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RESEARCH ARTICLE

The Effect of Climate Change on the Shallot Supply Chain: Impact and Risk Management Strategy

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ABSTRACT

To overcome the influence of climate change on the shallot supply chain, mitigation and adaptation efforts are needed that involve various stakeholders, including farmers, government, research institutions and markets and no less important are risk management strategies. This research aims to describe the influence of climate change on the shallot supply chain. Apart from that, the impacts and risk management strategies are also discussed. To achieve this goal, the literature study research method is used. Literature study allows researchers to understand the issue or phenomenon being researched thoroughly in this context, the influence of climate change on the shallot supply chain, by analyzing existing works and finding relevant findings. The results of the research show that the influence of climate change on the shallot supply chain is very significant compared to other factors such as shallots being easily damaged and rotten, having the potential to be attacked by pests and diseases both during storage and cultivation, easily experiencing scale shrinkage, and fluctuating prices. However, appropriate, comprehensive and disciplined risk management mitigation strategies can reduce the impact of disrupting the shallot supply chain. The author recommends the use of risk management standards, namely ISO 31000:2009. ISO 31000 is a guide to managing risk which is defined as a framework that provides the basis or principles and organizational structure for designing, implementing, monitoring, reviewing and continuously improving risk management throughout the organization.

INTRODUCTION

An unstable climate can affect shallot production because this plant is sensitive to changes in temperature, rainfall and humidity. Climate changes such as increasing temperatures, irregular rain patterns, or drought can reduce crop yields or cause crop failure, which in turn reduces the availability of shallots on the market (Busthanul et al., 2023). Climate change can also affect onion quality. For example, higher temperatures can affect the color, taste, and texture of shallots. Increased humidity can also increase the risk of disease and infection, which can affect onion quality (Islam et al., 2019; Belo et al., 2023). Production disruptions due to climate change can cause fluctuations in shallot prices. If production decreases due to extreme weather or climate-related natural disasters, onion prices are likely to rise as demand remains high while supply decreases.

Climate change will not only affect local production, but also the global shallot market. Since shallots are an internationally traded commodity, climate change in major producing countries can also impact supply and prices in global markets (Hasanah et al., 2023; Nurhayati et al, 2022; Soyet et al., 2023). Food security and food security by reducing the availability of shallots due to threatening climate change, which is an important source of nutrition and income for many farmers and communities.

Shallots are a horticultural commodity which is classified as a spice vegetable, where this commodity is quite important as a source of income for farmers and state income (Fadzil et al., 2023), which means that shallot products make a huge contribution to society and the country, because apart from being marketed domestically, this commodity is also exported abroad. This shallots commodity has many uses, especially in the household consumption sector, including as a cooking spice to add flavor to dishes, a complementary ingredient for food and medicine for certain diseases (Taviani, 2019), so that this commodity can be classified as one of the main basic needs considering its role.

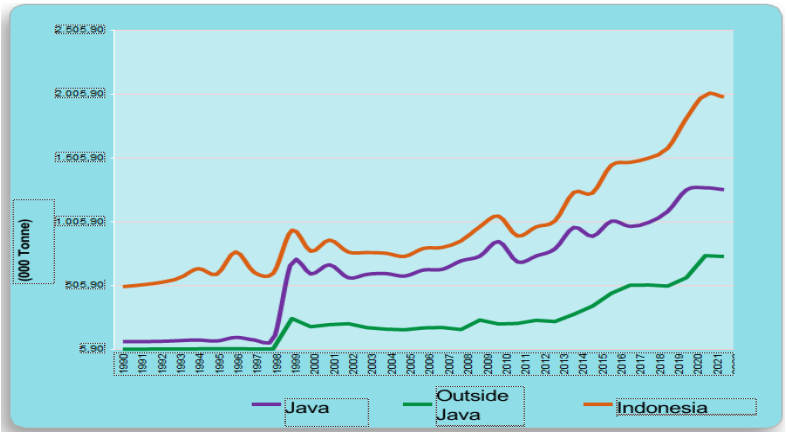

Figure 1: Progress of Indonesian shallot production, 1990–2022

Source: (Pusat Data dan Sistem Informasi Pertanian Kementerian Pertanian Republik Indonesia, 2023)

Growth in shallot production for the period from 1990 to 2022 was 5.31% per year, while for the last five years it was 6.31% per year. The average growth rate of harvested area is 3.69% per year for the 1990-2021 period and 3.45% per year in 2018-2022. And the average productivity for the 1990-2022 period was 1.51% and for the last five years was 2.92% per year. If we compare the growth rates for harvested area and productivity growth in relation to production growth rates, it is possible that the increase in shallot production is more influenced by the increase in harvested area than influenced by productivity because the average rate of growth in harvested area is slightly higher than the average rate of productivity growth.

Currently, consumption of shallots tends to increase along with the increase in population, the increasing variety of dishes using shallots, and the development of the processing industry and the need for quality shallot seeds (Rabinowitch, 2021). One of the plans for developing shallot agribusiness is prioritizing post-harvest handling and processing to increase added value. This is done because shallots are a source of income for farmers and the country's economy. Even though market prices often fluctuate sharply, the shallot business remains a mainstay for farmers (especially in the dry season) and can generate high profits (Pakhruddin et al., 2022; Mihrani et al, 2023). Demand for shallots continues to increase, not only in the domestic market, but also has the opportunity for export.

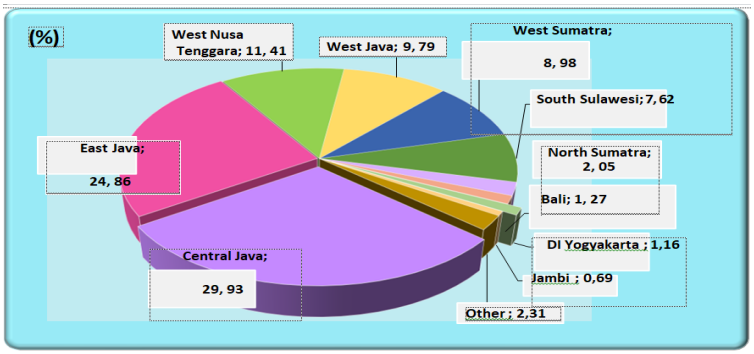

Figure 2: Shallot production center province in Indonesia, 2018-2022

Source: (Pusat Data dan Sistem Informasi Pertanian Kementerian Pertanian Republik Indonesia, 2023)

The need for shallots continues to increase along with increasing population and purchasing power (Basuki et al., 2021; Dewayanti et al., 2022). But there are several obstacles in the shallot business. One of the main obstacles is the occurrence of erratic price fluctuations. Price fluctuations cannot be guaranteed, depending on market conditions. Each region generally has different market conditions, resulting in price differences between one region and another.

One of the causes of this problem is the dependence of production on the season. In the harvest season, production is abundant, while in the lean season the opposite occurs. Abundant production will cause market prices to fall because supply levels are greater than demand. The situation will change to the opposite if the amount of production is lower than required, causing prices to rise. Seeing this and considering that shallots are a perishable product, the establishment of a shallot commodity-based industry has quite high prospects. Shallots can be processed in such a way that they have added value (Arsanti & Böhme, 2013; Rahmawati et al., 2018). This is an effort to meet people's needs for shallots and avoid price fluctuations caused by erratic production.

Climate change can cause changes in average temperature, rainfall patterns, and extreme weather events such as floods, droughts, and strong winds (Susanto et al., 2020). All of this can have a negative impact on horticultural production and the quality of the crop. Unexpected climatic conditions can disrupt plant growth and development processes, cause significant production losses, and even threaten the sustainability of the horticulture sub-sector in Enrekang Regency. In this context, it is very important to carry out a comprehensive study of the influence of climate change on the production of shallots, potatoes and cabbage in Enrekang Regency (Ariqoh et al., 2023). With a deep understanding of the impacts of climate change, appropriate adaptations can be implemented to mitigate the risks faced by farmers and the agricultural sector, especially the horticulture sub-sector as a whole. And will provide useful insights for policy makers in designing effective strategies to reduce the vulnerability of horticultural production to climate change. On a global scale, Indonesia has also committed to facing the challenges of climate change by adopting mitigation and adaptation strategies (Djalante & Thomalla, 2012; Asbur et al, 2024). This research will provide important participation on a national scale, by providing the scientific evidence needed to inform policy and adaptation measures at local to national levels.

RESEARCH METHODS

This research uses a literature study research method. The use of the literature study research method allows researchers to understand the issue or phenomenon being researched thoroughly in this context (Riege, 2003). The Influence of Climate Change on the Shallot Supply Chain, by analyzing existing works and finding relevant findings. By reviewing extensive literature, researchers can gain in-depth insight into the topic under study, including existing theories, concepts, and important findings (Wolfswinkel et al., 2013). Through literature studies, researchers can identify gaps in existing knowledge or unanswered research questions, which can then become the focus of their research (Nyanchoka et al., 2019). Thus, library research is a research method carried out by studying and analyzing existing written works, such as books, scientific journals, articles and other sources that are relevant to the topic being studied (Gauchi Risso, 2016). The main goal is to reorganize existing information, synthesize previously published views and findings, and identify knowledge gaps or unanswered research questions. This method allows the researcher to gain a better understanding of the subject under study, identify trends and patterns in the literature, and establish a strong theoretical basis for the research.

RESULTS AND DISCUSSION

The Effect of climate change on the shallot supply chain

The top of this supply chain is the shallot farmer or producer (Gumilar et al., 2023). They are responsible for planting, caring for, and harvesting shallots. After harvest, shallots are collected and transported to processing plants or local markets. This can be done by farmers themselves or by third parties such as wholesalers. Transportation vehicles that carry shallots from the fields to processing places or markets. At this stage, shallots can be further processed, such as cleaning, breaking, or packaging, before being distributed to local, regional, or national markets. Then, a processing plant or packaging facility where the shallots are processed and prepared for distribution. The shallots are

then sold to consumers in traditional markets, supermarkets, restaurants or street vendors. Finally, shallots are used by consumers in their cooking at home, restaurants, or other eating places. People (consumers) are people who cook or eat food that uses shallots as an ingredient.

Table 1: Impact of climate change on the shallot supply chain

Parameter	Impact of Climate Change	Implications
1. Shallot Production	Decreasing crop yields due to changes in rain patterns and extreme temperatures	The availability of shallots in local markets has decreased
2. Quality of Shallots	Risk of quality degradation due to higher temperatures or unstable humidity	Inconsistent quality of shallots causes price drops
3. Price of Shallots	Price fluctuations due to production disruptions or unstable supply	Price increases can result in economic losses for consumers and increase production costs
4. Area of Shallot Farming Land	Potential reduction in land area used for shallots due to climate change resulting in increased risks or production costs	Reducing land area can threaten food security and farmers' income.

In Indonesia, the main factors for climate change are temperature and rainfall. Indications of climate change can be modeled using time series analysis which provides information on trends in change (Verbesselt et al., 2010), cycle analysis and shifts around the average in the long term. Shifts in planting months and the length of each season indicate climate change. The use of time series analysis in line with climate change causes changes in rain patterns, the length of the rainy season, shifts in the start of the rainy season, and an increase in extreme climate events (Loo et al., 2015). Businesses in the agricultural sector such as rice, shallots, tobacco, cocoa and others have a risk of loss in the form of a decrease in production yields which results in a decrease in farmers' income (Dore, 2005; Purwaningrum et al., 2023). The risk of loss can be caused by various factors including rainfall, temperature, wind speed and air humidity, all of which are elements that form climate/weather.

Shallot production in 2023 is 2.14 million tons, an increase of 8.15% or 161.62 thousand tons compared to 2022 (Pusat Data dan Sistem Informasi Pertanian Kementerian Pertanian Republik Indonesia, 2023). The increase in production is in line with an increase in productivity of 0.22% or to 10.74 tons/hectare from the previous year 10.72 tons/hectare. The increase in harvested area by 7.88% or 14.58 thousand hectares will also influence the increase in production in 2023. The predicted per capita consumption of shallots in 2023 is 2.96 kg/capita/year, a decrease of 0.06% compared to 2023, previously it was 3.02 kg/capita/year. In 2023-2027, the projected consumption of shallots is likely to increase by 0.46% per year or an average of 3.03 kg/capita/year. By multiplying the per capita consumption of shallots by the total population, it can be predicted that direct consumption of shallots at the household level in 2023 will be 825.50 thousand tons.

Consumption of shallots at the household level in 2023-2027 is estimated to grow by 1.47% per year or an average of 860.62 thousand tons per year. In 2023, shallot production will be 2.14 million tons, the amount of waste is estimated to reach 177.09 thousand tons, the use of shallots for seedlings will be 214.40 thousand tons, and food stalls will be 40.53 thousand tons, industrial raw materials will be 40.53 thousand tons, and direct consumption of 825.50 thousand tons. Taking into account imports of 1.09 thousand tons and exports of 2.57 thousand tons, there will be a surplus of 844.46 thousand tons. Until 2027, it is estimated that there will continue to be a shallot surplus with an average growth of 25.17% or an average of 1.03 million tons per year. It is estimated that the shallot balance for the period 2023-2027 will experience positive growth both at the household level and taking into account domestic use (consisting of seeds and scattered) as well as exports and imports. The increase in production has been able to meet domestic needs.

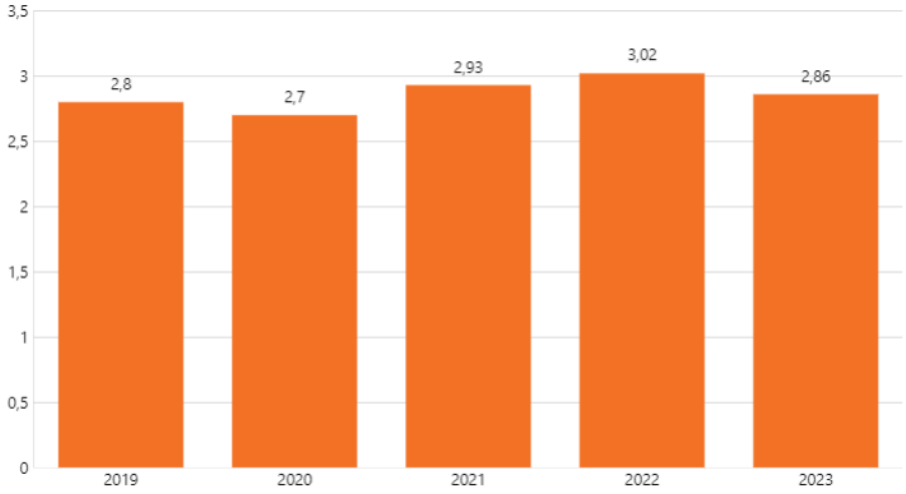

Figure 3: Consumption of shallots per capita of Indonesian People 2019-2023

(in kilograms/per capita/year)

Source: (Ahdiat, 2024)

Shallots are an agricultural commodity whose growth has a risk of loss due to the influence of various factors, including rainfall and changes in rainfall. Apart from that, there are non-climatic/weather factors that are thought to influence shallot production. These factors include labor, capital, seeds, fertilizer, pesticides, timeliness of planting, varieties and area of planting land (Merhaut, 2019). Various studies have been carried out regarding the influence of various factors on shallot production. Shallot varieties are one of the factors that influence shallot production. Sukasih et al. (2018) examined five superior varieties of shallots. The Bima and Katumi varieties produced the highest production, namely 9.37 and 9.09 tons per hectare in West Kalimantan. The minimum production of the five varieties is 6.11 tons per hectare.

Shallots are annual plants, have short stems and fibrous roots. Plant height can reach 15-50 cm and forms clumps. The roots are in the form of fibers that are not long, because of the nature of these roots, shallots cannot stand drying out (Swamy & Veere Gowda, 2006; Syamsafitri et al, 2023). Shallots *(Allium cepa L. var. aggregatum)* are one of the main cooking spices. Shallots come in the form of bulbs which can be eaten raw or used as a cooking spice, pickles and traditional medicine. Shallot seeds can be used for generative plant propagation. Shallot contain vitamin C, potassium, fiber and folic acid (Anggarani et al., 2021). Apart from that, shallot also contain calcium and iron. Shallots contain the compound alliin, which has antiseptic and bactericidal effects. Shallots are not only a delicious cooking spice, they also have health benefits. Domestic shallot production over the last three decades has shown positive growth, in line with exports experiencing quite high growth, as well as significant growth in imports. Based on data from the FAO (Food and Agriculture Organization) in 2017-2021, Indonesia within ASEAN is the fourth ranked exporting country that exports shallots with an average of 6.53 million USD as well as the second ranked importing country which imports shallots with an average of 51.76 million USD.

Table 2: Progress of average harvested area, productivity, shallot production per region

Region	Year	Average Harvested Area		Average Production		Average Productivity	
		Ha	Growth (%)	Tonne	Growth (%)	Tonne /Ha	Growth (%)
Java	1990-2022	75.860	3,86	616.154	29,12	7,19	**2,02**
	2018-2022	119.532	3,67	1.169.516	5,52	8,03	**0,07**
Outside Java	1990-2022	31.262	4,33	229.391	126,63	4,89	**4,90**
	2018-	56.95	3,22	607.6	8,30	6,43	**6,89**

	2022	4		99			
Indonesia	1990-2022	107.122	3,69	984.492	5,31	8,96	**1,51**
	2018-2022	176.487	3,45	1.777.215	6,31	10,05	**2,92**
Contribution to Indonesia in 2018-2022 (%):							
Java		**67,73**		**65,81**			
Outside Java		**32,27**		**34,19**			

Triyono et al. (2021) used the Cobb-Douglas model in their research on the variables that determine shallot production. According to Nurdiana (2023), factors that have a significant influence on shallot production are land area, capital, seeds and fertilizer, while labor has no effect. Suminartika et al. (2022) also used the Cobb-Douglass model and came to the conclusion that land area, seeds, fertilizer had a significant effect while medicine and labor had no effect on shallot production. Even though they do not use rainfall as a determining variable, the two studies provide some of the same conclusions.

Furthermore, Suswadi & Prasetyo (2022) used multiple linear regression and concluded that land area, number of seeds, and labor had a significant effect on shallot production, while pesticides had no effect. Elfia (2015) uses Isak and Michael's formula with purposive sampling to conclude that land area, labor, fertilizer and price influence shallot production. Nurhuda et al. (2021) research carried out using Pearson correlation (product moment) concluded that rainfall has a positive relationship with shallot production. Muhimmatunnisa (2020) in his research results concluded that shallot production in Brebes was influenced simultaneously by land area, rainfall and labor by 90.11%. The rest is influenced by other variables.

However, partially, shallot production in Brebes is only influenced by land area and labor. Rainfall does not have a partial effect because there is a new method (innovation) with rain shelters (plastic hoods) which can reduce the influence of rainfall. Still in the Brebes area, based on the results of different studies, shallot production is influenced by seeds and climate (Byulegenova et al., 2024; Widyantara & Yasa, 2013). Elsewhere on the island of Java is influenced by the use of technology. Agung's research (2005) shows that shallot production using rain-fed irrigation is influenced by seeds, fertilizers and medicines (pesticides). Sihombing et al. (2023) used factors such as seeds, climate, pesticides, and three factors related to shallot farmers, namely experience, formal education and age to determine their effect on shallot production. In conclusion, climate is very influential, planting in the rainy season faces less risk than the dry season.

The results of Karyani et al. (2018) research on Sumenep shallot Supply Chain Risk Events at the Farmer Level were caused by erratic weather. Losses will have an impact on reducing crop yields, reducing the quality of tubers, increasing production costs and ultimately reducing farmer income. From the results of interviews with farmers, there are nine risk agents at the farmer level, namely climate change, the emergence of pest attacks, the emergence of disease attacks, difficulty accessing information, lack of capital, errors in selecting seeds, negligence of workers, payments from old dealers and non-continuous delivery of onions. . Farmers are required to mitigate several priority risk agents.

However, farmers are becoming more challenged. One of the climate factors is rainfall. According to Yue et al. (2020), a number of plants are directly positively correlated with rainfall. Crane et al. (2011) stated that the climate is very dynamic and complex so that what farmers can do is adapt planting patterns to the local climate. The success of shallot cultivation depends on climatic conditions which are dynamic and difficult to control. Research on the effect of rainfall on shallot production shows that rainfall does not have a significant effect. This is because farmers work around this by planting patterns using plastic covers (rain shelters).

Table 3: Correlation of rainfall variables, rainy days, wet months, dry months on shallot productivity in several production centers

Shallot Productivity	Period	Rainfall	Rainy day	Dry Moon
Badas	I	-0,67	-0,57	0,45
	II	-0,49	-0,49	0,84*
Sukomoro	I	-0,20	-0,23	0,38
	II	-0.36	-0.72	0,11
Junrejo	I	-0,24	-0,23	0,58
	II	-0,62	-0,31	0,23

Source: (Sholikin & Haryono, 2019)

Note: *: Significant effect at the 0.05 level

I: 2008-2012

II: 2013-2017

Based on the results of the correlation analysis of rainfall, rainy days and dry months on shallot productivity in table 1, it can be seen that in these two periods rainfall and rainy days have a negative correlation with shallot productivity, which means that if there is an increase in rainfall or rainy days it can decrease shallot productivity. According to Safitri et al. (2019) too much rainfall can cause shallots to be attacked by Fusarium wilt disease. Fusarium wilt can cause shallot harvest failure. High rainfall also causes the nutrients Nitrogen, Potassium and Sulfur to be leached. The element of dry months provides a positive correlation to shallot productivity, which means that if there is an increase in the number of dry months it can increase shallot productivity.

In the long term, the climate changes. Climate indicators such as temperature and rainfall are changing due to global warming. This global warming causes changes in rainfall to become heavier. Shallot production is greatly influenced by the local climate and is very sensitive to rain and drought. Noted a decrease in the area of shallot planting land in East Java between 2012-2016 by 18%, from 9.98 to 8.43 thousand hectares. Global warming produces greater rainfall than usual. However, the intensity of rainfall and the number of rainy days have no effect on the amount of goods produced. Meanwhile, the number of dry months has a significant influence. The intensity of rainfall and the number of rainy days/months have no effect on shallot productivity in Badas, Sukomoro and Junrejo. This is characterized by a negative correlation between rainy months and production, namely an increase in rainfall or rainy months causes a decrease in productivity.

High rainfall causes the elements nitrogen, potassium and sulfur to experience purification. Meanwhile, the number of dry months is positively correlated, namely increasing the number of dry months can increase shallot productivity. However, shallots are a plant that is not resistant to drought. In general, the studies above agree that shallot production is actually more influenced by the number of dry months. Normal rainfall does not have a significant impact on shallot production. Research on rainfall that has been carried out is limited to normal rainfall.

The studies that have been carried out provide the conclusion that normal rainfall has no effect on the volume of shallot production.

The effect of decreasing production volume was actually found as a result of the many dry months. So far, the research that has been carried out does not touch the quality aspect. How does extreme rainfall and extreme drought affect the production volume and quality of shallots produced? With global warming, the possibility of extreme rainfall and extreme drought is quite open. For this reason, research needs to be carried out on both extreme rainfall and extreme drought to see their effect on production volume and quality of shallots. Cumulatively, the total need for shallots for national household consumption in 2023 will reach 797.3 thousand tons/year. Household consumption will decrease by 4.4% compared to 2022.

Impact and risk management strategy

Supply Chain Management (SCM) is a concept or mechanism for increasing a company's total productivity in the supply chain through optimizing time, location and quantity flow of materials (Varma et al., 2006). Supply chain management is defined as a series of approaches used to integrate suppliers, manufacturers, warehouses and stores effectively so that inventory of goods can be produced and distributed in the right quantities, to the right locations (Cigolini et al., 2004; Nurhayati et al., 2022), and at the right time so that overall system costs can be minimized while trying satisfying needs and services. In the previous operational definition of supply chain, there are three aspects that need to be considered, namely as follows: (1) Supply Chain Management is an approach used to achieve efficient integration of suppliers, manufacturers, distributors, retailers, and customers. This means that goods are produced in the right quantity, at the right time, and in the right place with the aim of achieving minimum overall system costs and also achieving the desired level of service, (2) Supply Chain Management has an impact on cost control, (3) Supply Chain Management has an important role in improving the quality of company service to customers.

Supply Chain Management involves many parties, both directly and indirectly, in an effort to meet consumer demand (Mentzer et al., 2001). Here the supply chain does not only involve manufacturers and suppliers, but also involves many parties, such as consumers, retailers, wholesalers, producers and product transporters. Risk Management According to Coiller in Massingham (2010), risk management is defined as a combination of the possibility of an event with the various consequences inherent in it. Supply chain risk management focuses on how to analyze and manage risk. In general, Risk Management is defined as the process of identifying, measuring and ascertaining risks and developing strategies to manage risks. Risk is defined as uncertainty that has a known level of probability of occurrence or uncertainty that can cause harm or loss. According to Giannakis & Papadopoulos (2016), supply chain risk can be defined as losses that are studied in terms of the possibility of occurrence, the possible causes, and the consequences in a company's supply chain and its environment.

Problems that can occur in shallot commodities from upstream to downstream in this context are vulnerable to weather and environmental conditions. Based on research results from Sjafrina et al. (2023), the priority risk for farmers is the risk of government policy regarding imported shallot policies, the priority risk for middlemen is the risk of competition with imported shallots, and the priority risk for retailers is the risk of competition with retailers (Akpan, 2018). Apart from that, based on the research results of Kurniawan et al. (2019), there are three types of risks that need to be considered in the shallot supply chain, namely market risk, partnership risk, information risk and price risk. This problem needs to be considered considering that there is a long supply chain flow until it reaches consumers. Therefore, good handling of shallots needs to be done by means of supply chain risk management.

Supply chain risk management is needed so that risks that occur can be minimized by providing mitigation for each risk during supply chain activities (Tummala & Schoenherr, 2011). Mitigation is needed so that risks do not affect the quality of shallots during the distribution process to consumers. Risk mitigation in shallot supply chain activities is carried out by identifying risks, analyzing risks, evaluating risks, and handling risks thoroughly using the risk management standard, namely ISO 31000:2009. ISO 31000 is a guide to managing risk which is defined as a framework that provides the basis or principles and organizational structure for designing, implementing, monitoring, reviewing and continuously improving risk management throughout the organization. The risk management process in ISO 31000 consists of risk identification, risk analysis and risk evaluation, overcoming risks, monitoring and conducting reviews. The use of ISO 31000:2009 is expected to provide mitigation for the risks that occur in shallots during distribution activities so that risks can be handled properly and no losses are experienced by each risk owner.

CONCLUSION

Shallots are suitable in areas with dry climates and receive more than 12 hours of sunlight. Shallots can grow in both the lowlands and highlands with rainfall of 300 – 2,500 mm/year and temperatures of 25-320C. The recommended soil types for cultivating shallots are regosol, grumosol, latosol, and alluvial, with a Ph of 5.5 – 7. Shallots can grow well at a height of 10 – 250 m above sea level. At an altitude of 800 - 900 m above sea level it can also grow, but at this altitude the temperature is low

which causes plant growth to be stunted and the tubers to be poor. Shallots should be planted in dry climates with slightly hot temperatures, namely around 25-320C and at high altitudes. Shallots can grow quite well at an altitude of 800 - 900 m above sea level. Shallots *(Allium ascalonicum L)* can be planted throughout the year (all seasons) with rainfall of 300 – 2500 mm/ year. Sufficient rainfall throughout the year can support plant survival due to sufficient water availability. Sunlight has a big role in the life of onion plants, especially in the process of photosynthesis. Shallots will form larger bulbs when planted in areas with more than 12 hours of light. Therefore, shallot plants prefer to grow in the lowlands with a sunny climate. Shallots are suitable for planting in loose, fertile soil with good drainage. Sandy soil improves tuber development, with a suitable soil pH of around neutral, namely 5.6 – 6.5. Problems that can occur in shallot commodities from upstream to downstream in this context are vulnerable to weather and environmental conditions. Risk mitigation in shallot supply chain activities is carried out by identifying risks, analyzing risks, evaluating risks, and handling risks thoroughly using the risk management standard, namely ISO 31000:2009. ISO 31000 is a guide to managing risk which is defined as a framework that provides the basis or principles and organizational structure for designing, implementing, monitoring, reviewing and continuously improving risk management throughout the organization. The risk management process in ISO 31000 consists of risk identification, risk analysis and risk evaluation, overcoming risks, monitoring and conducting reviews. The use of ISO 31000:2009 is expected to provide mitigation for the risks that occur in shallots during distribution activities so that risks can be handled properly and no losses are experienced by each risk owner.

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