55 Tangerine are classified into suppliers, distributors, retailers, and customers as depicted in Figure 1.

![Structure of the supply chain network](image)

**Figure 1.** Structure of the supply chain network

3.3. Chain and network management
Chain and network management symbolises the coordination and management structure in the implementation process by actors in the supply chain network. The coordination and management structure explain the decision-making process agreed by the members of the supply chain that is influential against the bargaining position. Chain and network management is explained through partner selection, contractual agreement (cooperation), transaction system, supporting actors, and collaboration in the supply chain that affect the resources [8].

3.4. Process of supply chain business
The process of supply chain business describes the entire processes that occur along the supply chain of Batu 55 tangerines. The process of supply chain business can be considered good if it is mutually integrated between members of the supply chain incorporated in the network [2]. The issues discussed in the process of supply chain business include the relationship of the process of supply chain business, distribution patterns, guarantee of brand identity and risks, and process of building trust [1].

The process of the supply chain business of Batu 55 Tangerines from the push or pull point of view is just in time. The process of pulling the customers’ demand for information is based on product availability by farmers while the process of pushing the unexpected customers’ demand is the anticipation of unknown needs that must be anticipated, for example when there is an increasing demand during celebrations of feasts and holidays throughout the year by making purchases from distributors in other areas [6].

3.5. Supply chain performance
The supply chain of Keprok Batu 55 Tangerines is measured by SCOR performance metrics that are classified into five performance attributes according to the achievement of customers as shown in the following Table 1.
Table 1. Calculation of total SCM performance

<table>
<thead>
<tr>
<th>Process</th>
<th>Score</th>
<th>Weight</th>
<th>Final Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan</td>
<td>65.2</td>
<td>0.124</td>
<td>8.08</td>
</tr>
<tr>
<td>Source</td>
<td>62.7</td>
<td>0.374</td>
<td>23.4</td>
</tr>
<tr>
<td>Make</td>
<td>89.1</td>
<td>0.244</td>
<td>21.7</td>
</tr>
<tr>
<td>Deliver</td>
<td>92.3</td>
<td>0.110</td>
<td>10.2</td>
</tr>
<tr>
<td>Return</td>
<td>92.3</td>
<td>0.101</td>
<td>9.32</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>72.7</td>
</tr>
</tbody>
</table>

From the calculations performed, it can be noticed that the highest weight for the process at level one is our process with a weight of 0.374. Then, the second priority is the make process of 0.244. The next priority is the plan (0.124), deliver (0.110), and return (0.101) processes. The total SCM performance value of Batu 55 tangerine is 72.7. This value indicates that the achievement of SCM performance is classified as Good. However, it can be improved especially for indicators that have low performance [3-4].

3.6. Activity and business process traceability

The connection of those various parties requires regulations, coordination and planning in implementing the traceability system. Based on business activities and processes, it can be explained that the presence of distributors can be the centre of product information collection and transparency provision for the entire involved parties, especially the final customers. The role of the distributors is quite strategic to provide the best service as a liaison between producers (upstream) and customers (downstream). Thus, it will be more effective if each meeting site of the activities and business processes is facilitated by access to integrated system-based information to support the mechanism of tracking and tracing functions [7-8].

4. Conclusions

The supply chain of Batu 55 Tangerine consists of farmers, distributors, retailers and consumers. Based on the calculation, it is identified that supply chain performance is classified as good although improvements can be made especially for indicators with low performance values. It is suggested that each meeting location of activities and business processes is facilitated by access to integrated system-based information to support the mechanism of tracking and tracing functions.

References

[7] Yandra R P 2011 Pengembangan model tracking and tracing dalam distribusi untuk mendukung komoditi pertanian (Development of tracking and tracing models in distribution to support agricultural commodities) Jurnal Ilmiah Teknik Industri 10 1-6. [In Indonesian]