Identifying and mapping risks in the coconut brown sugar processing business

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Abstract. The objective of this study was to identify and mapping the types and sources of risks in the coconut brown sugar processing business. The study's subjects were all the coconut brown sugar producers in the Tetenggolasa Village, South Konawe District, Indonesia. The sample was determined by census sampling method. Descriptive analysis was used in this study. The results of the study showed that there are 10 risks in coconut brown sugar processing business: coconut flower cannot be tapped all, coconut sap is stale, washy, spilled and drunk by pests, late growth of coconut flowers, difficulty to obtain firewood, coconut brown sugar process fail, spilled on boiling, coconut brown sugar broken at the stage of sales and the price was determined by the lender of the capital. High risk was identified just at the raw material procurement stage, such as the late growth of coconut flower, whereas all of risks at the stage of cooking and marketing were in low risk category.
Key Words: coconut flower, risk mapping, risk treatment, risk type, risk source.

Introduction. One of the processing industries of raw agricultural products in Indonesia is the coconut brown sugar industry. Coconut brown sugar is a type of sugar obtained from coconut sap that is a liquid produced from tapping the coconut flower. Southeast Sulawesi Province is one of coconut producing areas in Indonesia. The fact that sugar is a strategic commodity consumed by all age groups, has a large and potential market to develop, including coconut brown sugar. Most of the South East Sulawesi society uses brown sugar in order to produce cake, and the least reason for the consumption of the brown sugar is for its health benefits (Baka et al 2014). Although there are opportunities for the development of a good brown sugar business, there are also risks in the processing, among others, in terms of quality and quantity of raw materials (coconut sap) and auxiliary materials (preservatives, and firewood. This risk condition can cause losses in the processing of brown sugar. This also applies to coconut brown sugar processing business in Tetenggolasa Village.

Constraints in coconut brown sugar processing business were not only in the processing cycle but it is also influenced by climate conditions, namely by the rainy season and dry season. Coconut brown sugar produced during the rainy season produces higher amounts than during the dry season, but has a lower selling price. Therefore, mapping the risks of processing business of brown sugar is very important to know the amount of risk generated from the processing business.

The study of business risk and risk mapping has been done by Soedjana (2007), Praditya (2007), Fauziah (2010), Naureen (2011), Acquah et al (2012), Anisa (2012), Wiryani (2013) and Fausayana et al (2017). In Indonesia, risk research in brown sugar industry has been conducted by Fauziah (2010), Kusumawaty et al (2012), Wijaya (2012), Wiryani (2013) Abdulah (2015), Abdullah et al (2016), and Rianse et al (2015), Baka et al (2016). Research on risk mapping has also been conducted by previous researchers as Liu & Huang (2012), Akinola (2014), Tarasov (2011).

The present study is conducted to identify and map the risks of coconut brown sugar processing business in the Tetenggolasa Village, Buke Sub-district, South Konawe District. Studying risk profiles of rural communities also provides an insight on how to situate vulnerability, risk and climate change adaptation efforts within the context of the community's sustainable development agenda and can help to develop appropriate, inclusive

and well integrated mitigation and adaptation plans at local level (Asare-Kyei et al 2017), considering market analysis of demand and supply (Rodrigues-Entrena et al 2016).

Material and Method

Time and location of the study. Determination of study location was done purposively, that was in Tetenggolasa Village, Buke Sub-district, Konawe Selatan Dustrict. This study was conducted from April to June 2016. Population number was 23 individuals. Sample determination was done by using saturated sampling method.

Data analysis. The identified risks were analyzed by descriptive technique, firstly identifying the sources and types of risks, secondly observing the frequency of occurrence and calculating the total loss (consequence) of the risk identified at the processing stage of coconut brown sugar, thirdly mapping each risk based probability. The probability of risk was calculated by the formula (Sugiyono 2013):

$$\text{Risk probability (\%)} = \frac{\text{Event frequency}}{\text{30 days (1 month)}} \times 100$$

The amount of loss was determined based on the price of raw materials (coconut sap), the price of coconut brown sugar, the cost of treatment and the additional labor cost then multiplied by the number of incidents (each risk) within 1 month (Abdullah 2015). Based on the risk map, the probability of risk occurrence was divided into two categories: high and low. The boundary between the both high and low probability was determined by the average approach of the possibility (risk) of coconut brown sugar processing business. Based on this approach, in this study the possibility (probability) is high when it is ≥50% and low when it is ≤50%.

The impact of risks was also divided into two categories as high and low limits based on the highest average of identified risks. The amount of loss (IDR) of each risk derived from the total loss was divided into two parts to be able to map the risk whether included in the high and low risk category.

Results and Discussion

Business risk of coconut brown sugar processing. There are three stages of the activities undertaken in coconut brown sugar processing business starting from the stage of the procurement of raw materials sap, cooking, up to sale. Each of these stages of activity poses a potential risk and a significant loss to consider for future coconut brown sugar processing business. These risks should be identified sources to be managed appropriately.

The analysis of the possibility and magnitude of loss of coconut brown sugar processing risk was done based on frequency of occurrence. The risk mapping of coconut brown sugar processing business began with the process of identifying the risks that exist at any stage of the activity. The identified risks will be separated by the size and magnitude of a risk called risk mapping.

Stage of raw material procurement. Raw materials used in the business of brown sugar processing in the household scale was coconut sap, which was clear liquid in the coconut shoot whose shoots have not opened yet. In addition to sap as the main raw material there were also auxiliary materials used as preservative sap that was the use of lime. Procurement of the coconut sap raw materials was done for one-time procurement and one-time processing, i.e. morning. In addition to the raw materials of coconut sap and lime auxiliary materials, the timing of the interception also determines the existence of raw material procurement.

The success of the process depends on the procurement of raw materials. Raw material (coconut sap) that has good quality is characterized by a fragrant aroma of sap and has a sweet taste. Lime auxiliary materials are also important in order to maintain

the acidity level of the raw material (coconut sap). Provision of materials that are less precise helper will have an impact on the quality of coconut sap that will be processed into coconut brown sugar. There were many potential risk in stages of raw material procerument. The list of business risks of coconut brown sugar in this stage could be seen in Table 1.

Table 1

List of business risks of coconut brown sugar processing in the procurement stage of raw materials

No.	List of risks	Type of risk	Probability (%)	Loss amount (USD/month)	Source of risk
1.	Coconut sap could not be tapped all	Pure Non transferable Internal External	6.67	0.92	Heavy rain Limited labor
2.	Coconut sap was stale (foaming)	Speculation Non transferable Internal	6.67	0.62	Less lime Not hygienic coconut sap container Tapping is done noon at 13.00
3.	Liquid Coconut sap	Pure Non transferable Physical Internal	16.67	16.20	Tapping coconut flower was still young
4.	Coconut sap spilled and was drunk by pests	Pure Non transferable External	33.33	2.41	Bats and rats
5.	Late growth of coconut flower	Pure Non transferable Fundamental External	70.00	94.86	Long summer season

Coconut sap boiling phase. The main raw material in making coconut brown sugar was coconut sap. The availability and condition of coconut which is at a poor quality will decrease productivity, so coconut sap must be clear, smell nice and have sweet taste. Apart from the availability and condition of coconut sap, from the technical side of the processor can also affect productivity in the cooking (boiling) stage of coconut sap. The risks identified during the cooking step of coconut sap are as presented in Table 2.

Table 2

Business risk of coconut brown sugar processing at coconut sap boiling stage

No.	List of risks	Type of risk	Probability (%)	Loss amount (USD/month)	Source of risk
1.	Difficulty in obtaining firewood	Pure Non transferable Fundamental External	3.33	0.78	Continuous rain
2.	Coconut brown sugar process fail	Speculation Non transferable Internal	3.33	8.04	Coconut sap was stale (foaming)
3.	Coconut sap spilled on boiling	Speculation Non transferable Internal	3.33	0.34	Boiling juice without starch

Sales stage. The price of coconut brown sugar was $ 0.91 per kg on the coconut brown sugar processor and the price was $ 1.02 per kg at the merchant level. It was because the processor borrowed the previous capital to the collecting traders in running their business activities. The price of coconut brown sugar will be high ahead of the fasting month and at the day end of celebratrion at end of fasting month, due to the increased demand. Indonesian people prepare various cakes and foods for their own needs and for the celebration of the fasting month. One of the principal raw material of the cakes and food is brown sugar. The price of coconut brown sugar will decrease after celebration of the fasting month. There were many potential risk in sale stage. The list of business risk of coconut brown sugar in this stage could be seen in Table 3.

Table 3

Business risk of coconut brown sugar processing at coconut sap's sales stage

No.	List of risks	Type of risk	Probability (%)	Loss amount (USD/month)	Source of risk
1.	Coconut brown sugar is broken at the stage of sales	Speculation Non transferable Internal	6.67	0.47	Mostly soda
2.	The price is determined by the lender of the capital	Speculation Non transferable Internal Economy	3.33	1.03	Capital loan from coconut brown sugar broker collector

Risk mapping. The identified risks that started in the procurement stage of raw materials, continuing with the stage of cooking (boiling) coconut sap, and ending with stage of sales of coconut brown sugar were subsequently mapped. The risk mapping of coconut brown sugar processing business was based on risk management to determine the sources of risk from the highest to the lowest. Therefore, through risk map, mitigation of coconut brown sugar business processing risk can be done.

Based on the risk map, the probability of risk occurrence was divided into two categories: high and low. The probability of boundary between the high and the low risk was determined by the approximation using the average probability (%) of coconut brown sugar business processing risk, namely 50%. High risk category when the probability was >50%, and low risk category when the probability was <50%. The consequence of risk was also divided into two categories namely the high and small consequence based on the highest average of the identified risks of $ 47.43.

Figure 1 presents the probability and the impact of major and minor risks at the stage of supply of raw materials will be mapped based on the risk map.

In Figure 1, quadrant I presents an area with medium probability and consequence level, the risk map indicates the absence of occurrence in quadrant I. Quadrant II was an area having probability level and high risk consequence. The risk that occurs in quadrant II was the risk of old outbound.

Coconut flower risk could not be tapped all, stale coconut sap, liquid coconut sap, and coconut sap spilled on boiling was a risk that has the possibility of probability and small consequences that were in quadrant III. Quadrant IV has probability and moderate consequences. Risk of the procurement stage of identified raw materials did not present a moderate risk.
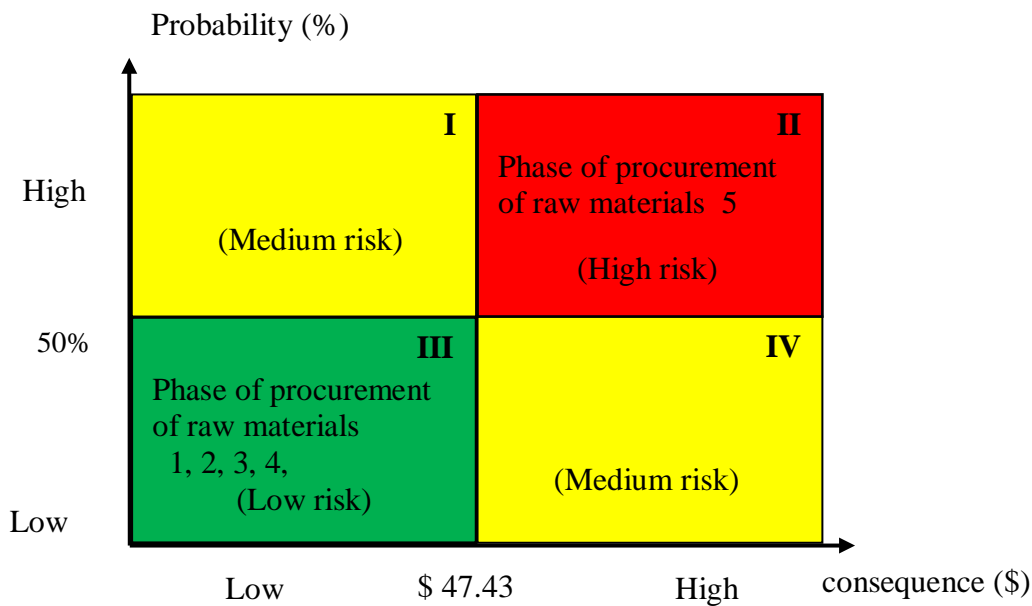
Figure 1. Risk mapping in raw material procurement stage.

The coconut sap boiling phase was a process where the tapping results would be boiled until the color of coconut sap became brown. The amount of coconut brown sugar produced was not only influenced by how much coconut sap was produced but could also be influenced by the resources of the processor, in this case was the accuracy of the processor in the cooking process. There are three risks identified during the cooking stage and will be mapped based on the following risk status:
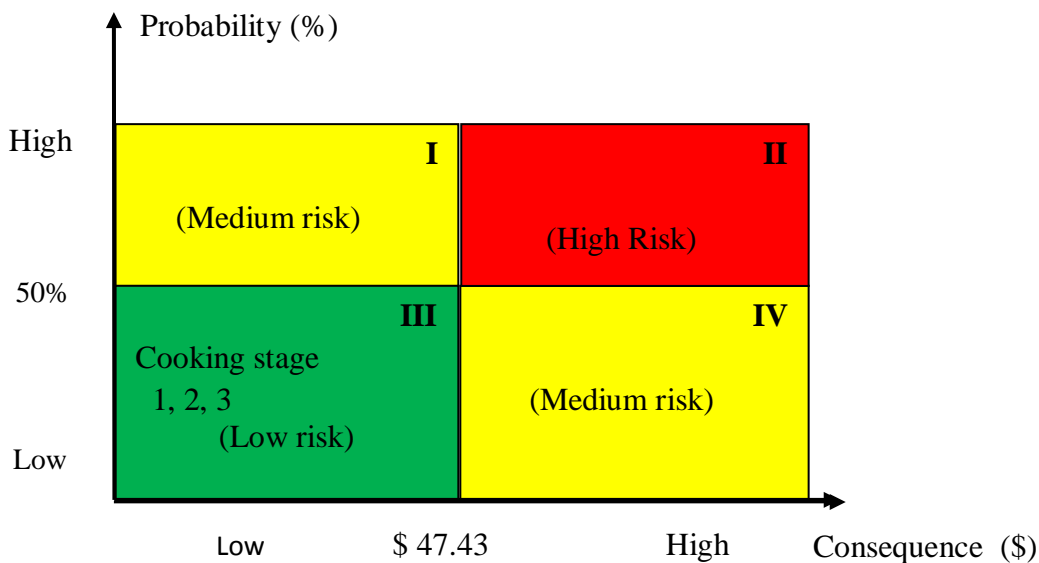

Figure 2. Risk mapping in coconut sap boiling stage.

Figure 2 showed that quadrant I, II, and IV consciousness there was no high probability and consequence identified at the cooking (boiling) stage of coconut sap. There were small risk category mapped in quadrant III, namely the risks of the difficulty in obtaining firewood, coconut brown sugar preparation process fail, and coconut sap spilled on boiling. The availability of raw materials and good condition of coconut sap will actually maintain the productivity of the coconut brown sugar processing business. The availability of firewood used for cooking ingredients has a small risk because firewood could be searched around the immediate surroundings of forests and even timber could

be purchased from farmers who have the land of trees that could be used as fuel for cooking the coconut brown sugar.

In cooking process the required precision in the provision of raw materials. Failure in the cooking process will bind the next impact that was in the stage of selling coconut brown sugar. The risks identified at the selling stage were the risk of coconut brown sugar to being destroyed and the price determined by the funder, the risks would be mapped based on the large and small status of a risk (Figure 2).

Figure 3 indicates that there was no medium and high risk at the stage of sales to be mapped in the quadrant I, II and IV. The risk of the cooking (boiling) stage of coconut sap was identified as a small risk for the coconut brown sugar processor, i.e. the risk of coconut brown sugar was destroyed and the price determined by the capital giver was mapped in quadrant III.

Probability (%)

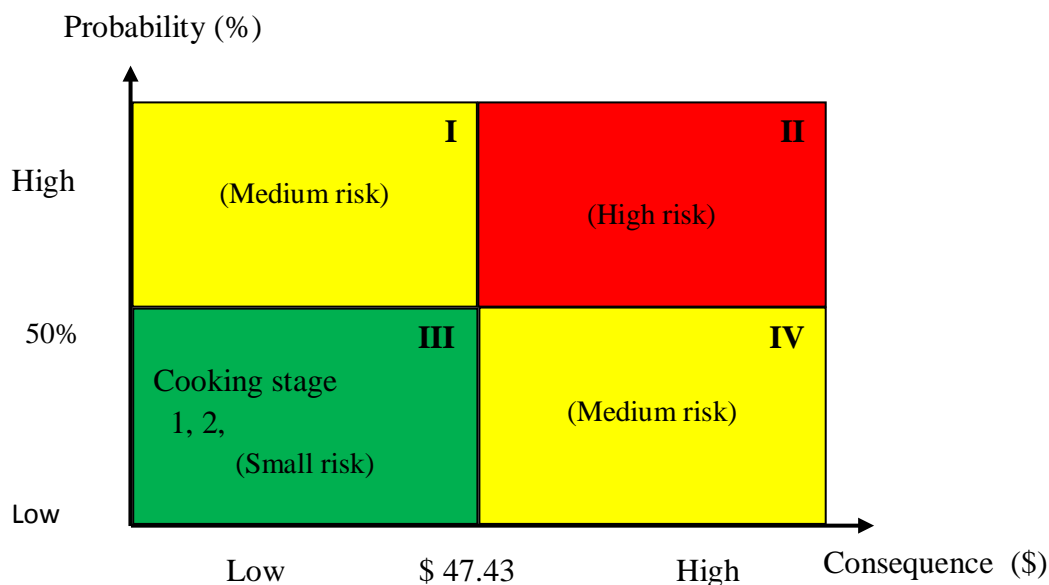|		
High	I (Medium risk)	II (High risk)
50%	III Cooking stage 1, 2, (Small risk)	IV (Medium risk)
Low	Low	High
	$ 47.43	Consequence ($)

Figure 3. Risk mapping in the sales stage.

The existence of risks may affect the level of profit received by the coconut brown sugar processor. The anticipation of this condition, the processor took some action or anticipation steps to overcome or at least minimize the probability of occurrence of the risks.

Conclusions. Based on the results and the previous discussions it can be concluded as follows: coconut brown sugar business identified 10 risks which are: coconut flower could not be tapped all, coconut sap was stale, washy, coconut sap spilled and was drunk by pests, late growth of coconut flower, difficulty to obtain firewood, coconut brown sugar process fail, coconut sap spilled on boiling, coconut brown sugar was broken at the stage of sales and the price was determined by the lender of capital. The high risks were in the procurement stage of raw materials, namely; late growth of coconut flower, while all the risks at the cooking and selling stages were in the low category.

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