

Investment risk management for vanilla agribusiness development in Indonesia

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Abstract. Indonesia's position as the world's largest vanilla producer has been replaced by Madagascar. This condition is caused by the declining quality of Indonesian vanilla. Competitiveness is related to the degree of transformation determined by investment capital, technology availability, and managerial ability. Limited investment is one of the characteristics of vanilla development in addition to high business risk and low technology adoption. It is affected by risk perceptions in production and investment behaviour of farmers. This study aims to analyse investment risks in the development of vanilla agribusiness and formulate investment risk mitigation strategies. The analysis uses Risk Matrix Analysis by measuring the degree of severity and probability, and the Analytical Hierarchy Process to assess the strategy. Agribusiness investment is an important element and catalyst to agricultural development. The risks of vanilla agribusiness investment are not only determined by risks arising from the financial aspect but also influenced by technical aspects. They are divided into production risk, price or market risk, financial risk, institutional risk, and human or personal risk. Risk mitigation strategies can be divided into on-farm strategies and share risk strategies. Stem Rot disease, vanilla theft, and price fluctuation are the most important risk in vanilla agribusiness investment.

1 Introduction

Vanilla planifolia A is a very popular natural flavour widely used in various industries [1]. In the food industry, vanilla is used as a flavouring agent in food and beverage products, while in the non-food industry, vanilla is widely used as an ingredient in fragrance and pharmaceutical industries [2]. In addition, vanilla can also be used as an antimicrobial agent to prevent mold, as well as antioxidants in foods that contain lots of unsaturated components.

In Indonesia, vanilla is mostly developed in West Java, East Java, North Sumatra, Lampung, Bali, West Nusa Tenggara, East Nusa Tenggara, South Sulawesi, North Sulawesi, Central Sulawesi, and to a lesser extent Papua. Vanilla plantation in Indonesia is managed by smallholder. In 2017, the total area reached 10,040 ha with a production of 1,534 tons [3].

Indonesian vanilla exports in 2017 reached 295 tons with a value of 90,575 thousand USD, while the import of vanilla was 120 tons with a value of 3,309 thousand USD [3]. Indonesian vanilla exports are simultaneously influenced by production, the rupiah exchange rate against the dollar, export prices, and domestic consumption [4]. Domestic demand for

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vanilla, especially in the form of vanillin, is still being met from the import market because Indonesia does not yet have a vanillin industry.

Since 1986, Indonesia has been the largest vanilla producer, but Indonesia's production has continued to decline and now Madagascar is the world's largest producer of vanilla [5]. This condition is caused by the decline in the quality of Indonesian vanilla due to various problems that occur in the vanilla commodity system.

Competitiveness is related to the degree of transformation determined by investment capital, technology availability, and managerial ability. One of the important aspects of agricultural development is an agricultural investment. It plays a strategic role in increasing production and income, as well as creating new job opportunities [3]. Agriculture development performance is influenced by the availability of agricultural investment which will be used to finance various agriculture activities. On the other side, limited investment is one of the characteristics of vanilla development in addition to high business risk and low technology adoption. Investment is affected by risk perceptions in the production and investment behaviour of farmers [4]. This study aims to analyse investment risks in the development of vanilla agribusiness and formulate investment risk mitigation strategies.

2 Research method

This study used primary and secondary data. Primary data are used in conducting context analysis. Secondary data consist of data on area, production, productivity, and distribution of vanilla plantations. The data sources are Central Bureau on Statistics and the Directorate General of Plantation. Data were collected through field observations and in-depth interviews. Observations were carried out in West Java and East Java in 2019. The unit of analysis of this research is the smallholder plantation.

The analysis used the Risk Matrix and Analytical Hierarchy Process. Three types of risk matrices are commonly used for risk ranking: qualitative, quantitative, and a semi-quantitative [6]. Risk ranking is based on a matrix whose axes are the ranks of severity and probability. Severity is the impact or damage which would arise if the risk were to be realized. Probability is the likelihood that the risk could arise. The combination of ranks of severity and probability creates risk rank. Severity is represented through the following categories negligible, marginal, moderate, critical, and catastrophic, while probability is represented through frequent, likely (probable), accidental, unlikely, improbable.

The Analytical Hierarchy Process is a methodology that uses an Eigenvalues approach for pairwise comparisons. It provides an approach that uses a scale for object measurements that are done in relative measurement [7]. The scale used starts with the numbers 1/9 for "the least value than", to 1 for "equal", up to 9 for "absolutely more important than" for whole paired-wise comparisons.

3 Result and discussion

The term investment is described as a commitment to current financial resources to achieve a higher level of income in the future [8], that deals with uncertainty domains. In agribusiness, the uncertainties inherent in climate variability, pests and diseases, yields, prices, government policies, global markets, and other factors that impact farming performance. It is important to assess and analyse the risks in any form of investment and especially in financial investments where risk tends to be of higher levels [9]. The awareness of uncertainty and probable vulnerabilities when making investment decisions will guide us to make a decision and formulate a mitigation strategy [10]. The system of efficient risk mitigation strategies can create significant value and increase competitiveness for agribusinesses. The agricultural

sector can improve efficiency, accelerate productivity, and increase profitability by managing the risk faced and selecting suitable risk management tools [11].

3.1 Prospect of vanilla in the global market

Vanilla has been developed in some areas in Indonesia: West Java, East Java, Bali, West Nusa Tenggara, East Nusa Tenggara, North Sumatra, Lampung, North Sulawesi, Central Sulawesi, South Sulawesi, and Papua. In 2017, the total area reached 10,040 with a production of 1,534 tonnes that carried out by smallholder plantations [3].

Vanilla plants can grow well in tropical areas between the lines of 20°N and 20°S at an altitude of 800-1200m above sea level. The ideal rainfall for this type of vine is 70-90 inches/year with temperatures between 21-32°C [12]. Vanilla cultivation activities consist of the provision of seeds, land preparation, planting protective plants or climbing poles, planting, embroidery, weeding, regulating tendrils and propagation, pruning, pollinating flowers, fertilizing, harvesting and post-harvest. The natural vanilla extraction process is obtained by curing vanilla beans [2]. The processed vanilla beans have a varied and complex composition which is influenced by several variables such as species, growing conditions, fruit maturity and especially the type of processing [13].

The global vanilla market is generally differentiated by product type and application. Based on the type of product, the vanilla market is divided into Madagascar, Mexican, Indian, Indonesian, and others. The global vanilla market is expected to grow due to the growing demand for the food industry. Another factor stimulating market growth is its application in the medical sector.

Vanilla is graded by using national standards for vanilla production in each producing countries. ISO 5565-1: 1999 provides some general guidelines on vanilla grading, handling and packaging. In addition, there is also a minimum quality standard from the European Spice Association (ESA) that must be fulfilled.

Main consumers in the global vanilla market are Nielsen-Massey Vanillas, Heilala Vanilla Limited, Archer Daniels Midland, Givaudan, Sensient Flavors, Döhler, Lochhead Manufacturing, International Flavors & Fragrances, McCormick & Company, Symrise, Kerry Group, Firmenich, Organic Spices, E.A. Weber Flavors, and Takasago International [14]. Global companies such as Unilever and Nestle since 2012 have decided to use pure vanilla. The decisions of these two large companies were followed by various global companies which in turn encouraged the growth in world vanilla demand to continue to increase sustainably.

At present, Madagascar is the world's largest producer of vanilla, supplying nearly 70% or about 1,500 tonnes of vanilla per year. In 2017, hurricane Enawo in Madagascar destroyed a third of the country's vanilla crop. As a result, vanilla production decreased dramatically. Due to the decreasing supply of vanilla in the world market, it has triggered an increase in the price of vanilla. The increase in world vanilla prices has stimulated the enthusiasm of Indonesian farmers to plant and develop. However, investment does not automatically occur considering the high risk in vanilla agribusiness.

3.2 Vanilla investment risk identification

Risk must be considered in making decisions and may be significant for the success of the investment [15], therefore it is necessary to analyse it as both, objective component of the investment, and subjective factor of the investment decision making [10]. Risk is the general likelihood of losing the original investment, and investments are exposed to various types of risks throughout the lifecycle of the investment. Some of the most common types of investment risks are market risk, liquidity risk, credit risk, and inflation risk.

Risk related to the agri-food sector is any current or future hazard with significant negative impacts [16]. Agriculture is a risky business due to the handling of living organisms and their exposure to weather conditions and other natural phenomena. Risk in agriculture, in general, can be analysed from five factors: production risk, price or market risk, financial risk, institutional risk, and human or personal risk [17] [16]. Investment in vanilla agribusiness is not only affected by investment risk only but also by risks from production activities. Based on this, the risk analysis in vanilla agribusiness investment requires a comprehensive approach. Risk identification can be seen from how the structure and dynamics of the vanilla value chain. It has 25 types of risk which are grouped into financial risk, production risk, market risk, institutional risk, and human risk (Figure 1).

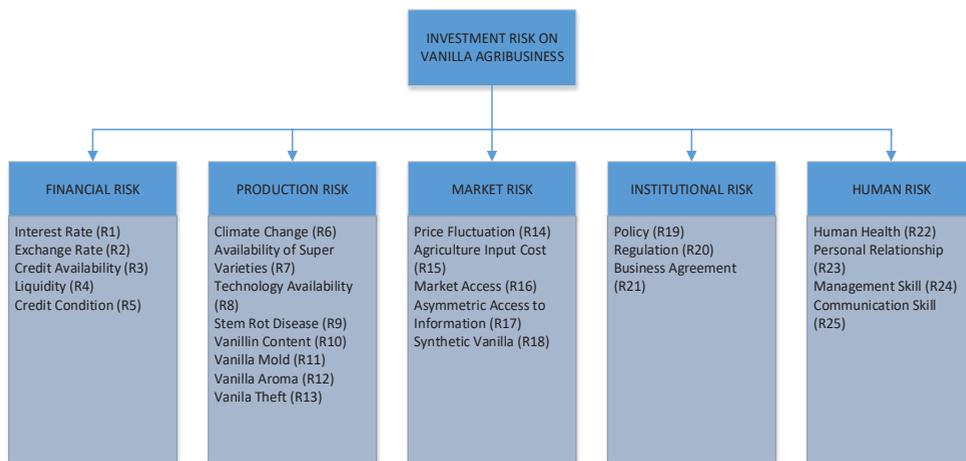


Fig. 1. Investment risk on vanilla agribusiness

3.2.1 Financial Risk

Financial risks are related to how agribusiness is financed and the variability of cash flows from agricultural operations due to financial liabilities for loans taken [18]. Financial risk can come from various sources such as changes in interest rates, availability of credit, or changes in credit conditions [19]. Financial risk includes Interest Rate (R1), Exchange Rate (R2), Credit Availability (R3), Liquidity (R4), and Credit Condition (R5).

Most of the farmers have limited capital in developing vanilla agribusiness. The amount of capital needed in developing vanilla agribusiness is relatively large, causing some farmers to borrow from financial institutions to finance their businesses. Product marketing that is oriented towards the export market has affected farmers' income due to changes in exchange rates. Financial risks usually arise from production and marketing risks. In addition, financial risks can also be associated with unfavourable changes in input costs, interest rates, borrowing, demand for cash, cash or credit reserves, and exchange rates.

3.2.2 Production Risk

Production risk arises from the uncertainty arising from the natural growth processes of crops and livestock. Weather, diseases, pests, and other factors will affect both the quantity and quality of agricultural products produced. The introduction of new varieties and production techniques provides the potential for increased efficiency, but these conditions sometimes have adverse effects, especially in the short term. In addition, new technology poses a threat of obsolescence. In contrast, the threat of obsolescence exists with certain practices. The

production risk includes: Climate Change (R6), Availability of Super Varieties (R7), Technology Availability (R8), Stem Rot Disease (R9), Vanillin Content (R10), Vanilla Mold (R11), Vanilla Aroma (R12), and Vanilla Theft (R13)

The problem with vanilla cultivation in Indonesia is that productivity and quality are still low. The quality of vanilla is generally influenced by the age of the harvest, the length of the pods and the processing after harvest. The low quality of vanilla produced by farmers as a result of picking young vanilla fruit because they are pressured by the economic needs of the family, fear of being thieves ahead, and the low level of farmers' knowledge of post-harvest vanilla. The main disease of the vanilla plant is Stem Rot disease. It is caused by the fungus *Fusarium oxysporum*. It attacks many young plants that are 3-4 years old or plants before they bear fruit for the first time.

Mold can grow and spread on vanilla beans that are too moist, have too little vanillin content, and haven't been properly preserved or ripened and prepared. It is necessary to meet the exact ratio of moisture content and percentage of vanillin to avoid mold in vanilla.

3.2.3 Market Risk

Market risks mostly focus on uncertainty with prices, costs, and market access [19]. Market risks are related to the volatility of agricultural commodity prices that occur due to weather variations that affect production, changes in energy prices, and asymmetric access to information. Market risk includes Price Fluctuation (R14), Agriculture Input Cost (R15), Market Access (R16), Asymmetric Access to Information (R17), and Synthetic Vanilla (R18).

The price of vanilla in the market is mainly determined by the quality level of the vanilla fruit. In general, the vanilla fruit trade at the farm level is carried out in the condition of fresh vanilla fruit, so that the price level that occurs is the lowest price as well as being vulnerable to price fluctuations.

The level of competition for Indonesian vanilla in the international market is mainly determined by the quality and price offered by each of the competing countries. In addition, this natural vanilla has very tough competition from synthetic vanilla. More than 95% of the world's demand for vanilla flavour is fulfilled by synthetic vanilla.

3.2.4 Institutional Risk

Institutional risks are associated with unexpected changes resulting from policies and regulations generated by both formal and informal institutions that affect agricultural activities [19]. Institutional risk results from uncertainties surrounding government actions such as tax laws, chemical use regulation, minimum labour wage, or environment management regulation. It is also related to the legal aspect of fulfilling business agreements and contracts. Institutional risk in vanilla investment related to Policy (R19), Regulation (R20) and Business Agreement (R21).

3.2.5 Human Risk

Human risk refers to factors related to human health problems or personal relationships that can affect agribusiness. It also includes the negative impacts arising from a lack of human resources skill and poor communications. The main obstacles faced by vanilla farmers in production activities to produce optimal quality and yield of vanilla plants are the lack of the process of pollinating flowers skill and cultivating knowledge. The human risk in vanilla investment includes Human Health (R22), Personal Relationship (R23), Management Skill (R24), and Communication Skill (R25).

3.3 Risk analysis

Risk analysis consists of various combinations of quantitative and qualitative models, in which qualitative risk modelling techniques are focused on causes and consequences while quantitative techniques are used to calculate the probability of events [20]. A risk can be assessed by determining two elements: the probability that refers to how often an event or a hazard occurs, and the impact that is related with the size of losses associated with the occurrence of an event or hazard.

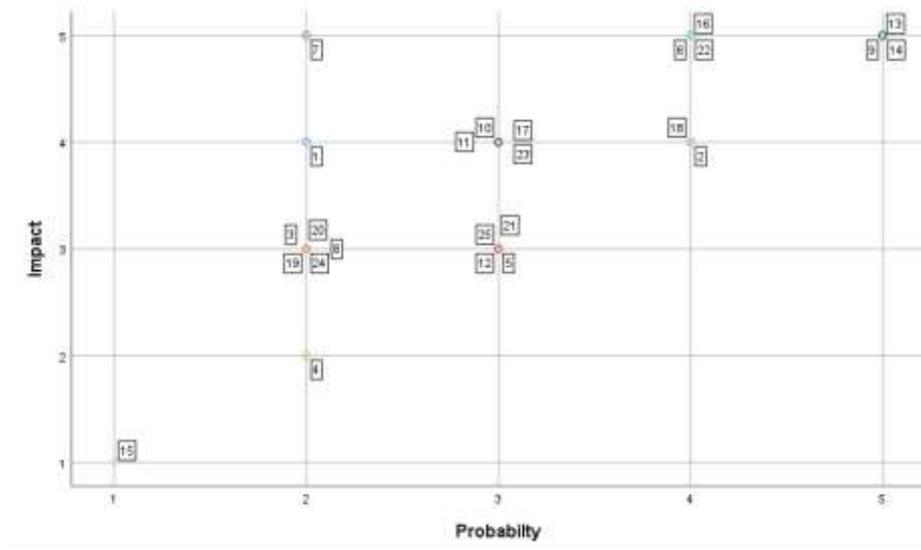


Fig. 2. Risk matrix for investment risk on vanilla agribusiness

Stem Rot Disease (R9), Vanilla Theft (R13), and Price Fluctuation have the highest rank in investment on vanilla agribusiness (Figure 2). There is a very significant disease in vanilla, namely Stem Rot Disease caused by the pathogen *Fusarium oxysporum*. Other diseases and pest have only a relatively minor impact, while Stem Rot Disease is the scourge of vanilla. If the plant has been attacked by this fungus it can destroy the vanilla plantation in a short time.

High but volatile prices and minimise the window of opportunity for would-be thieves. Competition for high priced vanilla beans has resulted in unfair competition and many cases of theft. These have resulted in a sharp decline in the quality of vanilla. Vanilla agribusiness is an activity to manage plants that are exposed to the risks of climate change and other natural phenomena, that caused the output price has then fluctuated.

3.4 Risk mitigation strategies

Agricultural production activities based on natural resources and climatic conditions expose various risks from weather variability, natural disasters, and pests and diseases due to production. Likewise, market shocks from domestic and international sources, such as shortages of supply due to drought or exchange rate fluctuations, can lead to price volatility. The 25 types of risk directly affect the economic returns, farmers' livelihoods, and in the long run on farmers' capacity to invest.

Risk mitigation strategies are related to three resilience capacities, namely resilience, adaptability, and transformation ability, which can be formulated as a strategy to overcome risk [21]. In general, risk mitigation strategies that can be taken are divided into accept, avoid

or eliminate, transfer, and control the risk [22]. Resilience is both agricultural management and a balance of short-term efficiency and long-term transformability [23]. Risk mitigation can help the farmer to build a more resilient production system.

Risk mitigation strategies can be seen as on-farm strategies and share risk strategies [24]. In vanilla agribusiness investment, risk mitigation strategies then break down into collecting information, avoiding or reducing to risk, selecting risky technologies, diversification, and flexibility for on-farm strategies, as well as farm financing, insurance, and contract marketing for share risk strategies. The risk mitigation strategies for the main risk are described in Figure 3-5.

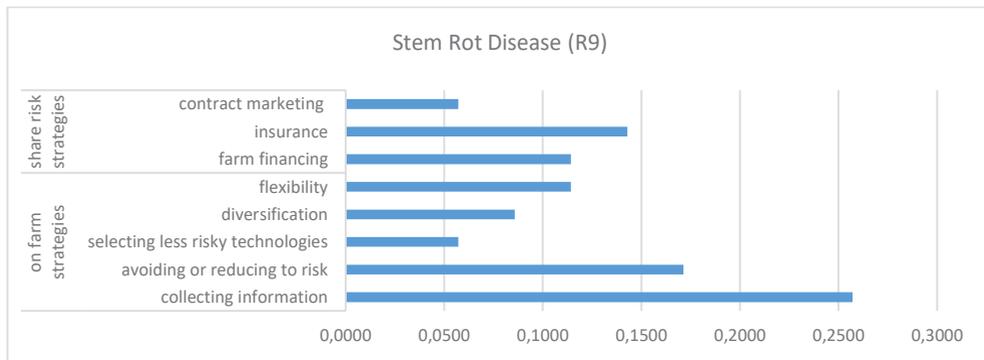


Fig. 3. Risk mitigation strategies for stem rot disease risk

Stem Rot disease can readily infect crops in the vegetative or flowering stages. The emergence of the disease is favoured by excessive soil moisture, too much shading of plants, inadequate fertilization, over-crowding and drought stress. Some strategies that can be chosen are collecting information and implement the Good Agricultural Practises (GAP), prune out infected plant parts, or use vanilla varieties that are tolerant to the disease.

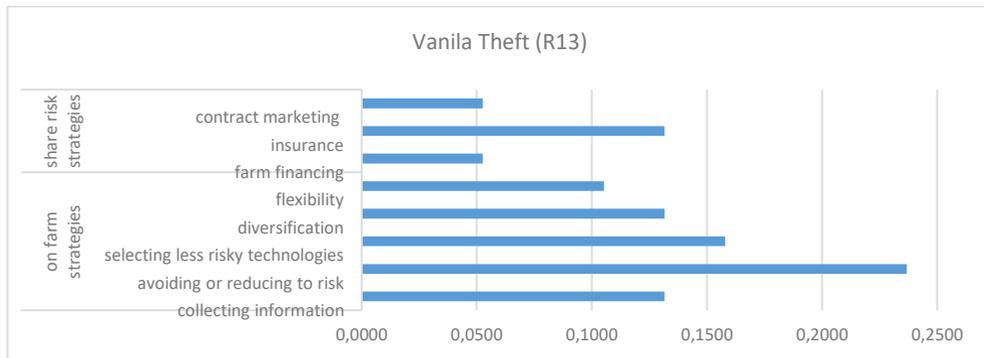


Fig. 4. Risk mitigation strategies for vanilla theft

Most of the vanilla farm locate far from the farmer's house. Vanilla theft can be avoided by selecting the location of vanilla farming. Planting vanilla in the yard with a modern planting system is a solution to overcome. Currently, the vanilla development is carried out by implementing a plantation model in the yard that allows farmers to cultivate and supervise intensively.

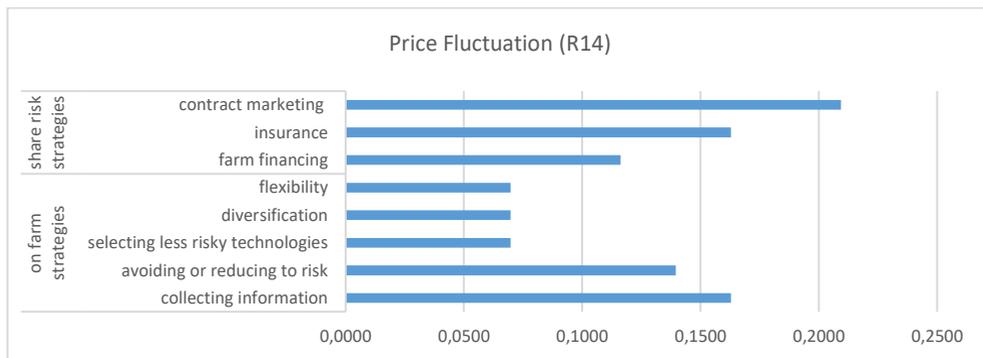


Fig. 5. Risk Mitigation Strategies for the Price Fluctuation Risk

A marketing contract is a type of forwarding contract by agreeing with the seller and the buyer to deliver a certain amount of product to the buyer in the future at an agreed price and other accompanying agreements [25]. It can reduce price risk, minimize production variability, ensure market access, and create higher returns [26]. Through a marketing contract, the quantity and quality requirements can be identified, therefore farmers can manage vanilla agribusiness to meet the predetermined requirements. In addition, farmers can obtain price certainty as a strategy to minimize the uncertainty in the agricultural production system.

4 Conclusion

Investment in vanilla agribusiness is not only affected by investment risk only but also by risks from production activities. Risk identification can be seen from how the structure and dynamics of the vanilla value chain, which consists of 25 types of risk which are grouped into production risk, price or market risk, financial risk, institutional risk, and human risk. Financial risk includes interest rate, exchange rate, credit availability, liquidity, and credit condition. The production risk includes climate change, availability of super varieties, technology availability, stem rot disease, vanillin content, vanilla mold, vanilla aroma, and vanilla theft. Market risk includes price fluctuation, agriculture input cost, market access, asymmetric access to information, and synthetic vanilla. Institutional risk in vanilla investment related to policy, regulation, and business agreement. The human risk in vanilla investment includes human health, personal relationship, management skill, and communication skills. Stem Rot disease, vanilla theft, and price fluctuation are the most important risk in vanilla agribusiness investment. The risk mitigation strategies divided into collecting information, avoiding or reducing to risk, selecting risky technologies, diversification, and flexibility for on-farm strategies, as well as farm financing, insurance, and marketing contract for share risk strategies.

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