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Economic Analysis of Cassava Production in Cambodia

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Abstract: ***The research is conducted to describe the socioeconomic characteristics of Cassava farmers; analyse the costs and returns in Cassava production; and determine the resource use efficiency of Cassava production in Cambodia. Multistage random sampling technique was used to select a sample size of 568 respondents for the study. Data analysis was carried out using descriptive statistics such as frequency counts and percentages. Most of respondent are male (73%) with 84.4% of the farmers married, having family size of 3-6 (80.3%) people, using mostly hired labour. More than 50% of the respondents have formal education, with 6 years and above farming experience, less than 50% of them had some input from non-farm actives. Gross margin result indicate that farmer obtain a net return of 1,269,487 riels per hectares with a benefit-cost ratio of 1.31. All variables input are significant with different level. The most important variable include: Household size, Land size, labour and capital. Findings showed that the farmers were inefficient in their resource use. This suggests that for the farmers to increase cassava output in the area, they should employ more of the productive resources such as improved varieties and labour to boost their productivity. The research concludes that cassava farming is profitable and so new innovation should be passed to the farmers to adopt.***

Keywords: Cost and Return, Economic, socioeconomic variables

1. Introduction

Cambodia is an agrarian country which agricultural sector contributed 20%to the Gross Domestic Product (GDP) of the nation and share of total employed population (aged 15 to 64 years old) shrank by almost 2.5 percent a year during 2009-14, dropping to 45.3 percent in 2014, from 57.6 percent in 2009 shedding half a million jobs(World Bank 2016). Total areaDevoted to agricultural cultivation is about 0.5 million hectares (FAOSTATE 2014)with the average area of agricultural land available per agricultural household is only 1.4 hectare(NIS 2013). Besides rice, which is the major food production in Cambodia, farmers, local and international traders, and industrials are attracted to cassava production.

Cassava (ManihotesculentaCrantz) is a perennial shrub, though harvested around a year and it is popularly grown for its tuberous root which consist about 15% peel, and 85% flesh(Olugbemi 2016).Cassava is essentially a tropical crop and does best with mean temperature of 25-29^{o}C(Onwueme and Sinha 1999) with annual rainfall is greater than 500 mm(MAFF 2015).

As a staple crop, cassava has certain inherent characteristics which make its cultivation attractive to smallholder farmers in Cambodia. Such traits include ability to thrive on soils where other crops failed; cassava is regarded as a famine reserve crop which requires relatively low amounts of inputs.The crop can withstand stress such as drought, available all year round, cheap to cultivate and generates good income for peasant farmers, thus providing household food security

As stated above, cassava is the second largest crop production in Cambodia after rice and is grown mainly by smallholder farmers for food to supplement the rice diet, for animal feed and for extraction of starch from its roots with recent years there has also been major interest in the use of cassava as a raw material for the production of ethanol(Sarom, et al. 2014). It is a kind of root crop that is convenient to grow, drought tolerant, insect and illness resistance, and has a high yield(FAO 2008-2012)

Cassava plays a very important role in household income for farmers. It significantly contributed the household income of the poor farmers and consequently to the country economy(MAFF 2015). Ministry of Agriculture, Forestry and Fisheries in Cambodia also mentioned that most of the cassava roots produced in the country is exported to the overseas markets through either Thailand or Vietnam and, only a small proportion of that is used in local cassava processing plants in the country.Barriers that prevent a direct trade of Cambodian cassava withthe international markets are complex and are less likely to overcome all at once. Nevertheless,Cambodian traders and processors are important to aware about the quality standard required, and ways how to improve the local products before they are in a position to enter the international markets by their own brand. According to *ATH et al., 2012*has concluded that cassava production will continue to be developed in Cambodia, especially its technical production and marketing. As technical production improves, it will extend to all farming areas. As for marketing will be promote both in local and international. As a result, farmer living standard will be better and prosperity from cassava production.

Although cassava can help increase household income and improve livelihood opportunities and benefits to smallholder farmers in Cambodia, there are serious concerns about the fluctuation of price(MAFF 2015). In this case, determinant of the cost and returns of cassava production is very important to address factors responsible for minimal production and bring about increased incomes of the farmers. Therefore, this study is to examine the economics of Cassava production in Cambodia with the specific objectives are to: describe the socioeconomic characteristics of Cassava farmers; analyse

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the costs and returns in Cassava production; and determine the resource use efficiency of Cassava production.

2. Materials and Methods

This study was conducted in Cambodia in most of provinces reported by Ministry of Agriculture Forestry and Fisheries with more than 1000hectars of cassava area in each province. Therefore this study conducted in 16 out of 24 provinces in Cambodia named: Banteaymeanchey, Battambang, Kampongcham, Kampongthom, Kompot, Kratie, Mondulkiri, Preahvihear, Pursat, Rattanakiri, Siemreap, Stuengtreng, Svayreing, Takeo, Otdormeanchey, and Pailen. The duration of research was between January to May, 2017.

A multi–stage sampling technique was used to select 568 cassava farmers across the country. Data collected through structured questionnaire. Primary data collected focused on socioeconomic characteristics of Cassava farmers, inputs used, cassava output and their prices. The data were analysed using descriptive statistics such as frequency distribution and percentages. Budgetary techniques analysed such as gross margin and profitability ratio were used to estimate the costs and returns of Cassava production in the study area. Farm budgetary analyses enable the estimation of the total costs as well as total revenue accrued to the enterprise within a specific production period (Olukosi 1999). The difference between revenue (returns) and Total Variable Cost (TVC) makes up the Gross Margin (GM). It evaluates the gross profitability of a given enterprise. It is useful where the value of the fixed cost is negligible as it is the case with Cassava production which is operated mostly at small scale level.

Therefore, Gross Margin is given as:

$$GM = TR - TVC$$

Where,
- GM = Gross Margin
- TR = Total Revenue
- TVC = Total Variable Cost

The profitability ratio used is Benefit-Cost Ratio (BCR) =Gross Benefit/Total Cost

Production functions were fitted into the data. Three of the forms tried are linear, semi-log and Cobb-Douglas. The implicit form of the regression model used was:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, U) \quad (1)$$

Where:
Y = Output of Cassava (kg)
X_1 = Gender (1 = Female, 2 = Male)
X_2 = Educational level (years of formal schooling)
X_3 = Capital (Riels)
X_4 = Farm size (in hectares)
X_5 = Non-Farm income (Riels)
X_6 = Labor (in man days)
X_7 = Age of farmers (in years)
X_8 = Farming experience (in years)
X_9 = Family size (number)
X_{10} = Cassava cuttings (Number of bundles)
U = Error term

Explicitly the functional forms are expressed as follow:

(a) Linear form:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + U \quad (2)$$

(b) Semi-log form:

$$Y = b_0 + b_1\log X_1 + b_2\log X_2 + b_3\log X_3 + b_4\log X_4 + b_5\log X_5 + b_6\log X_6 + b_7\log X_7 + b_8\log X_8 + b_9\log X_9 + b_{10}\log X_{10} U \quad (3)$$

(c) Double-log form:

$$\log Y = b_0 + b_1\log X_1 + b_2\log X_2 + b_3\log X_3 + b_4\log X_4 + b_5\log X_5 + b_6\log X_6 + b_7\log X_7 + b_8\log X_8 + b_9\log X_9 + b_{10}\log X_{10} U \quad (4)$$

Where,
b_0 = constant, b_1-b_{10} = estimated coefficients, X_1-X_{10} are as defined in Eq. (1). Economic, statistical and econometric criteria were employed to choose the lead equation based on coefficient of determination (R^2), significant levels of the parameters, and signs of the estimated coefficients that conform to the a priori expectations.

3. Result and Discussion

Table1 represents the demographic characteristic of respondents and others independent variables. The result revealed that most of the respondents are male with 73% of the total number follow by 27% are females. The age category ranked similar percentage for this research. The active group aged between 30 to 50 years old presented more than 50% of the total respondents. Therefore, these people are very active in farming. On the other hand, more than 80% of respondents are those who already married that mean they have enough capacity to work on their farm. Moreover, the household size ranked from 3 to 6 people per family presented a high percentage (80.3%) for this research so most of respondent have enough labor to work on their farm. For land size, 84.1% claimed that they have land from 1 to 5 hectares and only 12.3% of the total respondent holding land more than 5 hectares. In contrast, the education level of respondent is very low. In this research, 56% of the respondent mentioned that their highest education was at primary school level while 21.1% was secondary school level. Moreover, there is 9.1% was reported that they don't have any education (illiterate). Understanding about farming experience also important for this research. More than 40% of the respondent answered that they have more than 15 years experiences in their farming. Non-farm in come also contributed to this research with nearly 60% of respondent without other income besides farming. For those who have non-farm income, the average amount is 1 million riels with 23.3% received 0.5 to 1 million riels and 10.6% received 1 to 5 million riels from their non-farm income. The extra labor need to evaluate in this research since the cassava farming need much labor during harvesting. Among the respondents, 62.9% existed 1 to 3 peoples and 31.9% present 3 to 6 people as extra labor. Less than 40% mentioned that in term

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of capital they expect less than 5 million riels, 25% expected 5 to 10 million riels, 22% expected 10-20 million riels, and only 18% expected more than 20 million riels.

Table 1: Household demographic and other independent variable

Item		Frequency	Percentage
Gender	Male	584	73
	Female	216	27
Age	19-30 years	157	19.6
	30-40 years	215	26.9
	40-50 years	226	28.3
	50 years and above	202	25.2
Marital Status	Single	30	3.8
	Married	668	84.4
	Widow/Widower	102	12.8
Household Size	1-3 Persons	130	16.3
	3-6 Persons	642	80.3
	6 Persons and above	28	3.5
Land Size	Less than 1 hectare	29	3.6
	1-5 hectares	673	84.1
	5 hectares and above	98	12.3
Education	Illiterate	73	9.1
	Primary School	448	56.0
	Secondary School	169	21.1
	High School	98	12.3
	University	12	1.5
Farming Experiences	1-5 years	186	23.3
	5-10 years	214	26.8
	10-15 years	72	9.0
	15years and above	328	41.0
Non-farm income	No income	474	59.3
	Less than 0.5 million Riels	42	5.3
	0.5-1 million Riels	185	23.3
	1-5 million Riels	85	10.6
	More than 5 Million Riels	14	1.8
Labor	1-3 Persons	503	62.9
	3-6 Persons	255	31.9
	6 Persons and above	42	5.2
Capital	Less than 5 million Riels	280	35
	5 -10 million Riels	200	25
	10-20 million Riels	176	22
	More than 20 million Riels	144	18

Note: 4,000 Riels=$1USD

Costs that were considered here include cost incurred from variable inputs like labor, transportation, fertilizer and pesticide, and other costs. Labor cost shared the highest amount (47.2%) among total cost followed by transportation cost (31%) accounted for about 65.2% of the total production cost, while analysis of other variables shows that the percentages share of fertilizer and pesticide and other costs are 9% and 12.8%, respectively. Labor therefore took the highest percentage of Total Variable Cost (TVC). The Costs and returns analysis shows gross margin of 1,269,487 riels per hectares. This when divided by a year gives a monthly income of 105790.58 riels. The Benefit-Cost Ratio shows a figure of 1.31, meaning for every 1 riel invested in Cassava farming, an additional 1.31 riel will be realised.

Table 2: Costs and Returns analysis per hectares

A. Variables /Inputs	Amount (Riels)	%
Labor Cost	1,881,880	47.2
Transportation Cost	1,235,000	31.0
Fertilizer and Pesticide Cost	360,737	9.0
Other Cost	509,450	12.8
Total Variable cost	3,987,067	100
B. Revenue		
Dry cassava	5,101,754	97.1
Consumption	54,800	1.0
Stem	80,000	1.5
Gift	20,000	0.4
Total Revenue	5,256,554	100
Gross margin 5,256,554 - 3987067= 1,269,487		
Benefit-Cost Ratio, BCR: 5,256,554/3987067=1.31		

Cobb-Douglass production function was chosen as the lead equation out of the three functional forms tried since satisfied the economic, statistical and econometric conditions. The result in table 3 shows that all the variable inputs had positively effect. This means that these variables are directly related to Cassava output. A one unit increase in any of these variables will result to an increase in output by a corresponding coefficient of the variable. Age (X_2) and Education (X_5) are significant at 1% level of significance while Gender (X_1), Farm Experience (X_6), and Non-farm Income (X_8) are significant at 5% level of significant. Four variables are very significant at 10% include Household Size (X_3), Land Size (X_4), Labor (X_7), and Capital(X_9). The coefficient of determination (R^2) is 0.891; this implies that 89.1% of the variation in the output of Cassava production in the study area is explained by the explanatory variables in the model.

Table 3: Cobb-Douglass regression result of cassava production

Variable Inputs	Coefficient	Sig.
Gender	0.075	0.033*
Age	0.084	0.010**
Household Size	0.107	0.003***
Land Size	0.109	0.002***
Education	0.091	0.010**
Farm Experience	0.069	0.050*
Labor	0.096	0.007***
Non-farm Income	0.071	0.044*
Capital	0.107	0.003***
R^2	0.891	

Extracted from computer analysis results; **: Significant at 1%; *: Significant at 5%; ***: Significant at 10% level of significance;

4. Conclusion

From this research, it can be concluded that Cassava farming is a profitable venture in the study area. Gross margin provided by this farming was 1,269,487 riels per hectares. The Benefit-Cost Ratio shows that every 1 riel invested in Cassava farming, an additional 1.31 riel will be realised. Therefore, the farmers are inefficient in the use of their resources in Cassava production in the area. Therefore, more variable resources should be employed in order to achieve maximum output from Cassava production and increase their profit margins. The relevant institution in charge of Cassava should try to ensure that varieties that are not desirable are

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eliminated from the system and replace with desirable ones. Extension service should be improved to facilitate adoption of new technologies that will encourage the production of this crop where it is favourable but not yet considered to be grown. Good road networks should be provided to ease the cost of transportation.

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