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### Research Article

## Risk management of short supply chain of Momotaro Tomato Commodity in PT. Saribhakti Bumi Agri

### Abstract

Momotaro tomato is an introduced vegetable commodity in West Java. Development of introduced vegetables needs an effective and efficient supply chain performance to maintain the quality and quantity of the product until it reaches the consumers. PT. *Saribhakti Bumi Agri* is an agribusiness company that cultivates and sells introduced vegetables with shorter supply chain flows. Short supply chain has various benefits including lower prices and direct quality control by consumers. There are still various risks in the supply chain flow that unables PT. *Saribhakti Bumi Agri* to fulfill consumers' demand. This study identifies supply chain activities using the Supply Chain Operation Reference (SCOR) and identifies mitigation strategies with House of Risk (HOR) method. The results show that the risk that has the most severe impact are momotaro tomato were infected and plants did not grow, retail demand couldn't be fulfilled and products' quality couldn't meet the standard and decreasing interest of the product. The most effective mitigation action to be applied on every levels are conducting discussions between farm workers and the company regarding the SOP for the procurement and use of raw materials, evaluating the procurement of tools and materials and making market observations and consumer preferences more carefully.

## Introduction

Developing countries, including Indonesia, are having transformation in agrifood value chains and a globalised food markets in the last two decades [1]. Increasingly intense competition between countries demands agricultural sector to spur a new growth center that will give an impact on the national economy. Currently, one of the agricultural sub-sectors that has potential to be developed is horticulture [2]. Horticultural commodity also make the largest contribution to the national Gross Domestic Product (GDP) of the agriculture based trade sector (Table 1).

**Table 1:** GDP of the Agriculture-Based Trade Sector at Current Prices 2010-2014.

|  | GDP at Current Prices (Billion IDR) |        |        |        |        |
|--|-------------------------------------|--------|--------|--------|--------|
|  | 2010                                | 2011   | 2012   | 2013   | 2014   |
| 1. Food                                | 25,136                              | 26,347 | 28,314 | 30,640 | 33,098 |
| 2. Horticulture                        | 55,108                              | 61,410 | 65,162 | 71,137 | 75,649 |
| 3. Plantation                          | 7,563                               | 9,226  | 9,714  | 10,500 | 11,051 |
| 4. Animal Husbandary and Other Results | 34,104                              | 37,290 | 40,399 | 45,024 | 46,880 |

No. Sub-sector  
Source: [30].

Although the policy of developing horticultural commodities in Indonesia has led to an increase in production, it has not been in line with the dynamics of changes in consumer preferences and market demand. Consumer demands include the quality, size, appearance and various other factors that must be considered by farmers as producers [4]. Horticulture products in general have the following characteristics: (1) cultivation and harvest period are very dependent on season and climate, (2) perishable products, (3) products are difficult to transport and manage because of the complexity and size of the products and (4) quality may varies [5]. Also, the level of consumption of Indonesian people for horticulture products is still below the nutritional balance that should reach 70 kg/year per capita according to the Food Agriculture Organization (FAO).

In 2015-2016, the horticulture sector that experienced the highest production growth was vegetables. The increase in production will certainly have an impact on the increasing opportunity for population consumption of vegetables nationally [6]. The increasing amount of production is mainly due to the increase in planting area, but for some types of vegetables such as potatoes, cabbage and tomatoes, the application of introduced vegetable cultivation technology or upland vegetables has a significant impact on increasing production [7]. Introduced vegetable is a superior variety of vegetables originating from abroad which are generally

hybrid varieties. The development of introduced varieties usually begins with a series of studies to test production and adaptability in several regions in Indonesia [8]. Procurement of introduced vegetables is one way to increase competitiveness in the face of stiff competition in upland vegetable products in the domestic market [9]. Constraints that occur in introductory vegetable products or upland vegetables in Indonesia are the lack of supply, lack of continuity's guarantee of product quality, timeliness of delivery and supply chain performance that has not been effective and efficient [10].

West Java is the largest vegetable supplier in Indonesia with a percentage of 23%, followed by Central Java in second place with a percentage of 20% and East Java 14% (Central Statistics Agency) [9]. One type of vegetable plant in West Java that contributes the largest production to total vegetable production in Indonesia is tomato plants (General Directorate of Horticulture). The development of tomato production for three consecutive years (2014-2016) was dominated by West Java with production of 33.46% (Ministry of Agriculture).

Hernandez, conducted a study on the tomato supply chain in West Java and explained that there was one form of transformation implication in supply chain value that made direct sales of tomato farmers to supermarkets and large processing companies in Indonesia. Usually, the supply chain actors buy directly from farmers and process their products directly rather than relying on village intermediaries (tengkulak). Based on Parker's explanation in Aubry [11], the supply chain scheme is categorized as Short Supply Chain (SSC). The characteristics of SSC can be seen from the number of actors between producers and consumers that are very little or none at all. According to Casolani [12], the sustainability of SSC provides benefits in three different aspects, which are 1) environment: reduction in energy consumption and pollution, 2) economy: lower food prices for consumers and more profit for producers, 3) social: direct control of price and quality by consumers, easy control of product freshness, relationship of trust and information exchange with little or no intermediary between producers and consumers.

One of the agribusiness companies engaged in the development of introduced vegetables with the SSC system is PT. Saribhakti Bumi Agri located in Cicalengka District, Bandung Regency, West Java. Introduced vegetables kind which is also the biggest contributor to horticultural production in West Java is tomato originating from Japan called momotaro tomato. Premium kind of tomato sold almost 80% of the products in modern retail with price that's five-ten times higher because of its high standard of quality. That could be an opportunity for every parties involved in premium tomato supply chain [13]. Even though it has possibility of increasing the number of vegetable's consumption and product competitiveness, PT. Saribhakti Bumi Agri faces a variety of risks related to the application of SSC to introduced vegetable commodities, including 1) unable to meet the demand for their products coming from larger customers, 2) not being able to supply public institutions with consistent quality and appropriate amounts using their own products, 3) products that are produced prone to be considered too socially exclusive or for the middle class and 4) a small workforce and reliance on

individuals to do many tasks can result in overwork of workers [14].

Therefore, PT. Saribhakti Bumi Agri requires a performance measurement system as an approach to optimize the momotaro tomato supply chain network as well as a strategy that can regulate the supply of momotaro tomatoes to match the amount needed by retail [9]. Performance measurement aims to support design goals, evaluate performance and determine future steps both at the strategy and operational levels [15]. Strategies are also needed to improve the effectiveness and efficiency of product marketing [16].

## Materials and Methods

The object examined in this study is the management of short supply chain risk in momotaro tomato commodities. Research will be conducted at PT Saribhakti Bumi Agri, Kp. Cibatu, Tanjungwangi Village, Cicalengka District, Bandung Regency, West Java. Location selection is done purposively based on the consideration that PT Saribhakti Bumi Agri has its own characteristics, which are the application of a short supply chain system and the presence of several plant varieties which are rarely cultivated in West Java. This situation exposes the company to a variety of risks, such as the development of inadequate cultivation, production that does not meet retail demand and product quality that is not in accordance with retail criteria.

The design used in this study is a qualitative method with a qualitative-descriptive design. Primary data obtained from the results of the observation process in the field and interviews with informants. The informants are momotaro tomato farm laborers in PT. Sarihakti Bumi Agri, general manager of PT. Saribhakti Bumi Agri and purchasing managers retail company in Bandung. Secondary data are obtained from data collection institutions such as literature, journals, previous research and data from institutions or agencies such as the Central Bureau of Statistics, Department of Agriculture and archives of the Saribhakti Company.

Data analysis in this study used two analytical tools, descriptive analysis method and House of Risk. Descriptive analysis method is research conducted to determine the existence of independent variables, both one variable and more without making comparisons or connecting with other variables (Sugiyono). In this study, the independent variables and dependent variables are divided into two based on the stages of the House of Risk. In House of Risk phase 1, the independent variable consists of activity mapping based on SCOR, severity, occurrence and relationship and the dependent variable is the value of Aggregate Risk Potential (ARP).

House of Risk phase 1 connects needs (what) with a set of responses (how) where each response refers to one or more needs. The steps taken first is identifying any risks that may occur in every process/business activity. This can be done through mapping the process or activity of the actors involved in the supply chain of PT Saribhakti Bumi Agri based on the SCOR model (plan, source, make, deliver and return) and then identify what risks might occur in each process. Next is to assess the impact (severity) on each risk event that occurs.

The severity value ( $S_i$ ) states how much interference is caused by an event of risk to the business process of a company. For the assessment using a scale of 1 to 10 where 10 shows a very severe impact. Then, we identify risk agents and assess the likelihood of occurrence of each risk agent. The occurrence value states the level of chance of occurrence of a risk agent so that it raises the occurrence of a risk event or several events that can cause disruption to business processes with a certain level of impact. Risk agent denoted as  $O_j$ . The scale used is 1 to 10 where 1 means it's possibly won't ever happen and 10 means it is almost certain to occur. Lastly, identify the correlation between each risk agent and any risk events that occur at PT Saribhakti Bumi Agri. If a risk agent creates a risk, then there is a correlation between the two. The greater the correlation between a risk agent and the risk event, the greater the scale of value. Assessment of correlation in research is only done for the most impactful risks. The level of correlation is generally classified as no relationship (0), low (1), medium (3) and high (9). Then we can count the value of Aggregate Risk Potential (ARP)

Aggregate Risk Potential (ARP) is the result of possible risk agents and aggregate consequences of the occurrence of risks caused by risk agents. Rank risk agents based on  $ARP_j$  values from the largest to the smallest. The  $ARP_j$  calculation formula is as follows.

#### ARPj: $O_j \sum_i S_i R_{ij}$ Information:

ARPj: Aggregate Risk Potential

$O_j$ : Opportunity for risk agents to occur

$S_i$ : Impact of risk events

$R_{ij}$ : The level of connection between risk agents and the incidence of risk (correlation).

In House of Risk phase 2, the independent variable consists of sorting ARP values, mitigation actions, mitigation difficulties and the relationship between mitigation actions and risk agents and the dependent variable is the priority of risk mitigation actions. Select a number of risk agents with high priority ratings using pareto diagrams for  $ARP_j$  analysis. According to Pyzdek [17], the Pareto diagram is the process of giving a rating to determine potential opportunities that must be done first. The pareto application to risk is that 80 percent of losses are caused by only 20 percent of the crucial risk. If 20 percent of the risk can be handled, then the company can avoid 80 percent of the loss [18].

Determine the relationship between each preventive measure and each risk agent,  $E_{jk}$ . The value is {0, 1, 3, 9} which indicates that the value 0 means no correlation, 1 means weak correlation, 3 means moderate correlation and mitigation actions are effective enough to reduce the chance of occurrence of risk agents and 9 shows strong correlation and mitigation actions very effective in reducing the chance of the emergence of risk agents. Calculate the total effectiveness of each action with the following formula

#### Tek: $\sum_i ARP_j E_{jk}$ Information:

TE: Total Effectiveness

ARPj: Risk priority index

$E_{jk}$ : Value of correlation between mitigation actions and sources of risk

Assess the level of difficulty in carrying out each action ( $D_k$ ) and place the values below total effectiveness. The level of difficulty, which is represented by a scale (such as the Likert Scale), must reflect the source of funds and other resources needed in implementing the action. degree of difficulty using scales 3 to 5, where 3 shows that mitigation actions are considered quite difficult to do and 5 shows that mitigation actions are considered very difficult to do. Factors that affect the level of difficulty include funds, human resources, material, time and others. Lastly, calculate the total effectiveness of the ratio of difficulties with formula shown below and determine the priority order for each action ( $R_k$ ) where the first rank is the highest ETD value.

#### ETDk: TEk/Dk Information:

ETDk: The ratio of total effectiveness to difficulty

Tek: Total effectiveness

Dk: Level of difficulty

## Research Result

Momotaro Tomato Supply Chain Structure in PT. Saribhakti Bumi Agri.

The supply chain structure functions as a supplier of information, material, money and services from raw material suppliers to the end consumers through various factories and warehouses [6]. The structure of the supply chain for momotaro tomatoes can be seen in the following chart (Figure 1).

The flow that occurs in each momotaro tomato supply chain actor is as follows:

1. Warehouses and farm workers exchange information about the preparation needed for the production process. Farm workers make a list of the needs of production facilities such as fertilizers, seeds, drugs, pesticides etc. which are then handed over to the warehouse.
2. Because the packaging and warehouse houses are located in the same place, the packaging house will provide information about the target of the momotaro tomato harvest needed by the warehouse. After the planting period for farm workers is complete, the yield of momotaro tomatoes will be handed over to the packaging house. Farm workers will provide information on how many containers of momotaro tomatoes have been harvested. The packaging house will weigh, take photos and then record the results of the harvest. Farm workers will receive wage payments.

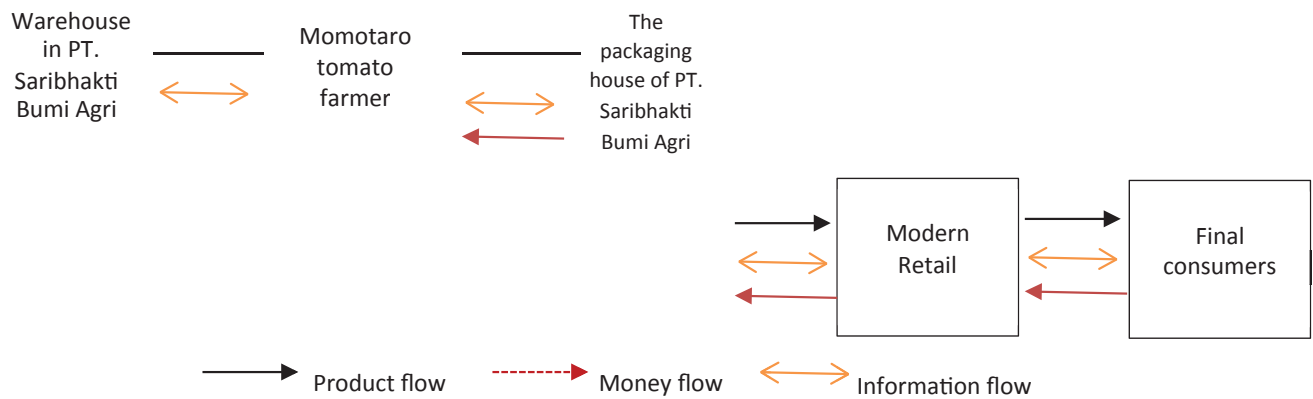


Figure 1: Momotaro Tomato Supply Chain Structure in PT. Saribhakti Bumi Agri.

- Modern retailers provide information about the amount of momotaro tomatoes needed (in kilograms) to the packaging house. Then the packaging house will adjust the amount of momotaro tomatoes available to pack. After the packaging process is complete, the packaging house of PT. Saribhakti Bumi Agri will make letter of delivery orders and purchase orders. Payment from retail to PT. Saribhakti Bumi Agri no later than two weeks after the purchase order is issued.
- Modern retailers then sell products that have been received from PT. Saribhakti Bumi Agri. The flow of information that occurs between modern retailers and end consumers is education about the benefits of momotaro tomatoes for consumer nutrition fulfillment needs. The final consumer buys momotaro tomato products from retail and retail get money from the purchase.

### Supply chain activities based on SCOR model

#### Activities at the Farmer Labor Level:

**1. Plan:** Planning activities at the farmer's level include planning the required production inputs, planning the production process and planning cultivation. In PT. Saribhakti Bumi Agri, momotaro tomatoes are cultivated using green houses. The use of a green house is an effort to avoid tomato plants from exposure to ultraviolet and infrared types of sunlight that make tomatoes black.

Production input planning includes the procurement of various production needs such as seeds, fertilizers, medicines and pesticides, equipment that supports and adjustments in the number of workers. This production input plan will later be addressed to each field coordinator to be subsequently submitted to farm workers.

Production process planning includes planting schedules and production targets. The planting schedule includes the time to start planting, maintenance time until the harvest period. Cultivation planning includes land preparation, seeding of tomato seeds, planting, maintenance and a gradual harvest process. Land preparation activities include processing land,

making beds and installing mulch. Maintenance activities include watering and irrigation, replanting, pressing, weed control, recycling, provision of supplementary fertilizers, installation of plants and control of plant disease pests.

**2. Source:** Sourcing activities carried out by farm workers include the procurement of production factors in the form of land, seeds, fertilizers, pesticides, supporting tools and labor. The land where the greenhouse was built was rented by PT. Saribhakti Bumi Agri from the district government of Bandung Regency with a rental fee of Rp 5,000,000/ hectare/ year. Farm workers get seeds from the nursery. The seeds sown are F1 seeds obtained directly from Japan as many as 200 seeds at a price of IDR 4.000/ seed. Workers who work on land or green houses are residents of the vicinity of Cibatu Village. Working hours per day on land starts from 07.00 - 12.00, interspersed with a one-hour break and then resumes from 1:00 p.m. to 3:00 p.m.

**3. Make:** Momotaro's tomato production at the farmer's level starts with seedling, planting preparation, planting, maintenance, harvesting and post-harvest. Before starting the production process, farm workers are usually given guidance and training in advance by the zone head. The production process at the farm level is the most important stage because if there is a risk that cannot be overcome, it will affect the sustainability of the supply chain at the next stage.

Constraints that occur during the production process are usually the effects of the procurement process, such as tomato plants whose growth is not as expected because the seeds are of inadequate quality and the handling of tomatoes affected by the disease is too late so the number of qualified products decreases.

**4. Deliver:** Distribution is the transfer of crops from the green house to the packaging house of PT. Saribhakti Bumi Agri. The crops are moved by being carried by male farm laborers using vegetable containers. Constraints that occur in the distribution process are the unavailability of transport vehicles while harvesting from the green house to the packaging house is 300 meters away with steep and rocky lanes. This can pose a risk of workforce accidents considering the burden carried

by each farm worker is quite heavy or the product is damaged during distribution.

**5. Return:** The crops which are then sorted in the packaging house will be adjusted according to the grade. There is no return of products from packaging houses to farm workers.

#### Activities at the Modern Retail Level

**1. Plan:** Planning carried out includes planning the procurement of products and the amount needed and pricing. For the procurement of own products, demand planning is uncertain. Within a month the request can be done 3–6 times with the distance of days on each request ranging from 3–7 days. The number of requests requested ranges from 50kg to 1 ton per month. The price offered by retail is IDR 28,000/ pack.

**2. Source:** Procurement activities carried out are the procurement of raw materials. The procurement of raw materials is carried out by PT. Saribhakti Bumi Agri through the delivery of momotaro tomatoes.

**3. Make:** Production activities are carried out entirely by PT. Saribhakti Bumi Agri, so there is no production process in retail activities. Retailers only check the momotaro tomatoes received.

**4. Delivery:** Retailers only need to wait for the product to be given because the momotaro tomato distribution process is carried out by PT. Saribhakti Bumi Agri.

**5. Return:** PT. XYZ rarely returns products because there are contracts regarding quality and PT. Saribhakti Bumi Agri is considered capable of maintaining the quality of the products provided.

#### Risk management in the momotaro tomato supply chain with the house of risk (HOR) method

*Analysis of House of Risk 1 at the Farmer Labor Level (Table 2–5).*

*Analysis of House of Risk 2 at the Farmer Labor Level.*

Based on calculations using the Pareto diagram, there are four risk agents that are prioritized for handling, namely the procurement of drugs and pesticides that are often late, plant pests and diseases, difficulty in obtaining good quality seeds (F1) and inappropriate cultivation techniques. From these risk sources, several mitigation plans are determined as shown in Table 6.

Based on the calculations in **Appendix 1**, mitigation actions with the largest ETDk value and priority to be carried out are conducting discussions between farm workers and the company regarding the SOP for the procurement and use of raw materials with a value of 12,871.

*Analysis of House of Risk 1 at the Packaging House Level (Table 7–10).*

*Analysis of House of Risk 2 at the Packaging House Level*

Based on the pareto calculation at HOR 1 at the packaging

**Table 2:** List of Risk Events in the Supply Chain Process at the Farmer Labor Level.

| No. | Risk Event (Event Risk)                                   | Code | Impact Severity (Si) |
|-----|---|------|----------------------|
| 1.  | Limited seed procurement                                  | E1   | 6                    |
| 2.  | Ineffective use of drugs and pesticides                   | E2   | 9                    |
| 3.  | Poor seed quality   | E3   | 8                    |
| 4.  | Overloaded work capacity                                  | E4   | 7                    |
| 5.  | Momotaro tomato plants are attacked by pests and diseases | E5   | 9                    |
| 6.  | Momotaro tomato plants do not grow                        | E6   | 9                    |
| 7.  | The quality of momotaro tomatoes decreases                | E7   | 8                    |
| 8.  | Depreciation of the Momotaro tomato harvest               | E8   | 7                    |
| 9.  | Cultivation is not in accordance with the SOP             | E9   | 5                    |
| 10. | Momotaro tomatoes are damaged during distribution         | E10  | 5                    |
| 11. | Momotaro tomatoes are rotten                              | E11  | 4                    |
| 12. | An accident happened to farm workers                      | E12  | 5                    |

**Table 3:** List of Risk Agent in the Supply Chain Process at the Farmer Labor Level.

| No. | Risk Agent (Source Risk)   | Code | Occurrence Rate (Oj) |
|-----|--|------|----------------------|
| 1.  | Lack of workforce  | A1   | 7                    |
| 2.  | Policy regarding the procurement of production inputs              | A2   | 9                    |
| 3.  | Difficulty in obtaining good quality seeds (F1)                    | A3   | 8                    |
| 4.  | Procurement of drugs and pesticides is often late                  | A4   | 9                    |
| 5.  | Climate and uncertain weather                                      | A5   | 4                    |
| 6.  | There is no SOP agreement between companies and farm workers       | A6   | 6                    |
| 7.  | Inappropriate cultivation techniques                               | A7   | 7                    |
| 8.  | Plant pests and diseases   | A8   | 8                    |
| 9.  | Remote distribution path   | A9   | 5                    |
| 10. | Distribution path is broken  | A10  | 6                    |
| 11. | There is no transportation to carry the crops                      | A11  | 6                    |
| 12. | The incompatibility of land conditions with momotaro tomato plants | A12  | 5                    |

house level, it was identified that there were five priority sources of risk, namely the lack of the tools used for the production process, manual sorting process, the number of production that did not meet the target, input prices tend to be high and lack of human resource. From these risk sources, several mitigation plans are determined as shown in Table 11.

Based on the calculations in the stage 2 HOR table (**Appendix 2**), the priority mitigation actions to be taken are evaluating the procurement of tools and materials (PA1). This evaluation must be carried out in two directions between company officials and employees who work. It aims to harmonize the planning and financing of procurement of additional tools and materials carried out by the company's stakeholders with the effectiveness of the work performed by employees. The hope, the capital issued by the company is able to improve employee performance so that the company can meet demand from retail.

*Analysis of House of Risk 1 at the Modern Retail Level (Table 12–15).*

**Table 4:** Table of House of Risk Phase 1 at the Farmer Labor Level.

| Risk Event                 | Risk Agent |     |      |      |     |     |     |      |     |     |     |     | Severity of Risk Event (Si) |
|----------------------------|------------|-----|------|------|-----|-----|-----|------|-----|-----|-----|-----|-----------------------------|
|                            | A1         | A2  | A3   | A4   | A5  | A6  | A7  | A8   | A9  | A10 | A11 | A12 |                             |
| E1                         | 0          | 3   | 9    | 0    | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 6                           |
| E2                         | 0          | 1   | 0    | 9    | 0   | 0   | 0   | 1    | 0   | 0   | 0   | 0   | 9                           |
| E3                         | 0          | 3   | 9    | 0    | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 8                           |
| E4                         | 3          | 1   | 0    | 0    | 0   | 0   | 0   | 0    | 0   | 0   | 0   | 0   | 7                           |
| E5                         | 0          | 0   | 0    | 9    | 1   | 0   | 1   | 9    | 0   | 0   | 0   | 0   | 9                           |
| E6                         | 0          | 1   | 9    | 9    | 0   | 0   | 3   | 9    | 0   | 0   | 0   | 3   | 9                           |
| E7                         | 1          | 1   | 3    | 9    | 3   | 1   | 9   | 9    | 0   | 1   | 1   | 1   | 8                           |
| E8                         | 1          | 3   | 3    | 3    | 1   | 0   | 3   | 9    | 1   | 1   | 1   | 3   | 7                           |
| E9                         | 0          | 0   | 0    | 0    | 0   | 9   | 0   | 0    | 0   | 0   | 0   | 0   | 5                           |
| E10                        | 0          | 0   | 0    | 0    | 1   | 0   | 0   | 0    | 9   | 9   | 9   | 0   | 5                           |
| E11                        | 0          | 0   | 1    | 3    | 1   | 0   | 1   | 3    | 0   | 0   | 0   | 0   | 4                           |
| E12                        | 1          | 0   | 0    | 0    | 0   | 3   | 0   | 0    | 3   | 0   | 0   | 0   | 5                           |
| Occurrence of Agent j      | 7          | 9   | 8    | 9    | 3   | 6   | 7   | 8    | 5   | 6   | 6   | 5   |                             |
| Aggregate risk Potential j | 287        | 864 | 2048 | 3132 | 147 | 408 | 931 | 2544 | 335 | 450 | 360 | 280 |                             |
| Ranking                    | 10         | 5   | 3    | 1    | 12  | 7   | 4   | 2    | 9   | 6   | 8   | 11  |                             |

**Table 5:** Pareto Table at the Farmer Labor Level.

| Agen Risiko | ARP   | Peringkat | %ARP   | %Kum. ARP | Kategori      |
|-------------|-------|-----------|--------|-----------|---------------|
| A4          | 3132  | 1         | 26,574 | 26,574    | Prioritas     |
| A8          | 2544  | 2         | 21,585 | 48,159    |               |
| A3          | 2048  | 3         | 17,377 | 65,535    |               |
| A7          | 931   | 4         | 7,899  | 73,435    |               |
| A2          | 864   | 5         | 7,331  | 80,765    |               |
| A10         | 450   | 6         | 3,818  | 84,584    | non prioritas |
| A6          | 408   | 7         | 3,462  | 88,045    |               |
| A11         | 360   | 8         | 3,054  | 91,100    |               |
| A9          | 335   | 9         | 2,842  | 93,942    |               |
| A1          | 287   | 10        | 2,435  | 96,377    |               |
| A12         | 280   | 11        | 2,376  | 98,753    |               |
| A5          | 147   | 12        | 1,247  | 100       |               |
| Jumlah      | 11786 |           |        |           |               |

*Analysis of House of Risk 2 at the Modern Retail Level*

Based on the results of the Pareto calculation, there are five risk agents that are priorities in handling. The five priority risk agents will be given a mitigation strategy through HOR phase 2. The handling will be given a discussion with the head of retail purchasing. The following is a table that shows some mitigation actions against priority risk agents that are expected to reduce the chance of such risks (Table 16).

Based on the calculation of HOR phase 2 (Appendix 3), the mitigation action that will take precedence over its application is to make market observations and consumer preferences more carefully (PA5). With the observation of the market and consumer preferences, it is likely that each other risk agent can be overcome. Thus, retail also has another alternative to meeting consumer demand if indeed there are obstacles that occur along the momotaro tomato supply chain.

## Summary and Conclusion

### Conclusion

Based on the results of research and discussion on Risk Management in Short Supply.

Chain (SSC) Momotaro Tomato Commodities at PT. Saribhakti Bumi Agri, Kecamatan Cicalengka, Kabupaten Bandung that has been done, then the following are the conclusions obtained.

1. Identified risk events and at the level of potential harmful impacts on the momotaro tomato supply chain at the farmer's level are ineffective use of drugs and pesticides, momotaro tomato plants attacked by pests and diseases and momotaro tomato plants that do not grow at the packaging house the risk that has the highest potential severity impact is unmet retail demand and the quality of the product being distributed is not appropriate. The risk event that has the most detrimental impact on the retail level is that momotaro tomatoes are not in demand anymore and there is an excess product availability. The risk source that most often causes risks to occur at the farm laborer's level is the policy regarding the procurement of production inputs and the procurement of drugs and pesticides are often late. For packaging houses, there is a lack of equipment used for the production process and the amount of production that does not meet the target. Whereas at the retail level, the quality of momotaro tomatoes is not appropriate and the quantity does not meet demand.
2. The priority risks to be addressed at the farmer's level are the procurement of drugs and pesticides often late, plant pests and diseases, the difficulty of obtaining good quality seeds (F1) and inappropriate cultivation techniques. Furthermore, at the level of packaging

**Table 6:** Mitigation Actions at the Farmer Labor Level.

| Code | Risk Agent                                    |           |             | Code | Mitigation Action  |
|------|---|-----------|-------------|------|--|
| A4   | Procurement of drugs pesticides is often late |           | and         | PA1  | Conduct discussions between farm laborers and companies regarding SOPs for procurement and use of raw materials          |
|      |   |           |             | PA2  | Do further research on momotaro tomatoes   |
|      |   |           |             | PA3  | Conducting routine and scheduled mentoring and supervision from the company on the process of planting momotaro tomatoes |
|      |   |           |             | PA4  | Looking for alternative raw materials  |
| A8   | Plant pests and diseases                      |           |             | PA1  | Conduct discussions between farm laborers and companies regarding SOPs for procurement and use of raw materials          |
|      |   |           |             | PA5  | Hold or attend training and counseling held by institutions or agricultural institutions.                                |
|      |   |           |             | PA6  | Distribute drugs and pesticides to farm workers prior to the planting process  |
| A3   | Difficulty in quality seeds (F1)              | obtaining | good        | PA2  | Do further research on momotaro tomatoes   |
|      |   |           |             | PA4  | Looking for alternative raw materials  |
|      |   |           |             | PA7  | Registering momotaro tomatoes to the relevant authorities  |
|      |   |           |             | PA8  | Import large quantities of seeds   |
| A7   | Inappropriate techniques                      |           | cultivation | PA1  | Conduct discussions between farm laborers and companies regarding SOPs for procurement and use of raw materials          |

**Table 7:** List of Risk Events in the Supply Chain Process at the Packaging House Level.

| No. | Risk Event (Event Risk)  | Code | Impact Severity (Si) |
|-----|--|------|----------------------|
| 1.  | Retail demand is not fulfilled   | E1   | 9                    |
| 2.  | The number of products marketed is limited                                     | E2   | 7                    |
| 3.  | The workforce works beyond its capacity  | E3   | 8                    |
| 4.  | Retail violates or breaks the contract in the middle of the cooperation period | E4   | 6                    |
| 5.  | Provision of late production   | E5   | 6                    |
| 6.  | Delays in delivery   | E6   | 7                    |
| 7.  | Late payment from retail   | E7   | 5                    |
| 8.  | Momotaro tomatoes are rotten at storage  | E8   | 5                    |
| 9.  | Products damaged during distribution   | E9   | 8                    |
| 10. | The quality of product distributed is not appropriate                          | E10  | 9                    |
| 11. | The selling price of momotaro tomatoes is volatile                             | E11  | 6                    |

**Table 8:** List of Risk Agent in the Supply Chain Process at the Packaging House Level.

| No. | Risk Agent (Source Risk)                                 | Code | Occurrence Rate (Oj) |
|-----|--|------|----------------------|
| 1.  | Lack of human resources                                  | A1   | 8                    |
| 2.  | Lack of numbers of tools used for the production process | A2   | 9                    |
| 3.  | Long distances to obtain production inputs               | A3   | 7                    |
| 4.  | Manual sorting process                                   | A4   | 8                    |
| 5.  | Delay in issuing invoices by companies                   | A5   | 6                    |
| 6.  | Government policies and regulations                      | A6   | 7                    |
| 7.  | Inadequate infrastructure                                | A7   | 6                    |
| 8.  | HR is not thorough in the sorting process                | A8   | 6                    |
| 9.  | The amount of production that does not meet the target   | A9   | 9                    |
| 10. | The price of input tends to be high                      | A10  | 8                    |

house is the lack of the number of tools used for the production process, manual sorting process, number of production that does not meet the target, input prices tend to be high and lack of human resources. At the retail level, the priority is the quantity does not meet demand, the increase in purchase prices, the distance of shipping is far away, there is an error in demand forecasting and the marketing strategy is not appropriate.

- The most effective mitigation action to be applied at the farm laborer level is conducting discussions between farm workers and the company regarding the SOP for the procurement and use of raw materials. Risk management which is a priority at the packaging house level is to evaluate the procurement of tools and materials. At the retail level, the priority mitigation strategy to be implemented is to make market observations and consumer preferences more carefully.

### Suggestion

Based on the research that has been carried out along the momotaro tomato supply chain, suggestions that can be recommended are as follows:

- PT. Saribhakti Bumi Agri needs to discuss the making of a clear SOP regarding the procurement and use of raw materials. The preparation of this SOP should be carried out together with farm workers who are involved and present representatives from related institutions or agricultural institutions. This is done to curb the time of providing raw materials to farm workers to avoid shrinking the quality and quantity of momotaro's tomato production.
- Some problems that are actually crucial are still not communicated between momotaro's tomato supply

**Table 9:** Table of House of Risk Phase 1 at Packaging House Level.

| Risk Event                 | Risk Agent |      |     |      |     |     |     |     |      |      | Severity of Risk Event (Si) |
|----------------------------|------------|------|-----|------|-----|-----|-----|-----|------|------|-----------------------------|
|                            | A2         | A1   | A4  | A5   | A6  | A7  | A8  | A9  | A10  |      |                             |
| E1                         | 3          | 9    | 3   | 3    | 0   | 1   | 1   | 1   | 9    | 0    | 9                           |
| E2                         | 0          | 3    | 0   | 0    | 0   | 1   | 0   | 0   | 3    | 9    | 7                           |
| E3                         | 9          | 9    | 1   | 9    | 0   | 0   | 0   | 3   | 0    | 0    | 8                           |
| E4                         | 0          | 0    | 0   | 0    | 1   | 0   | 0   | 0   | 3    | 0    | 6                           |
| E5                         | 0          | 0    | 9   | 0    | 0   | 0   | 1   | 0   | 0    | 3    | 6                           |
| E6                         | 0          | 1    | 0   | 1    | 0   | 0   | 1   | 0   | 0    | 0    | 7                           |
| E7                         | 0          | 0    | 0   | 0    | 9   | 0   | 0   | 0   | 0    | 0    | 5                           |
| E8                         | 0          | 0    | 0   | 0    | 0   | 0   | 3   | 3   | 0    | 0    | 5                           |
| E9                         | 0          | 0    | 0   | 3    | 0   | 0   | 9   | 1   | 0    | 0    | 8                           |
| E10                        | 0          | 3    | 0   | 9    | 0   | 0   | 1   | 9   | 3    | 0    | 9                           |
| E11                        | 0          | 0    | 0   | 0    | 0   | 1   | 0   | 0   | 3    | 9    | 6                           |
| Occurrence of Agent j      | 8          | 9    | 7   | 8    | 6   | 7   | 6   | 6   | 9    | 8    |                             |
| Aggregate Risk Potential j | 832        | 1872 | 623 | 1688 | 306 | 259 | 708 | 822 | 1620 | 1200 |                             |
| Ranking                    | 5          | 1    | 8   | 2    | 9   | 10  | 7   | 6   | 3    | 4    |                             |

**Table 10:** Pareto Table at the Farmer Labor Level.

| Agen Risiko | ARP  | Peringkat | %ARP   | %Kum. ARP | Kategori      |
|-------------|------|-----------|--------|-----------|---------------|
| A2          | 1872 | 1         | 18,852 | 18,852    |               |
| A4          | 1688 | 2         | 16,999 | 35,851    | Prioritas     |
| A9          | 1620 | 3         | 16,314 | 52,165    |               |
| A10         | 1200 | 4         | 12,085 | 64,250    |               |
| A1          | 832  | 5         | 8,379  | 72,628    |               |
| A8          | 822  | 6         | 8,278  | 80,906    | non prioritas |
| A7          | 708  | 7         | 7,131  | 88,036    |               |
| A3          | 623  | 8         | 6,274  | 94,310    |               |
| A5          | 306  | 9         | 3,082  | 97,392    |               |
| A6          | 259  | 10        | 2,608  | 1,00,000  |               |
|             | 9930 |           | 100    |           |               |

**Table 11:** Mitigation Actions at the Packaging House Level.

| Code | Risk Agent   | Code | Mitigation Action  |
|------|--|------|--|
| A2   | Lack of numbers of tools used for the production process | PA1  | Conduct evaluation of procurement of tools and materials                     |
|      |  | PA2  | Allocate funds to add production tools                                       |
| A4   | Manual sorting process                                   | PA3  | Plan to procure technology to support the production process                 |
|      |  | PA4  | Increase the number of workers and determine the work station of each person |
| A9   | The amount of production that does not meet the target   | PA1  | Conduct evaluation of procurement of tools and materials                     |
|      |  | PA3  | Plan to procure technology to support the production process                 |
|      |  | PA5  | Making SOPs based on agreements between farm workers and the company         |
|      |  | PA6  | Supervise and assist from planting to post-harvest                           |
| A10  | The price of input tends to be high                      | PA1  | Conduct evaluation of procurement of tools and materials                     |
| A11  | Lack of human resources                                  | PA4  | Increase the number of workers and determine the work station of each person |

**Table 12:** List of Risk Events in the Supply Chain Process at the Retail Level.

| No. | Risk Event (Event Risk)                                    | Code | Impact Severity (Si) |
|-----|--|------|----------------------|
| 1.  | Delays in delivery   | E1   | 7                    |
| 2.  | Availability of thinned momotaro tomatoes                  | E2   | 8                    |
| 3.  | The price of buying momotaro tomatoes per kilo is volatile | E3   | 7                    |
| 4.  | Product returns occur                                      | E4   | 6                    |
| 5.  | Availability of excess momotaro tomatoes                   | E5   | 9                    |
| 6.  | Momotaro tomatoes are no longer in demand                  | E6   | 9                    |
| 7.  | High shipping costs  | E7   | 7                    |

**Table 13:** List of Risk Events in the Supply Chain Process at the Retail Level.

| No. | Risk Agent (Source Risk)                            | Code | Occurrence Rate (Oj) |
|-----|---|------|----------------------|
| 1.  | There was an error forecasting the request          | A1   | 8                    |
| 2.  | Increased purchase prices                           | A2   | 6                    |
| 3.  | Marketing strategy is not yet appropriate           | A3   | 6                    |
| 4.  | Termination of cooperation                          | A4   | 5                    |
| 5.  | The quality of momotaro tomatoes is not appropriate | A5   | 9                    |
| 6.  | Quantity does not meet demand                       | A6   | 9                    |
| 7.  | Packaging damage                                    | A7   | 5                    |
| 8.  | Product damage                                      | A8   | 7                    |
| 9.  | Distant shipping distance                           | A9   | 6                    |

chain actors from workers to the company. Therefore a joint evaluation is needed between companies, farm workers and packaging staff. The things that need to be evaluated on each actor are the tools which are in fact still inadequate, the schedule for giving drugs and pesticides that are still late, working hours that exceed the time limit, the need for permanent contracts for day laborers, the lack of permanent labor especially in packaging houses, as well as the unavailability of good quality seeds continuously so that the continuity



**Table 14:** Table of House of Risk Phase 1 at Retail Level.

| Risk Event                 | Risk agent |     |     |     |     |      |    |     |     | Severity of Risk Event (Si) |
|----------------------------|------------|-----|-----|-----|-----|------|----|-----|-----|-----------------------------|
|                            | A1         | A2  | A3  | A4  | A5  | A6   | A7 | A8  | A9  |                             |
| E1                         | 0          | 0   | 0   | 0   | 0   | 0    | 0  | 0   | 9   | 7                           |
| E2                         | 1          | 9   | 0   | 9   | 1   | 1    | 0  | 0   | 0   | 8                           |
| E3                         | 0          | 3   | 0   | 0   | 1   | 3    | 0  | 0   | 0   | 7                           |
| E4                         | 0          | 0   | 0   | 0   | 9   | 9    | 3  | 9   | 0   | 6                           |
| E5                         | 9          | 0   | 3   | 0   | 0   | 3    | 0  | 0   | 0   | 9                           |
| E6                         | 0          | 3   | 9   | 0   | 0   | 3    | 0  | 0   | 0   | 9                           |
| E7                         | 0          | 1   | 0   | 0   | 0   | 0    | 0  | 0   | 9   | 7                           |
| Occurrence of Agent j      | 8          | 6   | 6   | 5   | 9   | 9    | 5  | 7   | 6   |                             |
| Aggregate Risk Potential j | 712        | 762 | 648 | 360 | 321 | 1233 | 90 | 378 | 756 |                             |
| Ranking                    | 4          | 2   | 5   | 8   | 6   | 1    | 9  | 7   | 3   |                             |

**Table 15:** Pareto Table at the Modern Retail Level.

| Agen Risiko | ARP  | Peringkat | %ARP     | %Kum.ARP | Kategori      |
|-------------|------|-----------|----------|----------|---------------|
| A6          | 1233 | 1         | 22,140   | 22,1     | Prioritas     |
| A2          | 762  | 2         | 13,683   | 35,8     |               |
| A9          | 756  | 3         | 13,575   | 49,4     |               |
| A1          | 712  | 4         | 12,785   | 62,2     |               |
| A3          | 648  | 5         | 11,636   | 73,8     |               |
| A5          | 621  | 6         | 11,151   | 85,0     | non prioritas |
| A8          | 378  | 7         | 6,788    | 91,8     |               |
| A4          | 369  | 8         | 6,626    | 98,4     |               |
| A7          | 90   | 9         | 1,616    | 100,0    |               |
|             | 5569 |           | 1,00,000 |          |               |

**Table 16:** Mitigation Action at the Modern Retail Level.

| Code | Priority Risk Agent                        | Code | Mitigation Action  |
|------|--|------|--|
| A6   | Quantity does not meet demand              | PA1  | Looking for products that can substitute momotaro tomatoes               |
| A2   | Increased purchase prices                  | PA2  | Implement a promotion system that is beneficial for consumers and retail |
| A9   | Distant shipping distance                  | PA3  | Allocate more costs for shipping funding                                 |
| A1   | There was an error forecasting the request | PA2  | Implement a promotion system that is beneficial for consumers and retail |
|      |  | PA4  | Looking for partners who are willing to accommodate excess products      |
|      |  | PA5  | Make market observations and consumer preferences more carefully         |
| A3   | Marketing strategy is not yet appropriate  | PA2  | Implement a promotion system that is beneficial for consumers and retail |
|      |  | PA5  | Make market observations and consumer preferences more carefully         |

of momotaro's tomato production is hampered. This evaluation should involve outside parties as mediators from the three parties.

- Further research is needed regarding the alternative of momotaro tomato seeds in addition to having to import

from Japan. As well as the need to register products so that there is no difficulty in obtaining momotaro tomato seeds.

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