Risks of farming in wetland and dryland of North Lombok: Types, levels, and management

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Abstract. North Lombok farming, as other businesses, is hurdled with risks, resulting in lower production and income and threats to food security. This paper presents the risks of farming in North Lombok, Indonesia, in terms of its types, levels, and management. Data for these were collected through a series of interviews with agricultural producers on wetlands and dryland in North Lombok Regency, Indonesia. Interviews were carried out in face to face and semi-structured mode, allowing for a more qualitative understanding of collected information on the topics researched. Dryland and wetland were selected to enable comparisons of the two types of land. Data for this study were analyzed accordingly, quantitatively and qualitatively, to achieve the stated research objectives. The study revealed that farming in wetland and dryland of North Lombok, Indonesia, faced various risks in different levels and therefore required specific management of each type of risk. Overall, risks in farming need to be managed by reducing or eliminating the risks in order to keep farming running or sustainable. When farming is running well, with no or fewer hurdles, then farming becomes more productive and helps improve the state of food security in the region or elsewhere.

1. Introduction

North Lombok farming, as other businesses, is hurdled with risks. Risks of farming in North Lombok are of several sources and in the various levels of severities. The main causes of risks in farming in North Lombok can be grouped into two sources, i.e. production risk and market risk. Production risk is a variation of production caused by any factors that influence the production of crops and animals in farming. Typically, the sources of this risk come from nature, such as weather, climate, pests and diseases, and soil conditions. Market risk is the risk associated with price, cost, and market access [1]. The production risk is high in the region as the area has low rainfalls, while the market risk is also high as the regency is located quite isolated, providing less access to the market. Focusing the risks in farming in North Lombok into these two groups ease data collection and analysis since the farming communities in the field know this risk more than other types of risks, such as institutional, financial, and personal. In addition, the risk of institutional, personal, and financial has been included in the two types of risk.

Rainfalls in North Lombok are lower than its neighboring regencies and city. This is proven, for example, in 2020, when the rainfalls in North Lombok were 1,536 mm [2]. The rainfalls in the neighbors

of North Lombok were 2,186 mm in Mataram [3], 1,861 mm in West Lombok [4], 1,653 mm in Central Lombok [5], and 1,561 mm in East Lombok [6]. The low rainfalls mean less water available, and then the area becomes dryland.

This dry condition causes farming to become riskier and threats agricultural production. As a result of risky farming, agricultural production decreases, making agricultural production, such as food, less available for the people in the region and for others outside the region [7]. The condition of low availability of foods is one aspect of food security, in addition to the aspects of food access and food consumption [8-12]. Access to foods is gained through income to buy the foods and through physical access to reach the foods.

The further impact of low agricultural production is low income for the agricultural producers. This low income can also lead to the condition of low food security, as the people have less access to the foods they need, with obviously people cannot purchase foods without their sufficient income. Access to foods is one of the aspects of food security, i.e. to add to the aspects of food availability and food consumption [8, 10-12].

Furthermore, North Lombok is the youngest regency in West Nusa Tenggara Province. The regency was established in 2008 [13]. As new regency, the infrastructures and facilities are less available than the older regencies in the Province of West Nusa Tenggara. One of the consequences of lack of facilities is that this region becomes a bit isolated and several other consequences such as lack of services provided to the community in the region [14]. This information is meant to indicate that the people in the region receive less physical access to foods, and hence they tend to insecure in foods.

In brief, the condition in North Lombok as a risky faming threats food security in all of the aspects of food security. The aspect of food availability is threatened as foods are produced less; the aspect of access is threatened as the people generate less income and the region is more isolated than other older counterparts. The accumulated result of threats in the aspects of food availability and food access is the threat in food consumption or food utilization by the people in the region. However, it should be aware that people can possibly be in food insecure even when the foods are available and accessible, yet the people opt not to consume the foods.

What should be done to increase the state of food security in North Lombok? One of the answers is to increase food production. For this reason, the risks of farming in North Lombok need to be managed for enabling production activities to continue and to keep growers motivated. However, sound management of the risks requires sufficient information on the risk types, level, and current management by the farmers. This paper presents risks of farming in North Lombok, Indonesia, in terms of its types, levels, and management. This information is expected to help people and the region of North Lombok Regency to increase their state of food security. Accordingly, this paper supports the achievement of Sustainable Development Goals (SDG) number 2, i.e., zero hunger [15], that is to live without hunger, with the condition of secure foods.

2. Methods

This study on farming risk in North Lombok is applied by combining qualitative [16-19] and quantitative research [20-22]. The risk and its description are facilitated by qualitative research method, and quantitative parts of the study is facilitated by quantitative research. There are five districts in North Lombok [2], all of these districts were taken as sample of locations. In each district, one village was selected in purposive way [23-25] for having more agricultural land than other villages in the districts. Six farmers were targeted to be respondents in each village with dryland and another six with wetland, making up 30 farmer respondents in dryland and 30 farmer respondents in wetland. The selected respondents were interviewed in face to face mode, assisted with prepared questionnaires. Data were analyzed quantitatively and qualitatively. The quantitative measure used in this study is ‘coefficient of variance’, and it count with help of ‘excel’ facility, using ‘covar function’ [26]. The other part of analysis is qualitative analysis and evaluation [16, 27], in which meanings of findings are sought to bring senses to this study.

3. Results and discussions

This sub section commences with the presentation of farming practice by farmers in North Lombok. The farming system provides an initial understanding on risks that may threaten the farming in the region. This is followed by results and discussions of the main contents of this paper, including the sources of the risk of production and market, levels of risks, and risk management to reduce the impact the identified risks.

3.1. Farming system in North Lombok

Farming described here is farming in both wetland and dryland in North Lombok Regency, West Nusa Tenggara, Indonesia. Wetland farming is meant that the agricultural land has irrigation from continuous supply of water, and hence the land can produce any time during the year. The dryland agriculture is the practice of farming that relies only on water from the rain and hence it is usually planted once a year, that is during the rainy season. Outside that period, the land is left fallowed. Raining is occurred normally during around October through to around April [2, 28, 29].

The availability of water for irrigating the land impacts on agricultural practices, both in term of planting times and types of crops grown. Farming in wetland is practiced during the year around with usually mono cropping system. The land is planted three times a year with seasonal crops. The cropping patterns that were applied by farmers in wetland in North Lombok was rice in the first season, followed by rice or secondary food crops, and finally rice or secondary crops (corn, peanut, vegetables, etc.) in the third planting season. The crops were gown in mono cropping system, mean here as to plant one kind of crops in one season on the land possessed by the farmers. Some farmers were found planting more than one kind of crops with borders of one crop to another is clearly observable. This farming system is called as unspecified farming system [30, 31]. The choice of lots of rice planting in the first season could be seen as having connection with water availability during the rainy seasons, under which water can be available both from irrigation channel and from rainfalls. The more than needed water, causes some amount of water must be sent out (drained) frequently to adjust to the needs of plants, otherwise the plant can be damaged or spoiled. It was found by the author [32, 33] that there were two main reasons connected to water availability of growing rice in the wet season, that is, rice is the most suitable to water abundance and other crops may be damaged by the condition of excessive water availability. The choice appears to be a strategy for reducing risk of farming during rainy season. These results again show managing risk is one of the important aspects of farming life and necessitates handling.

The farming system on the dryland of North Lombok is featured with a mixed cropping system. As farmers take less control on water availability then they take more control on timings of crop planting and its types. The planting times are at rainy season, started normally in October each year [2, 28, 29]. The crops planted are rice, corn, peanut, cassava, and several types of vegetables. They are planted in mixed cropping system. With production period of 3-4 months, then crops can be harvested in March or April. This production period started with the crop plantings in October and harvest in March/April, left crop production is less risky, as moisture still exists to support the crop grown. In addition, in partial parts of the land paddocks there are plantings of perennial crops. This perennial crop has a function to give shade to the farmers as found by the authors [33] in new cropping lands in East Lombok. They are also meant to improve the conditions of land and preparing land for sustainable agricultural production, as prescribed by authors [34].

3.2. Sources of risk in farming in North Lombok

Authors have identified two group of risks consists of production and market risk, and these grouping are based on consideration that all of other risks, including the risks of institutional, financial and personal has included the first two mentioned risks. This section reported the sources of these risks for wetland and dryland agriculture in North Lombok. Production risk is the risk that causes production to be various or up and down, or to reduce production [1].

The sources of risks in wetland and dryland farming in North Lombok were the similar. The sources for this risk in the farming in wetland in North Lombok were lack of water and attacks from pests and diseases to the crops. In dryland areas of North Lombok, these sources of risks were the same but with addition of dryness of land. These sources of production risks are similar to risk sources found in other places of the world [1, 35-37]. In essence, lack of water for crop production is similar to dryness of the land. Both are the condition of insufficient water for supporting the growth of crops, with the possible end result of production failure of decrease. However, the term of risk used by agricultural producers implicitly bring different level of severity. That is, dryness implies more severe impact than lack of water. This may be validated with through investigation results that farmers in wetland farmers mentioned the term lack of water more than the term of dryness, as oppose quantitatively to that in dryland farms.

Similarly, the source of market risk in farming in wetland and dryland of North Lombok is price decrease for the products that farm produced. Farmers in North Lombok perceived that they could experience a loss or a decrease in income due to the price drop. Additional information can be stated here that farmers feel disadvantaged with the practice of selling farm products in their farm gates or at their houses. This practice puts farmers in lower bargaining position for their product than the traders or buyers. The traders come to the villages and by the farmer products. As these traders collect farm products from the villages, then they are called as assemblers. It appears that the market risk occurs from the dominant position of assemblers relative to the agricultural producers.

3.3. Levels of risk in farming in North Lombok

The risk level is counted quantitatively by using 'covariance'. Covariance is obtained by dividing the variance of data to it means [30]. In loose term, this measure indicates how far the actual individual data deviate from its means. From this statement then, risk is interpreted as deviance of data, in the sense that the higher the value of covariance then the risk becomes higher.

The risk of production is counted from production per hectare of the crops. In this way, production difference is not because of farm size but because of farm yield. The production is collected from individual farmers as the respondents. Market risk is counted from prices of specific farm products. The price is measured in Rupiah per kg (IDR/kg), hence variation that may happen is not due to the differences in measurement.

Risk levels, according to Hernanto [30] is categorized as low when the value of the coefficient of variation (CV) is 0.50 or lower, and high when the CV is more than 0.50. According to this category, then the risks of farming in North Lombok vary, and they appear to be dependent on land types and crops grown. Production risk in dryland is higher than in wetland (Table 1). This means that it is riskier to run farming in dryland than in wetland. This finding is logical since all crops need water sufficiently) for their growth [38, 39]. Quantitative levels of production and market risk of crops farmed in wetland and dryland in North Lombok are presented in Table 1.

Table 1. Risk levels of production and market of crops farmed in wetland and dryland of North Lombok.

Land type	Crop	Risk level (CV)	
		Production	Market
Wetland	Rice	0.09	0.06
	Peanut	0.06	0.03
	Corn	0.08	0.02
Dryland	Rice	0.65	0.10
	Peanut	0.58	0.08
	Corn	0.77	0.05

Table 1 also shows that production risk is higher than the market risk for all crops grown in the wetland or dryland of North Lombok. Overall, all risks are categorized as low, with the exception that only the risk of production in dryland is quantitatively high. Nevertheless, all farmers in the interviews

mentioned that their farming practices are qualitatively risky, for both of the risk of production and market. This different of risk levels between quantitative and qualitative may need to be validated with more samples than currently, and this may confirm or disconfirm the findings in this study.

3.4. Risk management in North Lombok farming

The risk of lack of water or dryness is managed by farmers in two strategies, i.e. to match the panting schedule and to match the crops to be farmed. Firstly, crop producers match the planting schedule with the availability of water. This case is more obvious for planting in dryland than in wetland. The plantings of crops in dryland are scheduled at the beginning of the rain season, i.e., around October each year. There is only one planting season in the dryland. With this planting schedule, the crops (seasonal crops, not the perennials) with a production period of 3-4 months then be harvested in February/March of the next year. For the wetland there is no problem on timing of planting, meaning that planting can be done any time, since water for irrigation is available whenever required. In wetland farmers grow crops three times a year.

Second strategy for reducing risk of lack of water for irrigation is by selecting crops to be farmed. It appears from Table 1 that crops selected for dryland and wetland are similar, consisted of rice, peanut, and corn, as the main crops. However, the number of farmers planting the crops in each season differs between wetland and dryland. In dryland with one planting times, the most planted crop is corn, followed by rice of dryland type, and peanut. This crop selection is judged by farmers as the selected crops are suitable for the condition of lack of water. This selection or suiting to the water availability is more obvious for the selection on dryland rice than the other two crops (corn and peanut).

The crop selection in wetland is indicated by number planting in each season (the first, second and third). The selection of rice (of wetland type) is obvious that all farmers planted the crop in the first planting season, but the number of plantings of these crops decreases in the second season and decreases again in the planting season. It appears here that farmers attempt to plant rice as much as possible under the condition of sufficient water availability and then reduce the number of rice planting and replace it with other crops (peanut or corn) in the second and third planting season. The selection of rice as the main production is found to be similar to planting priorities in new cropping land in East Lombok [33], that farmers attempt to plant rice as much as whenever possible. There is another reason of planting rice in full in the first planting season, that is, other crops may be damaged under conditions of excessive water. In the rainy season, the water from the rain is considered excessive, and this can damage other crops, as note the case for rice. Rice still grows well with a lot of water existence. This finding again shows that farmers manage the risk of crop damage by selecting of crops that resist the condition of excessive water availability. There is a strong indication that farmers have a very good sense of risk of production and manage it very well by suiting the crop selection.

The market risk of low price of farm products in wetland and dryland in North Lombok is managed by farmers by selling their products to nearby local markets. They do not sell their farm product on farm gates. This strategy improves the price of farm products since in nearby markets, farmers can meet with more buyers, and they can get informed about higher prices of their products. Framers who sell their products in their farms are risking their products for lower prices as the farmers receive less information on better prices. This is also supported with a smaller number of buyers who come to buy on farms, and they usually offer low prices.

This market risk and the strategies applied by farmers in North Lombok indicate the importance of symmetric information, as opposed to asymmetric one. Well-received and open information are very helpful to farmers in North Lombok to decide to sell their products at the higher prices. However, farmers have limited access to information. In this issue, local government may help to inform farmers with market information, such as price levels and locations with higher prices, hence farmers can get better deal for their products. With less information accessible for farmers, then farmers become very dependent to price offers from local assemblers.

All of the implemented strategies are for running the farming well, in the sense that farmers can get higher production and better prices for their farm products, both accumulating to higher income. All of

this cause farmer income to increase. The income increase can eventually improve farmer motivation to run their farming. High income is one of the main motivations in the behavior of the people, including farmers, in so called rational behavior [40-43]. When farming is running well, with no or less hurdles, then farming becomes more productive, including producing more foods. The more food production than previously helps improve the state of food security in regions or elsewhere.

4. Conclusion

Farming in the wetland and dryland of North Lombok, Indonesia, faced various risks. There are two main risks that farmers face, including the risks of production and market. Production risk sources from lack of water for irrigating the crops. Market risk comes when farmer products receive low prices. Nearly all risks in farming are quantitatively low but qualitatively high or intense, with almost all farmers mentioned the risks and its sources. Overall, risks in faming need to be managed by reducing or eliminating those risks, in order to keep farming running sustainably. Farmers have implemented strategies for reducing production risks by suiting the planting times and the crops, while market risk is reduced by selling products to nearly local markets while equipping themselves with information on better prices than the prices on the farm gates. All of the implemented strategies are for running the farming well. When farming is running well, with no or less hurdles, then farming becomes more productive, including producing more foods, and hence helps improve the state of food security in region or elsewhere.

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