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To Link this Article: http://dx.doi.org/10.6007/IJARBSS/v12-i1/11436 DOI:10.6007/IJARBSS/v12-i1/11436

Received: *06* November *2021,* ***Revised:*** *09* December *2021,* ***Accepted:*** *27* December *2021*

Published Online: 10 January 2022

In-Text Citation: (Syazliana & Khairuddin, 2022)

To Cite this Article: Syazliana, S. N., & Khairuddin, F. (2022). Risk Assessment on Factors Affecting Coconut Field Operation Among Smallholders to Enhance Coconut Production. *International Journal of Academic Research in Business and Social Sciences*, *12*(1), 277–289.

Vol. 12, No. 1, 2022, Pg. 277 – 289

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Risk Assessment on Factors Affecting Coconut Field Operation Among Smallholders to Enhance Coconut Production

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Abstract
The coconut production for smallholders' livelihoods is vital as their sustainable supply chain satisfies the local demand. The demand of the coconut products has raised over the past decade due to the highest awareness of the fruit's health benefits. Unfortunately, the decreasing of coconut production cannot meet the demand, thus need importing the coconut from the other countries such as Philippine, Indonesia, and Singapore. On average, Malaysia's coconuts production from 2014 to 2016 declined significantly from 595,097 tonnes to 504,773 tonnes (FAOSTAT, 2019) due to several factors such as physical, biological, environmental factors and others. Thus, this study was conducted to assess the level of risk and risk factors affecting coconut field operation among smallholders to enhance coconut production in the future. Quantitative research was used in this study involves coconut production as a dependent variable and pest and disease attack, workers' skill, technology and input supply as the independent variables affecting coconut production. The samples of 53 respondents were selected from 60 populations through the random sampling method from Kota Bharu district. The questionnaires were distributed to the coconut smallholders to get the primary data on the factors affecting coconut production. Risk assessment was conducted by identifying the level of risk faced by the smallholders to enhance coconut production using the descriptive analysis from the related questions given to the smallholders. The result shows that 9.4 % of the respondents stated there is very high-risk level and 81.1% stated high risk level in producing coconut. Based on multiple linear regression analysis, it was shown that risk in access to technology is the dominant factor affecting coconut field operation, which shows the beta, β is 0.522 by using 0.10 (p-value). Technology is essential in any other agricultural industry because it can bring out for sustainable the coconut industry. By improving the technology in processing and production, it helps to increase coconut productivity. Therefore, it is necessary to suggest a better solution for the major factors affecting coconut production. This information can expose the coconut palm growers to act at their fields to avoid decreasing coconut yield.
Keywords: Level of Risk, Factors Effecting Coconut Production, Smallholders, Coconut Industry.

Introduction

Coconut, or the scientific name Cocos nucifera L. from the family Palmae, is commonly known as 'Tree of Life, because of its multiple uses and considerable utility. Coconut cultivates in more than 90 countries, primarily Asia, Pacific, and South America. In Malaysia, coconut is one of the important crops for the national economy. Besides, Malaysia remains one of the top 10 coconut producer countries and coconut is essential as the fourth main industrial crop after oil palm, rubber, and paddy. Moreover, the coconut sector is divided into two groups: estate or plantation and smallholders in Malaysia. Most coconut planted in Malaysia is traditionally cultivated by smallholders (Omar & Fatah, 2020).

As shown in Figure 1, in 2010, coconut production in the country amounted to 550,140 tonnes, followed by an expansion of production in 2012 to 624,152 tonnes. However, coconut production declined significantly from 2014 to 2016 and was steady in the following years to 500,000 tonnes until 2019 by referring to the Food and Agriculture Organization of the United Nations (FAOSTAT, 2019).

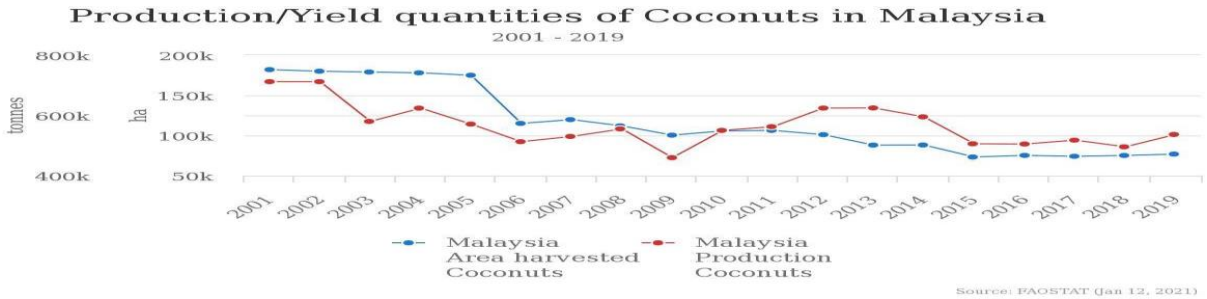

Figure 1.1: The combination of Malaysia area harvested coconuts and Malaysia production coconuts.

(FAOSTAT, 2019)

The coconut sector for smallholders' livelihoods is vital as their sustainable supply chain satisfies the local demand. However, on average, Malaysia's coconuts production from 2014 to 2016 declined significantly from 595,097 tonnes to 504,773 tonnes (FAOSTAT, 2019). It is shallow when compared to the output of the significant coconut producers in the world. This study's primary focus is the problems in field operation that causes decreasing in coconut production in Malaysia. However, the demand for coconut products has increased over the past decade due to the highest awareness of the fruit's health benefits. Unfortunately, coconut production cannot meet the demand, thus need import the coconut from other countries such as Philippine, Indonesia, and Singapore.

According to (FAOSTAT, 2019) it shows an overview of Malaysia's import markets of coconut. In 2019, Malaysia's total import value was RM 8.11M, while Malaysia's total import volume is 9.72K/metric tonnes. With the highest of Malaysia's dependence on coconut imports, local growers will face stiff price competition. If they continue to run at a loss, they may give up the cultivation of coconuts and switch to other crops. Thus, in the long run, it may affect national food security. Risk represents the probability of experiencing a major or minor hazardous event that is out of the ordinary. Agriculture is susceptible to risks that are frequently unpredictable and beyond the control of human beings. Like other agriculture industries,the coconut industry also faced risk.

Research Objectives

i. To determine the level of risks faced by the workers
ii. To identify the major factors affecting coconut production.
iii. To suggest a better solution for the major factors affecting coconut production

Risk Factors Affecting the Coconut Production

Pest and Disease Attack

Pest and diseases are the major causes of crops production in Malaysia. If farmers do not take any action to prevent these problems, it leads to severe losses faced by the smallholders. One of the widely distributed harmful pests that attack coconut palms in Malaysia is Red palm weevil (Rhynchophorus ferrugineus, Oliver, RPW). The infestation spread rapidly after the first case was reported and cause severe damage to thousands of coconut trees. Many of these pests are found in low densities and are eliminated naturally before they cause significant economic damage to the environment. Nevertheless, the pest always becomes the risk in enhancing any production in agriculture industries.

The Red palm weevil (Rhynchophorus ferruginues, Oliver, RPW) positively attacked coconut in Malaysia. According to (Herath et al., 2015), the majority 85% of smallholders stated that their fields were being affected by RPW. They also noted that the recommended control measures were not effective in reducing pest damage. Besides, coconut plantations in Malaysia have been devastated by phytoplasma diseases, known as Letal Yellowing (LY), and these diseases are considered the most significant factors affecting the coconut productivity of smallholder producers. According to (Nejat et al., 2009), coconut plantations have been devastated by phytoplasma diseases, known as Letal Yellowing (LY). These diseases are considered the most significant factors affecting coconut production worldwide, creating significant economic losses of up to 50%.

Unskilled Workers Affect the Production

Agriculture can improve the agriculture industry by incorporating traditional farming practices with expert knowledge, sufficient technology and requisite skills. Lack of required skilled workers for a specific job is one of the significant risks faced by the agriculture sector. Skills are essential for an individual coconut grower to make decisions in his/her field of works. When it comes to skill development, especially in the agricultural industries, it is observed that there is a significant discrepancy. The development of agriculture industries is substantial when the modern technology has been developed thus need scientific knowledge and necessary skill to handle their works properly. In addition, in the coconut industry, the individual coconut growers also require specific skills to make determinations about their respective fields of work. Therefore, skilled farmers are needed to increase coconut productivity, beginning with selecting mother palms for seed nuts, selecting good quality seed nuts, the maintenance of nurseries for quality planting material, integrated pest and disease management, and plant protection measures. According to (Herath et al., 2015), low productivity has a detrimental association with insufficient expertise or education. They believed farmers who could not have experience managing their farms might encounter difficulties of insect pest attacks or plant diseases, rather than farmers with more specialized skills and higher education.

Access to Technology

Technology is a body of knowledge used to create tools, develop skills and extract or collect materials. Between 1980 and 2000, enhanced agricultural technology packages were applied within the coconut-based farming systems by the National Coconut Development Program (NCDP) and The Malaysian Agricultural Research and Development Institute (MARDI). These innovations are designed to increase smallholder incomes by rising crop production. The concerted efforts to promote improved technologies to smallholders were supposed to produce positive outcomes by increasing productivity. However, access to technology also is a critical problem. According to (Herath et al., 2015), smallholders do not have easy access to new technology and only 28.75% of coconut farmers possess a high knowledge level that can adapt to the latest technology. Besides, this problem also has a significant positive relationship with age; older farmers have more difficulties accessing new technology. This may be because the aged and experienced farmers are reluctant to change and are willing to practice what they have been doing for a long time. However, according to (Udimal et al., 2017), age is also considered a factor in new technology acceptance. Older farmers have gained knowledge and experience through time and are better equipped to analyze technological information than younger farmers. Age, on the other hand, has been proven to have a negative association with technology adoption.

Access to Input Supply

The access to input supply is one of the constraints associated with low coconut productivity. The rules include inefficient use of productivity-enhancing input such as fertilizer and pesticides, planting materials, and lack of seedlings. Even though MARDI has developed the new varieties' seedlings, the varieties are still insufficient for all coconut farmers. The availability of high yield planting materials is crucial to ensure coconut planting's productivity and profitability are higher rather than other industrial crops. Lack of input supply such as the planting materials, fertilizer and pesticides, and lack of seedling will affect the coconut yield. Thus, lack of the superior coconut planting materials for replanting program throughout the world have resulted in worldwide coconut planting decreases at 12 million hectares during the last 10 years (Then, 2018). Additional efforts should be made by public and private coconut stakeholders to develop good high-yielding, pest and disease tolerant coconut planting material to support the coconut planting program and the global coconut industry's long-term growth. Moreover, most coconut smallholders also do not have a place to buy certified seedlings, and there are no sufficient seedlings available in the Department of Agriculture or certified private estates. Research done by (Man & Shah, 2020), stated that the farmers were also disappointed with the quality of the seed they purchased from Pasar Tani claiming that the production efficiency falls short of their expectations, resulting in a low yield.

Materials and Methods

Location od Study

The study was conducted at the State Department of Agriculture, Jalan Sultan Yahya Petra, Kota Bharu, Kelantan. The place was chosen because the location of the study is the area of coconut cultivation in Kelantan.

Population and Sample Size

The target population is the whole community of individuals drawn to be a sample for the research. The population for this research is consisted of the smallholders in 4 villages such

as Kampung Che Latiff, Kampung Jejabi Banggu, Kampung Bukit Marak and Kampung Kedai Baru in Kota Bharu, Kelantan. It is estimated the population for this survey is 60 people and by using the Raosoft calculator, it is recommended only 53 respondents that will take place in this research. Thus, the collected data will be strong enough to answer this research objective. In this research, the sampling design used is simple random sampling. Simple random sampling is a random sample of the population subset. It means each of the smallholders in the 4 villages may be selected to answer the questionnaire.

Data Collection

Quantitative research was used in this study through the survey method and the data was collected by a structural distribution of the questionnaire. The questionnaire was divided into 3 sections are section A, B, and C. Section A consist of demographic information, section B consist of risk factor affecting coconut production and section C dependent variable which is coconut production. SPSS was used to analyze the data such as reliability test, descriptive analysis and regression analysis.

Theoretical Framework

The Theoretical framework is a logical structural representation of the concepts, variables of dependent and independent also relationship involved in this study. Their function is to identify what needs to be measured, examined and described. The Theoretical framework is important to guide and ensure the study is managed well. So that the researcher will identify whether a dependent and independent variable is related or not at the end of the study. A dependent variable for this study is coconut production while the independent variable are worker's attitude, training, worker's skill and management implementation.

Results and Discussions

Descriptive Analysis

Demographic Information

Table 5.1 shows the information of respondents had been collected when conducted this study. The questions in Section A are very important to identify each of the respondents. Questions such as gender, age, status, education level, experience (year), total farm area (ha), coconut varieties used, and yield (nuts/ha/year) have been measured and analyzed these data using descriptive analysis. The table shows the demographic profile of the 53 total respondents for coconut smallholders in this study. 83% of the respondent is male and among all of the respondents 32.1% at the range age above 51 years old.

According to the smallholder's experience at the range of 11-15 years in handling coconut cultivation. The majority of the smallholders have less than 1-hectare farm area and the common variety used is Pandan.

Table 5.1: Result of demographic information

		Frequency (n)	Percentage (%)	Mean	Minimum	Maximum
Gender	Male	44	83.0	1.17	1.00	2.00
	Female	9	17.0			
Age	<20 years	2	3.8			
	21-30 years	7	13.2			
	31-40 years	13	24.5	3.70	1.00	5.00
	41-50 years	14	26.4			
	>51 years	17	32.1			
Experience (year)	<5 years	13	24.5			
	6-10 years	11	20.8			
	11-15 years	14	26.4	2.70	1.00	5.00
	16-20 years	9	17.0			
	>21 years	6	11.3			
Total farm area (Ha)	<1 ha	40	75.5	1.25	1.00	2.00
	2-4 ha	13	24.5			
Coconut varieties used	Malayan Tall	13	24.5			
	MATAG	11	20.8	-	-	-
	Mawa	10	18.9			
	Pandan	19	35.8			

Descriptive Analysis of Coconut Production

Table 5.2 shows the result of respondents rated on coconut production. Overall, it can be concluded that the respondents were slightly agreed with the statement related to coconut production. Besides, it also can quickly identify the level of risk faced by the workers. Based on Table 5.2 below, the mean of each question is above 3.30 while the standard deviation is more than 0.7. Thus, the highest mean is 4.1509 with a standard deviation of 0.86372, which indicates that the smallholder agreed with the statement of risk level in coconut production is high. Hence, the risk in coconut production will have a high impact in reducing coconut production. Moreover, the second-highest mean is 3.9057 with a standard deviation of 0.76621, which indicates the statement of individual farmers that did not have easy access to new technology and lack proper technical assistance affect coconut production. Then followed by farmers able to handle the risk efficiently with a mean of 3.6981 and a standard deviation of 0.74897.

Table 5.2: Descriptive analysis of coconut production

No.	Statement	Mean	Standard Deviation
1.	Pest and diseases are the significant causes of reducing coconut production among smallholders.	3.6415	.81085
2.	Lack of required skilled workers for a specific job is one of the significant risks faced by the coconut productivity of smallholder producers.	3.3208	.70092
3.	Individual farmers that did not have easy access to new technology and lack proper technical assistance affect coconut production.	3.9057	.76621
4.	Decreasing coconut production because of limited access to input supply such as seedlings, fertilizer, and pesticides is one of the risks of coconut smallholders.	3.6415	.78677
5.	The yield always increases for every season/month/year.	3.3019	.74897
6.	Farmers able to handle the risk efficiently.	3.6981	.74897
7.	Risk level in coconut production is high.	4.1509	.86372

Descriptive Analysis of the Level Risks Faced by the smallholders

Table 5.3: Descriptive analysis of the level risks faced by the workers

Level of risk	Frequency	Percent	Valid Percent	Cumulative Percent
No risk	-	-		
Low risk	-	-		
Moderate risk	5	9.4	9.4	9.4
High risk	43	81.1	81.1	90.6
Very high risk	5	9.4	9.4	100.0
Total	53	100.0	100.0	

In coconut production, it is necessary to know how the level of risks presents in the coconut field so that smallholders in Kota Bharu, Kelantan can improve the productivity of the coconut industry. The first objective of this study is to determine the level of risk faced by the workers. Risk assessment was done by identifying the level of risk faced by the smallholders to enhance coconut production using the descriptive analysis from the related questions given to the smallholders. It can quickly identify which level of risk they have faced. Based on Table 5.3, the smallholders' level of risk is slightly different from no risk to very high risk. Therefore, the result shows the 43 over 53 respondents with 81.1% stated there is high risk. Then, both 5 respondents stated there are moderate risk and very high risk with 9.4%. However, there are no respondents at the level of no risk and low risk. The survey results revealed that the production of coconuts was fraught with risk. By suggesting a better solution to the major risk influencing coconut output, farmers will maximize their profits in the future.

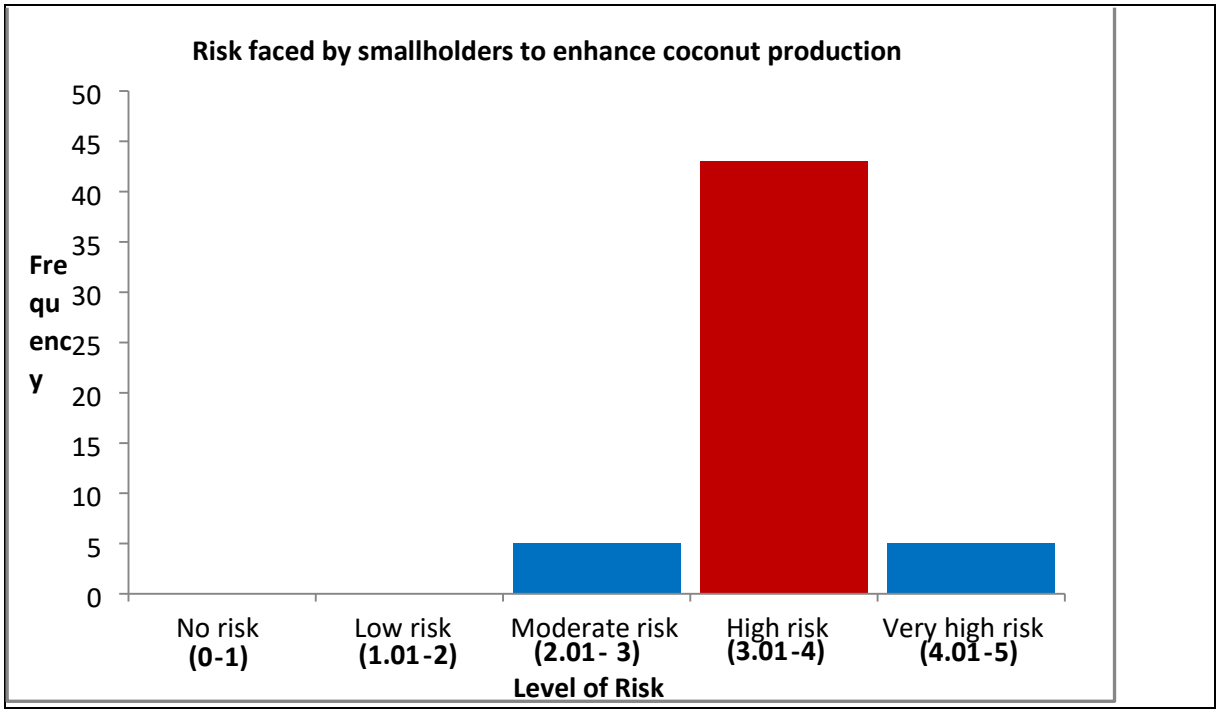

Figure5.1: Bar chart shows the level of risks faced by the smallholders to enhance coconut production.

Based on Figure 5.1, most smallholders face high risk followed by moderate risk and very high risk. This study was supported (Fausayana et al., 2018) coconut smallholders are constantly faced with risks, such as production, price, and marketing. From the study, it was identified that smallholders faced a high risk to produce coconut production. When the production risk is high, it causes the productivity of the head to decrease. If the risk continually happened on coconut production would affect the coconut industry's sustainability soon

Multiple Linear Regression Analysis

Table 5.4: Model Summary

Model	R	R-square	Adjusted Rsquare	Std. Error of the Estimate
1	.510[a]	.260	.199	.24362

The multiple linear regression analysis finding is shown in Table 5.4 above, which is the most significant factor in the coconut production among the smallholders in Kota Bharu, Kelantan. Based on the results above, the R-value is 0.510, indicating the moderate positive deal with the variance shared by the independent variables. Meanwhile, it showed that the value of R-square is 0.260, and this shows that there are 26% of the variance in the dependent variable, which is the production of coconut within the regression model, is explained by one significant independent variable in this study which is the access of technology as refer to the Table 5.5. However, the other 74% was influenced by the other factors.

Table 5.5: Multiple linear regression analysis

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	Beta, β	Std. Error	Beta, β		
(Constant)	1.490	.910		1.637	.108
Pest and disease attack	.283	.162	.234	1.743	0.88
Unskilled workers	-.171	.165	-.151	-1.037	.305
Access of technology	.628	.179	.522	3.512	.001
Access to Input Supply	-.103	.144	-.098	-.718	.476

a. Dependent Variable: Coconut production

The least square regression line of *y* on *x* for a set of data is in the form of

$Y= \beta0 + \beta1X1 + \beta2X2 + \beta3X3 + \beta4X4 + Ɛ$

$Y = 1.490 + 0.522X_1 + 0.234X_2 + (-0.151X_3) + (-0.098X_4)$

Where:

y = Coconut production β

= Constant

X_1 = Access of technology

X_2 = Pest and disease attack

X_3 = Unskilled workers

X_4 = Access to input supply

Ɛ = the error term

According to Table 5.5 the results showed that one independent variable, which is access to technology had a statistically significant relationship with coconut production. In contrast, the other three independent variables, pest and disease attack, unskilled workers, and access to input supply, had no statistically significant relationship with the dependent variable. As a result, based on the data presented above, this study concludes that the dominant factor is access to technology, with a beta, β value of 0.522 and that the highest factor among the others has a significance value of 0.001 (p-value), which is less than the 0.05 level of significance. The key element that makes access to technology most dominant is whenever the coconut smallholders do not get the proper technical assistance. They expect that government agencies or extension agents play essential roles in disseminating information and technical knowledge, guiding suitable communication approaches and profitable channels to influence smallholders to adapt to new technology. According to (Albore, 2018), an extension agent is the type of leadership that will bring smallholders to provide an expanding critical thinking aspect into the success. The participation of extension services is crucial because they play important roles as educators in selecting and producing solutions or recommending new alternative courses of solution and action for consideration

Suggestion Solution for Improvement and Effectiveness of Technology Access

Smallholders

Technology is fundamental in agricultural activities, especially in coconut field operation, to enhance coconut production among the smallholders, thus gaining the highest profit maximization. The Malaysian coconut sector might be changed from a small industry to a more competitive sector throughout the world. Furthermore, lack of involvement of young

generations in coconut cultivation and the whole agricultural industries because they are more venture in industrial and service sectors as their primary source of income (Mohammad et al., 2020). The suggestion to attract younger generations to this problem is government should provide them with a lot of incentives to strengthen and revitalize the industry. The incentives such as National Young Agropreneur Council (MAM), the Young Agropreneur Programme, the National Agricultural Skills Training Programme (PLKPK) and microlending facilities should be offered to them in order to promote this industry, which might serve as a model for other looking to enter the industry.

Extension Agent

When farmers have access to extension services, they are more likely to accept new technology. Farmers learn about the benefits of new technology through extension services provided by extension agents. Extension agents typically cover a wide range of areas, such as enhanced technology for smallholder utilization, improved crop variety and planting technique, improved crop water supply and management, and so on. The extension agent's role can also help set up local smallholder organizations and groups by providing a benefit through the extension program and boosting agricultural output by applying the indispensable element to smallholders.

Extension agents should frequently visit smallholders' coconut farms, thus recognizing the issues and quickly overcoming the problems faced by the farmers and accomplishing the fulfillment to achieve target based on the applicable guideline. This suggestion supported by (Omar & Fatah, 2020), which has done a research study on unrevealing the factors affecting agriculture profitability, stated that a field visit from an extension agent has a statistically significant favorable influence on coconut production. Therefore, a field visit from an extension agent is essential for enhancing the distribution of technical information among smallholders in the coconut industry. Moreover, the other suggestion for extension agents is by introducing the program like training sessions to the farmers because it can help them develop their entrepreneurial skills to think of farming as a business and adopt innovations that would boost productivity. It also can improve their knowledge and abilities.

Policy Makers

Furthermore, as the coconut sector expands rapidly due to increased demand for coconut-based products, the question of whether Malaysia can boost coconut output and improve operational efficiency arises. Currently, technology innovations in use are still productive, but the input-output combination might be enhanced to yield better results. So, it is essential for agriculture policymakers to play their roles, thus promoting the coconut industry to become more sustainable in the future market. The better solution is agriculture policymakers such as MARDI, and the Department of Agriculture should continue to play an essential role in the coconut industry's research and development (R&D). According to (Udimal et al., 2017), an increase in production may have occurred as a result of the use of technological advances in coconut production, including the use of chosen hybrids and inbred varieties, as well as the implementation of effective agricultural methods.

Conclusions and Recommendations

It can be concluded from this current study that the coconut industry needs to be given greater prioritized because it can emerge as one of the new wealth crops in the future. It is

expected to become a significant commodity in the country, thus contributing to gross domestic product (GDP). Besides, the majority of coconut smallholders in Kota Bharu are facing a high risk in coconut production. From the descriptive analysis, they lack literacy status toward the probability of the risk occurring in the coconut field operation. When the production risk is high, it causes the productivity of the head to decrease. If the risk continually happened on coconut production would affect the coconut industry's sustainability shortly. The research finding in this study can recommend several aspects to improve and ensure the coconut productivity always give a higher yield. The first is Department of Agriculture plays an essential role in helping smallholders manage their coconut farms, mainly smallholders in Kota Bharu, Kelantan. It also recommended that the government include sustainable coconut development as a national priority program to meet demand, improve farmer dissemination of innovative technologies, capacity building for smallholder farmers, promote local consumption of coconut-based products, increase the number of manufacturing industries in major coconut producing regions to produce marketable and profitable products.

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