ADVANCING SMALLHOLDERS' SUSTAINABLE LIVELIHOOD THROUGH LINKAGES AMONG STAKEHOLDERS IN THE CASSAVA (*MANIHOT ESCULENTA* CRANTZ) VALUE CHAIN: THE CASE OF DAK LAK PROVINCE, VIETNAM

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Abstract. Cassava (*Manihot esculenta* Crantz) is a versatile crop that plays a vital role in sustaining smallholders' livelihoods, and in increasing farmers' income. This research assessed the cassava value chain in Dak Lak province, Vietnam. It demonstrated the need for enhanced efficiency in the production of cassava thus enhancing the cassava value chain. Value chain analysis was conducted through a questionnaire-based survey of 300 household farmers, in-depth interviews with key informants, and focus group discussions in seven communes in three districts. The aim was to explore how to improve and develop the value chain, increase stakeholders' incomes and particularly, to ensure sustainable household livelihoods. The findings relating to the sharing of value added among the stakeholders showed that farmers create the highest value added but that intermediaries derive the most profit. In addition, relationships exist amongst different stakeholder ranging from input providers to the final users which are overwhelmingly starch and ethanol factories. There is a local linkage between input suppliers and farmers, both spot-market and persistent relationships which exist between farmers and intermediaries. Furthermore, the distribution of both gross and net profits overwhelmingly favors the traders and processors. However, intermediaries play an important role and the farmers would not secure full benefits without their support.
Keywords: *gross profit, household, intermediaries, stakeholders relationship, value added*

Introduction

Cassava (*Manihot esculenta* Crantz) is a perennial drought-resistant crop cultivated mainly in dry areas, which contributes significantly to the nutrition and livelihood of many farmers (Sewando, 2012). This crop is a versatile plant that is used in the production of a large number of products ranging from traditional food products to livestock feeds as well as having uses in the industrial sector as a raw material for ethanol and starch and its numerous derivatives (Pingmuanglek et al., 2017). The Vietnamese cassava value chain is characterized by numerous intermediaries due to inadequate commercial infrastructure as well as a fragmented pattern of land use for cassava production (Thao et al., 2013). As a result, cassava has a lower value compared to other crops in the same region. Dak Lak province is in the middle of the Central Highlands where four other provinces, Gia Lai, Kon Tum, Lam Dong, and Dak Nong are also located (Dak Lak, 2018). In Dak Lak, cassava is grown as a cash crop by rural

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households and the income earned from cassava plays a vital and increasing role in farmers' livelihoods (Son et al., 2016). The area cassava plantations in Dak Lak province has grown from 30,732 ha in 2014 to 36,300 ha in 2017 (GSO, 2018a), and the yield of cassava during that period fluctuated only slightly from 18.3 to 18.8 tonnes per hectare (GSO, 2018b). Cassava farmers also face various challenges stemming from a lack of access to modern inputs and improved varieties, as well as the problems relating to the local infrastructure and a lack of access to credit (Njukwe et al., 2014). Hence, improvements in the productivity of cassava, the processes used, their products, in the means of distribution in the value chain would lead to an improvement in output (Masamha et al., 2017).

This would in turn contribute to an increase in household income which would lead to increased spending in areas such as education and health services as well as other aspects of daily life (Rutherford et al., 2016). Nevertheless, unpredictable cassava prices in developing countries have tended to increase the vulnerability of farming household incomes (Ouma and Jagwe, 2010). In addition, the farmers have limited to connection with the market as well as a lack of comprehensive information. Consequently, building relationships among stakeholders in the cassava value chain and increasing cassava productivity is necessary in this region. The aim of the study is to improve and develop the cassava value chain, increase stakeholders' income and particularly, to find out the appropriate strategies to ensure sustainable household livelihoods.

Review of literature

Cassava is a crucial source of food in Africa because it can be planted in unfertile soil and is also able to resist severe weather (McNulty and Oparinde, 2015; Meridian Institute, 2012), and it is, for instance, a vital staple crop in Liberia (Coulibaly et al., 2014a). Africa is one of the leading cassava producing regions contributing over 56% of the total global supply (FAO, 2018). It has been proposed that labour, transportation systems and novel technologies, as well as the coordination of agents, are all factors by which the efficiency of the cassava value chain could be improved (Trienekens, 2011). The cassava market is primarily based on the cassava tuber and products made from it. However, cassava leaves also offer an additional source of nutrition although there have been few studies to date of their benefits or of how they are consumed and whether there is a wider market for them (Andersson et al., 2016). The utilization of locally available resources such as cassava, not only creates value-added products but also brings benefits to the local society, with benefits accruing to all stakeholders within the cassava value chain in the region (Mcnulty and Adewale, 2015). Olukunle (2013) found that income and employment for farmers in Nigeria could be created from the cassava value chain as well as other actors in the value chain with over one million jobs being created in rural areas of Nigeria and an increase of approximately US$450 per year in the income of 1.8 million participating farm families. However, although a strong long-standing market has been established in the cassava sector it was found that the farmers gained a smaller percentage of the total profits, compared to traders who received the largest part of the profit. Naziri et al. (2014) studied the cassava value chain and the diversity of post-harvest losses arising in four countries on two continents, Thailand and Vietnam in Southeast Asia, Nigeria and Ghana in sub-Saharan African. They found that post-harvest losses at different stages of the cassava value chain were due to cassava cultivation, processing and consumption methods and the relationships and linkages

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among the value-chain stakeholders. However, they suggested that there was no "one-size-fits-all" solution for dealing with post-harvest losses but those solutions depended on the specific characteristics of different value chains. They estimated that in Ghana, economic losses due to partial spoilage of cassava root were be between 16 and 28% caused by the long distance between the production site and the place of final consumption. Similarly, in Nigeria, economic losses suffered by cassava root due to breakage and deterioration during harvesting and distribution were estimated to be between 10 and 30%. Daniels et al. (2011) were able to provide a complete picture of the value chain in Nigeria including farmers, processors, traders, input suppliers and other stakeholders

In Cambodia, the yield of cassava is from 8 to 10 tonnes per ha with the average area under cassava being 0.2 to 1 ha/household. A study of the cassava value chain was conducted by the IBC (Inclusive Business for promoting sustainable Cassava smallholders) project in Tboung Khmum province and the study particularly examined government policy (SNV Cambodia, 2015) as well as examining gender-related aspects of the value chain. The linkages among stakeholders were analyzed with the aim of improving knowledge as well as proposing appropriate measures for further strengthening the cassava value chain. In recent years, the productivity and yield of cassava in Vietnam has increased and it now ranks third in terms of agricultural production after rice and corn. The area planted to cassava has reached 560,000 ha, with an average yield of 17.63 tonnes/ha and a production of 9.87 million tonnes annually (Hieu, 2016). This is because the area in which cassava is grown has been widened and hybrid varieties have been applied with farmers now cultivating 70% hybrid varieties including KM94 and 30% local varieties (Phuc, 2015). The average yield of cassava in 2016 was approximately 19 tonnes/ha (FAO, 2018), which was more than double that in 2000 (8.4 tonnes/ha). Nguyen et al. (2005) presented a complete picture of the cassava value chain and also the relationship among the stakeholders in the chain. The study also examined the role of the government as well as their operations and the sharing of benefits between stakeholders in the value chain, finding that as (Olukunle, 2013) noted in Nigeria, the farmer received unfairly small share of the benefits while intermediaries obtained most of the profit in the cassava value chain. According to (Naziri et al., 2014) study of postharvest losses there were differences between the northern and southern parts of Vietnam. In the north, production was mostly by small-scale farmers while in the south, it was characterized by both larger scale production and processing units normally consisting of from 20 to 30 hectares. That study found that post-harvest losses mainly occurred on large sized and small-sized plots because the local people lack of knowledge as well as in harvested. The kind of losses experienced were breakage and deterioration of roots as were found in other areas studied. Vietnam is a tropical country and it is unsurprising that cassava has become one of its most vital crops (GSO, 2018c). In Dak Lak the area planted with cassava increased from 32,000 ha to over 36,300 ha between 2011 and 2017, with the average cassava yield fluctuating around 19 tonnes/ha and the total production reaching a peak of 703,300 (*Fig. 1*) tonnes in 2017. The province is, therefore, a region where cassava is one of the most prominent crops. The study reported discusses the major aspects of the cassava value chain in Dak Lak province. Firstly, it systematically identifies and maps the stakeholders participating in the distribution channel and marketing of cassava and details the profit and cost structures. Secondly, it identifies the sharing of benefits between the various actors and analyzes the gross and net profits within the chain. It also examines how and by whom

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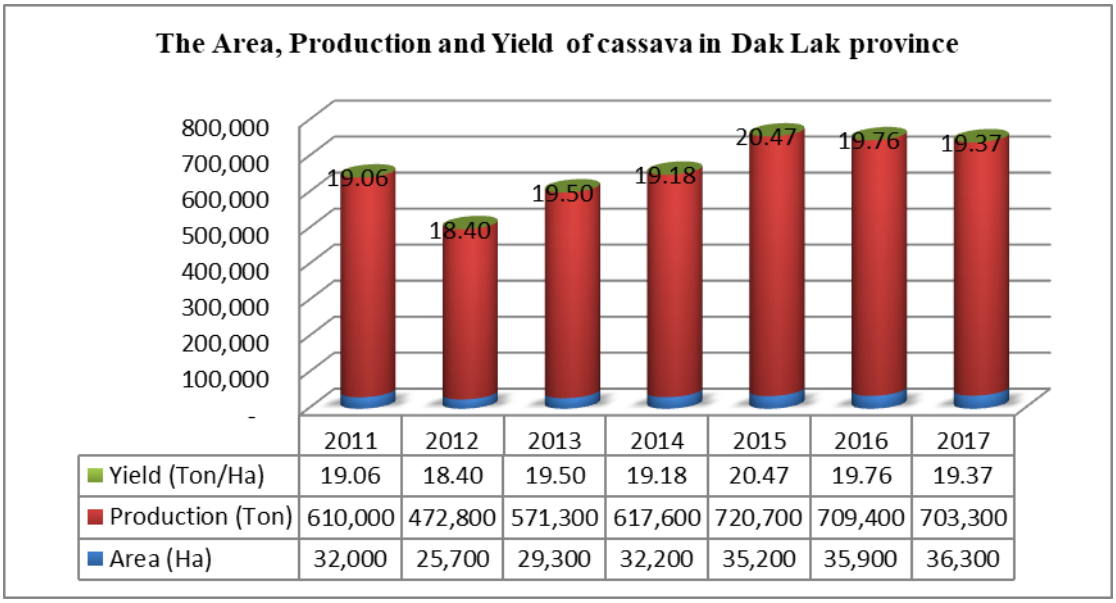
benefits could be gained from enhancing the relationships among the actors and organizations involved. Thirdly, it examines ways in which the cassava value chain could be upgraded by improvements in cassava productivity (Naziri et al., 2014). Finally, it highlights the role of relationships and coordination mechanisms in improving farming-related policies in order to enhance the cassava value chain and to increase the earnings of farmers.



	2011	2012	2013	2014	2015	2016	2017
Yield (Ton/Ha)	19.06	18.40	19.50	19.18	20.47	19.76	19.37
Production (Ton)	610,000	472,800	571,300	617,600	720,700	709,400	703,300
Area (Ha)	32,000	25,700	29,300	32,200	35,200	35,900	36,300

Figure 1. *The area, production and yield of cassava in Dak Lak 2011-2017*

Materials and methods

Study area

Dak Lak province is located in the Central Highlands between longitude 107°28'57" and 108°59'37" east, and between latitude 12°9'45" and 13°25'06" north (*Fig. 2*). It occupies an area of 13,125.37 km^2 (Dak Lak, 2018). Currently, the population is over 1.8 million people with a provincial population density of over 137 people per square kilometre. There are 47 ethnic groups living in the province, the largest; of which, the Kinh account for about 70% of the people, with other ethnic minority communities including Ede, Thai, Tay, M'nong, and Nung people representing the remaining approximately 30%. The climate of the province is separated into two sub-regions with the North West being quite hot and dry in the dry season, while the climate in the south east is cool and pleasant.

The Krong Bong district is located in the south east and the centre of the district is 55 km from Buon Ma Thuot city in the north west of the province (Krong Bong, 2018). Krong Bong has an area of 1,257.49 km^2 and a population of 90,126 people. It is affected by the tropical monsoon, and it's climate, which has two distinct seasons, rainy and hot, is not only impacted by the generally high altitude but is also influenced by the Cu Yang Sin mountain, which rises to over 2,400 m.

Ea Kar district was established on 13th September 1986 under decision No. 108/1986/QĐ-HĐBT of the Vietnamese government. It is 52 km from Buon Ma Thuot city, along the No. 26 National Highway. It is located to the north of Dak Lak province

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and has a land area of 1,037.47 km^2 and the population density is over 138 inhabitants per square kilometre. Cassava is one of the staple crops produced to meet the material needs of local industry and it is the largest producer among agricultural crops in Dak Lak province (Ea Kar, 2017).

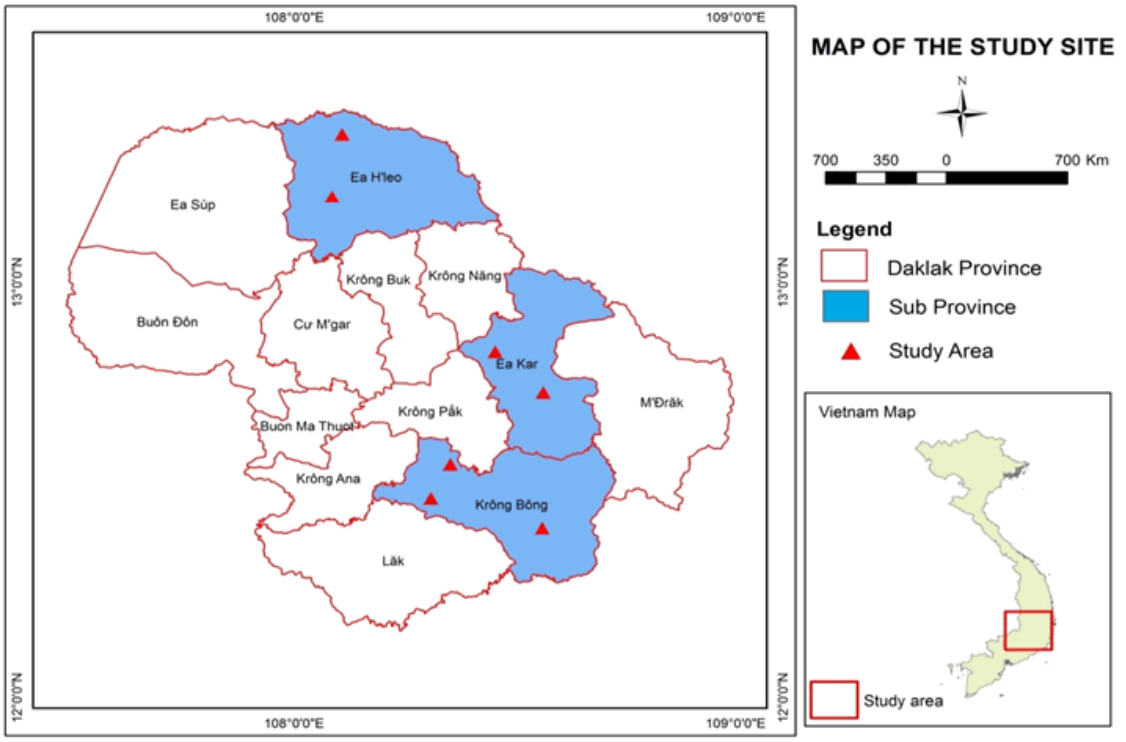

Figure 2. *The location of the study area*

Ea H'Leo district is the northern gateway of Dak Lak province. The district is approximately 80 km from Buon Ma Thuot city and was separated from Krong Buk district on 8th April 1980 under government decision No.110/QĐ-HĐBT. It has an area of 1,335.12 km^2 and a population of 125,123 people. Cassava is a prominent crop in the region (Ea H'leo, 2018). The study reported was conducted by surveys in three districts, Ea Kar, Krong Bong and Ea H'leo which are prominent areas of cassava production in Dak Lak. The major source of household income is from cassava, other cash crops and cattle husbandry. The average area planted to cassava by households is from 0.5 ha to 3.5 ha and the average yield is approximately 20 tonnes/ha. Most of the households growing cassava consist of northern ethnic minorities such as the Ede, Dao, Tay and Nung.

Data collection and analyses

Data collection

The study was conducted using a case study approach, which is one of several methods of conducting social science research (Yin et al., 2009). Data collection was conducted with the aid of structured questionnaires (Fonji et al., 2017). Data relating to household characteristics (Mukete et al., 2018) came from a household survey, interviews with key informants and focus-group discussions with heads of household

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and actors in the cassava value chain. The cross-sectional design enabled the researchers to address the study objectives and this method was adopted in order to save time during the data collection process (Kothari, 2004; Masamha et al., 2017). This method has been employed in a number of previous studies of the cassava value chain and related issues (Komen et al., 2010; Masamha et al., 2017; Son et al., 2016). The researchers selected seven communes from the three districts, Krong Bong, Ea Kar and Ea H'leo, using the multi-stage sampling method. In each commune, a questionnaire-based survey was conducted to collect relevant data from stakeholders in the cassava value chain based on visits to households. In this study, the interviews covered at least 70% of the households in each commune, where the farmers grow cassava. The questionnaire employed consisted of a mixture of open and closed ended questions. It was written in English then translated into Vietnamese before being used to interview the indigenous people (Echato and Echato, 2018). To complement the survey data, both primary and secondary data were collected from stakeholders who directly participate in the value chain, including from input providers, traders and processors (Masamha et al., 2018). Both in-depth interviews using a semi-structured questionnaire and direct observation in the field were also applied in this study (Coulibaly et al., 2014b). The in-depth interviews were conducted with key informants, including directors of local cassava starch factories (Son et al., 2016), input suppliers, cassava growers, collectors, traders, in Cu Kty, Hoa Son and Cu Pui (Krong Bong district), Ea Sar and Ea Pal (Ea Kar district), and Ea Tir and Ea H'leo (Ea H'leo district). These key informants were surveyed using a different questionnaire, which covered core processes (Naziri et al., 2014) traded quantities and prices of inputs as well as the selling price of cassava in the local market compared to other areas. Focus group discussions with cassava farmers were conducted during 2018 in the seven different communes included in the study. Field trips were used to gather primary as well as secondary data. The basic unit for this research was the *household farmer* which was defined as a group of people living together in the same house and taking part in the same daily activities (Mukete et al., 2018). The populations of the study were the cassava growing household farmers in Dak Lak province. Goal-directed sampling, a commonly used sampling approach was adopted, with the sample of participants being selected based on preselected criteria appropriate to a specific research question (Mack et al., 2005). The total sample size was 300 households across the seven communes, and 20 both collectors and traders, and key informants were interviewed as well as the owner of a cassava starch factory in the area.

Statistical analyses

Both qualitative and quantitative methods of analysis were applied in this study to understand the roles and actions of the major's actors (Apata, 2013). The analysis of the data from the questionnaire-based survey involved coding, data entry and analysis using the SPSS Version 20 statistical program (Masamha et al., 2017; Mukete et al., 2018) and Microsoft Excel. Frequencies and means for socio-economic and demographic data were described based on descriptive statistics (Masamha et al., 2017).

The qualitative data from the in-depth interviews with stakeholders and focus group discussions were analyzed by specific content analysis in order to identify and examine the most important topics (Masamha et al., 2018). A value chain details the many activities that are required to take a product or service through the different phases of production and delivery to the final consumers, and its disposal after use (Kaplinsky and

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Morris, 2000). The analysis of the cassava value chain was based on the value-chain analysis method (VCA) (Naziri et al., 2014) and value-chain upgrade solutions were computed in this study using a quantitative method. The VCAs were designed using techniques to determine specific relationships and linkages at different stages among actors who participate in the cassava value chain. Analyzing supply stages, marketing and trading relationships between actors in chain analysis has become a key tool since it can enable an understanding of the whole chain (Meaton et al., 2015).

This study identified major aspects of the cassava value chain in Dak Lak province. The production cost, intermediate input (II) value added (VA) and other economic parameters, including gross profit (GPr), net profit (NPr). These were evaluated based on specific actors' perspectives. Revenues were calculated according to the following equation:

$$\text{Revenues} = (Q \times P) + \text{income from by-products}$$

where Q = quantity sold and P = price paid by buyer (Purcell et al., 2008).

Components of total value generated by the value chain such as output value (Y) and product value were also calculated using the Q × P formula, based on analytical frameworks for value chain analysis proposed by international organizations such as Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ, 2007).

Value added (VA) was calculated to measure the new wealth created by a productive activity and thus the creation of wealth and the contribution of the production process to the growth of the economy. VA was calculated according to the following equation:

$$VA = Y - II$$

where Y = total sales (output) value and II = intermediate input such as fertilizer, pesticide and seedlings.

Profit elements were calculated as follows:

$$GPr = VA - (\text{wages and salaries} + \text{interest charges} + \text{taxes})$$

$$NPr = GPr - \text{depreciation}$$

GPr expresses the economic gain, or loss, to an actor once all current production costs have been met. NPr indicates the economic gain or loss taking into account the predictable costs of actual investment.

Results

Description of stakeholders in the cassava value chain

Input provider

The study found that there were both backward and forward linkages in the cassava value chain. Input providers were backward-linked from the farmer. Thus, input providers were important actors who supply agricultural products to meet farmer demands for items such as seedlings, fertilizer and pesticide as well as being a source of informal credit for agricultural activities. A good relationship between providers and

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farmers has the potential to improve the value chain by giving farmers access to informal credit without them needing to resort to the banking system or other sources of credit, and can help small-scale household farmers to pool their resources to deal with activities which cannot be done by individual farmers.

Farmer/producer

This is the first actor in the chain and they are mostly located in rural areas where an inequitable infrastructure has developed, with the farmer being at a disadvantage by needing to supply fresh cassava to the buyer (Njukwe et al., 2014). *Table 1* shows the socio-economic characteristics of household farmers across the study sites. The average age of the respondents is one of the major factors that affect the chain with 82.33% being over 35 years of age and 71.67% having received at least secondary formal education. Furthermore, it was notable that males represented almost 90% of the respondents suggesting that cassava production is overwhelmingly dominated by men. In addition, most of the farmers (92.32%) had more than 5 years' experience of cassava cultivation. The fresh cassava produced by farmers is mostly sold locally to large traders or factories as well as to other collectors at both the village market and the farm gate. However, this spot linkage only exists during the harvest period. The seedlings for the cassava varieties cultivated in the region are derived from multiple sources such as producers' own farms or those of neighbours, local seeding centres or from donations by international organisations conducting research about cassava cultivation. The land is generally prepared with a machete, hoe or dibble and the cassava plant cutting is inserted vertically, horizontally or at an angle (El Bassam et al., 2010). Some farmers who own larger areas prepare their land using tractors.

Table 1. *Socio-economic characteristics of respondent at the study sites*

Profile		**COMMUNE**							**Total**	**%**
		CUKTY	**CUPUI**	**EAHLEO**	**EAPAL**	**EASAR**	**EATIR**	**HOASON**		
Gender	Female	3	7	5	5	4	5	3	32	10.67
	Male	41	35	40	38	38	37	39	268	89.33
Total		**44**	**42**	**45**	**43**	**42**	**42**	**42**	**300**	**100**
Age of the respondent	< 25	0	0	0	0	1	0	1	2	0.67
	> 55	8	5	8	7	5	11	13	57	19
	25-35	3	14	7	9	12	1	5	51	17
	35-45	17	19	16	14	13	20	11	110	36.67
	45-55	16	4	14	13	11	10	12	80	26.66
Total		**44**	**42**	**45**	**43**	**42**	**42**	**42**	**300**	**100**
Level of formal education	0	1	6	5	2	3	3	2	22	7.33
	1	10	15	6	9	9	9	5	63	21
	2	26	18	27	28	23	24	29	175	58.33
	3	7	3	7	4	7	6	6	40	13.34
Total		**44**	**42**	**45**	**43**	**42**	**42**	**42**	**300**	**100**
Number of years of cultivation by farmer	< 5	1	10	9	5	5	6	2	38	12.67
	> 15	12	4	15	7	6	8	11	63	21.00
	10-15	18	14	14	21	18	19	18	122	40.67
	5-10	13	14	7	10	13	9	11	77	25.66
Total		**44**	**42**	**45**	**43**	**42**	**42**	**42**	**300**	**100**

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Transportation of the harvested cassava from the field may be by truck, motorbike or bicycle, but is mostly accomplished by a tractor-pulled trailer known locally as a *xe cay* (*Fig. 3*). Cassava is widely grown as a mono-crop by small-scale farmers on fragmented land (0.1 to 4.5 hectares) for food purposes and for use in the industrial sector. Nevertheless, larger scale inter-cropping models are also practiced by a small number of household farmers who sell their produce to processing factories. Cassava production is labour intensive (Masamha et al., 2017) so it is one of the best options to improve a farmer's livelihood in a rural area where there is an excess of labour available.

Collectors and traders

Collectors can be grouped based on the quantity of cassava which they buy, namely local, small and large and they include local people as well as those who come from a different region. They play a vital role in the linkage between the cultivation and consumption of fresh and dried-chip cassava. Depending on the buying capacity of the collector, the cassava is collected by different means. Local collectors usually gather directly from both small-scale cassava farmers and from indigents who collect the cassava residue from the harvested fields in or near the village. Larger collectors are able to buy fresh cassava from previous actors in the value chain as well as providing information to those other actors. Most of the product is then sold to starch or ethanol factories with a small volume being delivered to the Tay Ninh province cassava factory.

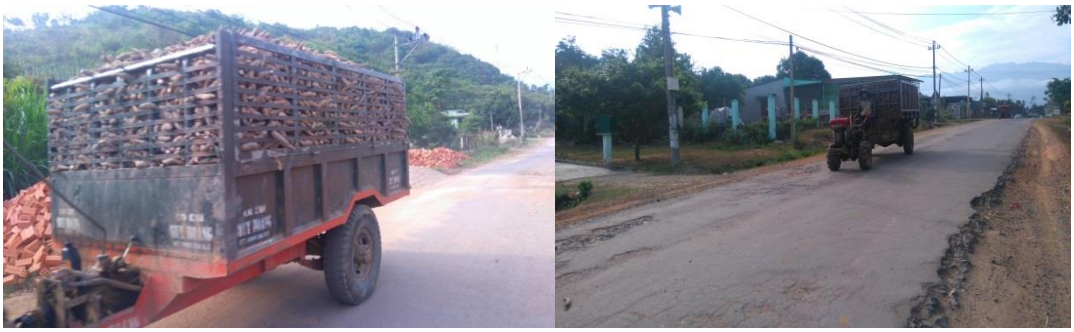

Figure 3. *Transportation in the cassava value chain. (Photo by author)*

Processors

Most of the cassava produced in Dak Lak is bought by starch or ethanol factories in each district. There are seven starch factories in Dak Lak province with capacities ranging from 150 to 250 tonnes of cassava starch per day, all of which are owned by the Dak Lak Starch Cassava Company. In addition, cassava is used as a raw material by Dai Viet, which was established in 2010, and is one of the biggest ethanol factories in Vietnam with an installed capacity of 54,000 tonnes of ethanol per year. The factories buy cassava in the form of dried chip or fresh root from small collectors as well as from traders and farmers who have large cultivation areas. Thus, most of the cassava tubers are transported to factories by collectors or traders (Son et al., 2016). In addition to its industrial use, fresh cassava is also processed into cassava chips by small-scale chip producers for use both in household animal husbandry and by animal feed companies. There is also a small amount of cassava root used for human consumption including in the form of local traditional cakes known as *Banh Trang* or *Bot Loc*.

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Cassava value chain distribution channel in Dak Lak province

Currently, there are a number of distribution channels for cassava derived from cultivation by farmers to the final customer. However, there are only two major channels and these have an effect on the income of the households surveyed in this study. Firstly, the cassava is supplied to starch companies in order to produce starch (Son et al., 2016) for the export market (85%) with the rest (15%) for the domestic market. The second channel is to the ethanol factory which uses cassava as its feedstock to produce ethanol for a diverse range of domestic consumers (*Fig. 4*).

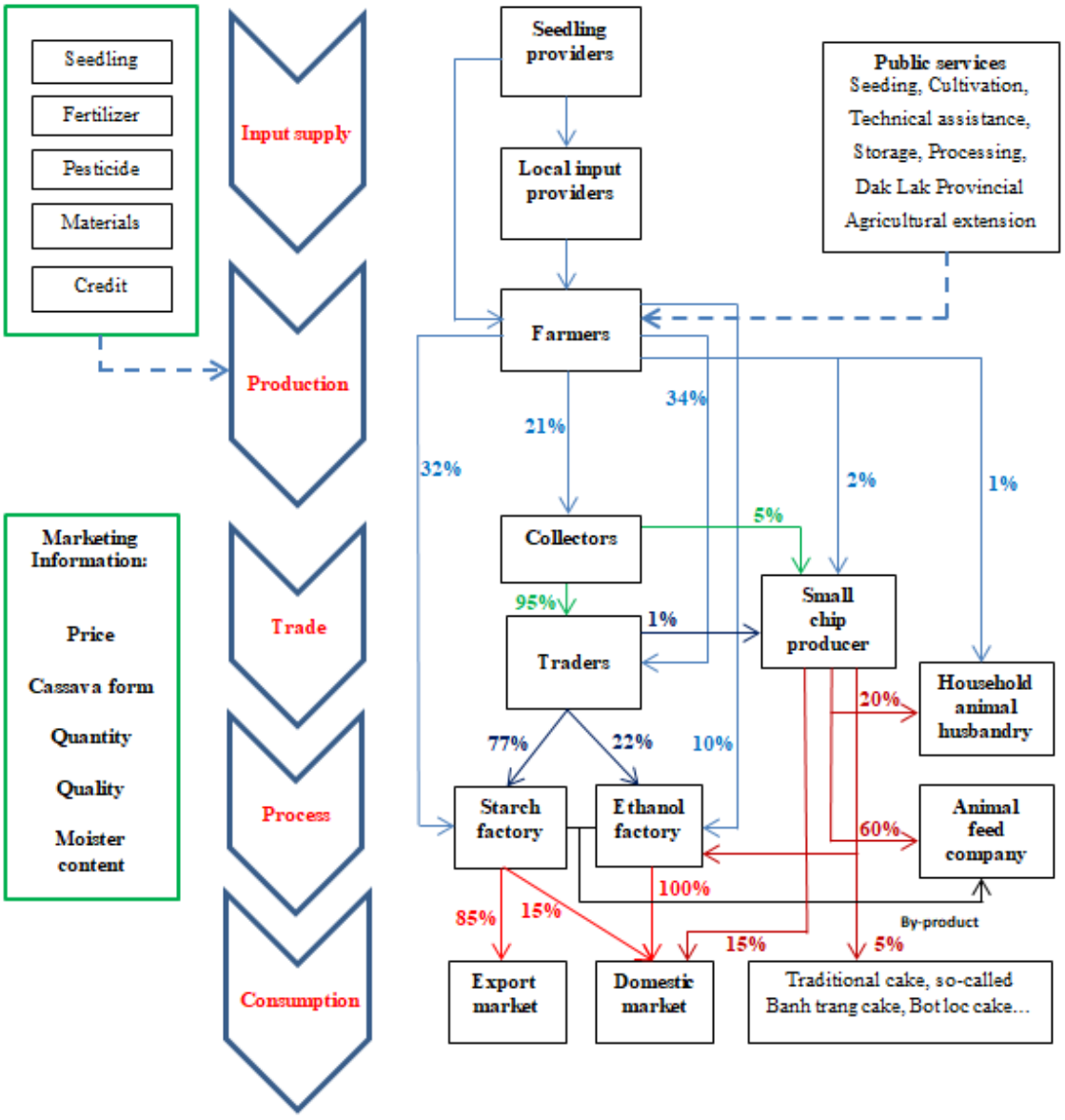

Figure 4. *Dak Lak cassava value chain map*

Based on our findings, it was estimated that 97% of the total cassava production is sold in fresh-root or dry chip form for industrial use with the rest being used to meet household requirements. In the first distribution channel, the fresh cassava tubers are

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either sold by the farmer to intermediaries (collectors, 21% and traders, 34%) and then sold to a starch factory, or are supplied directly by the farmer to the factory (32% - all percentages based on total production) to produce starch. In the second distribution channel, the farmers sell either directly to the ethanol factory (10% of total production) or through traders (22%) (*Fig. 4*). In addition, small chip producers and household animal husbandry account for 2% and 1% of total production respectively.

Financial analysis of stakeholders in the cassava value chain

Cassava growers

The yield of cassava production in the study site fluctuated in a range of 20 to 25 fresh root tonnes/ha. However, in exceptional cases, the yield was as low as 5.5 tons per hectare. This is because some households make an inadequate investment in growing cassava. Moreover, the low fertility of the land and the use of poor quality varieties also contribute to low productivity. The average yield was approximately 20 tons of cassava tubers per hectare. The conversion rate was 50%, and the farmer can thus obtain around 10 tons of dried chip cassava from the fresh quantity harvested. The producers had various options to sell their products to buyers. Depending on individual farmer's targets and market price information, the cassava growers sold 21%, 34%, 32% and 10% of their produce respectively to collectors, traders, starch factories and the ethanol factory. In terms of the price obtained for cassava, there is great variability depending on the price of exported starch (Son et al., 2016). In this study, the total farmer's income was VND47.895 million or US$2,048 per hectare (US$1 = VND23,390). The price of cassava was approximately VND2 million per tonne and the average yield was around 23.64 ton ha^{-1}. In the value chain analysis of cassava, the cost of intermediate inputs represented 8.52% of the total income of the producers, of which the highest percentage (over 50%) related to seedlings (VND4.081 million) (*Table 2*).

Table 2. *Major indicator analysis of fresh cassava value chain per hectare*

Item	Value (VND1,000)	Value USD	Proportion %
Output	**47,895**	**2,048**	**100.00**
Intermediate input	**4,081**	**174**	**8.52**
Seedlings	2,257	96	4.71
Fertilizer	1,000	43	2.09
Pesticide	239	10	0.50
Transporting	556	24	1.16
Fuel	29	1	0.06
Value added	**43,814**	**1,873**	**91.48**
Land preparation	3,338	143	6.97
Planting labour	3,570	153	7.45
Fertilizer labour	214	9	0.45
Weeding labour	1,702	73	3.55
Pesticide labour	133	6	0.28
Harvesting labour	6,019	257	12.57
Transport labour	97	4	0.20
Interest	122	5	0.25
Gross profit (GPr = NPr)	**28,618**	**1,224**	**59.75**

Exchange rate: 1 US$ = 23,390 Vietnamese dong (VND) (HSBC, 2018)

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The value added was calculated to be VND43.814 million (US$1,873) which accounted for 91.48% of the total production and this confirms that cassava is a favourable crop, which contributes to household farmer income with high economic efficiency, producing a GPr of VND28.618 million per hectare with low intermediate input costs.

In the case of chip cassava, the value added and the NPr accounted for 92.33% of the total production and 55.64% per hectare, respectively (*Fig. 5*). Although the total cost incurred also involved incurring an additional VND4.320 million (US$67) per hectare for peeling and drying the fresh cassava. However, both the income and profit received by the producers was higher for chip cassava than for fresh cassava since chips attract a higher price than fresh cassava, selling for VND4,500 per kg compared to VND2,026 per kg respectively. Furthermore, processing cassava into dried chips at the farm level provides employment for the indigenous people and thus helps to deal with rural employment, which is a growing problem in the region, and also helps to diversify the farmers' income. Finally, the farmer is able to negotiate the selling price with other actors in the value chain because they can store their product in dried chip form for a longer period in order to wait for the optimal market price (Viet et al., 2013).

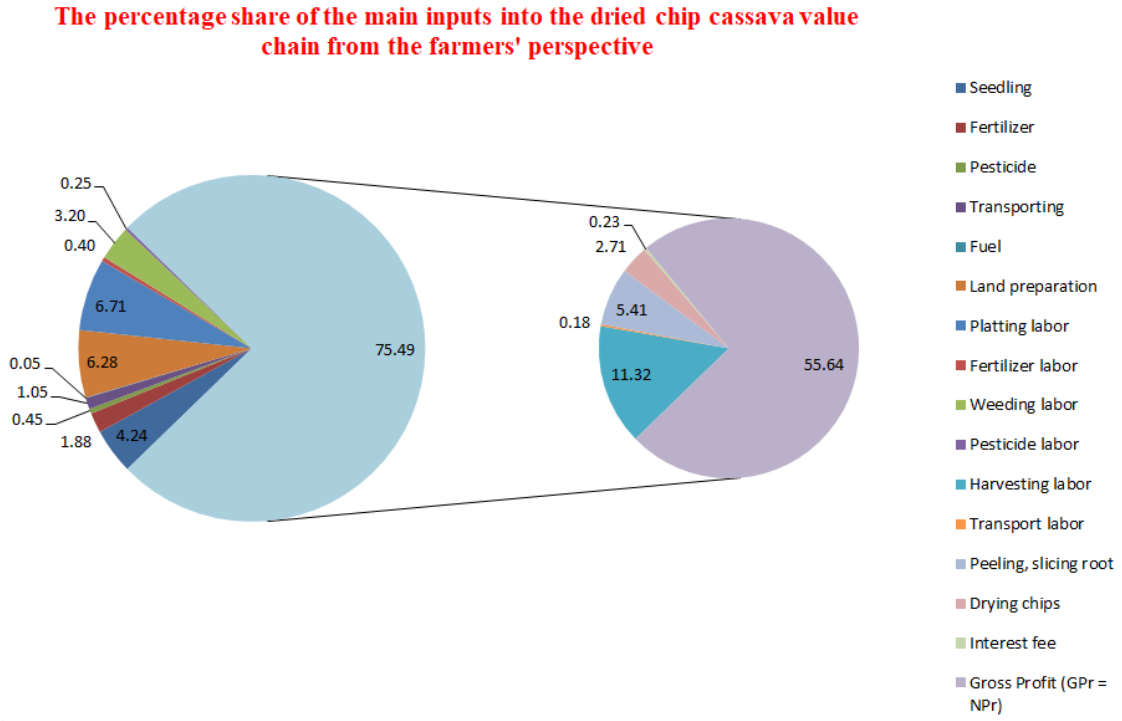

Figure 5. *The percentage share of the main inputs into the dried chip cassava value chain from the farmers' perspective*

The study found that based on different market price and productivity scenarios, the producer can always gain profit from their production. This is an advantageous situation and one that is attractive to household farmers who participate in the cassava value chain. In the worst-case scenario with both a low selling price and productivity, the farmers GPr was VND215 per kg, while the producer's GPr was VND1,729 per kg (*Fig. 6*) for the best scenario with a lucrative market and high productivity coinciding.

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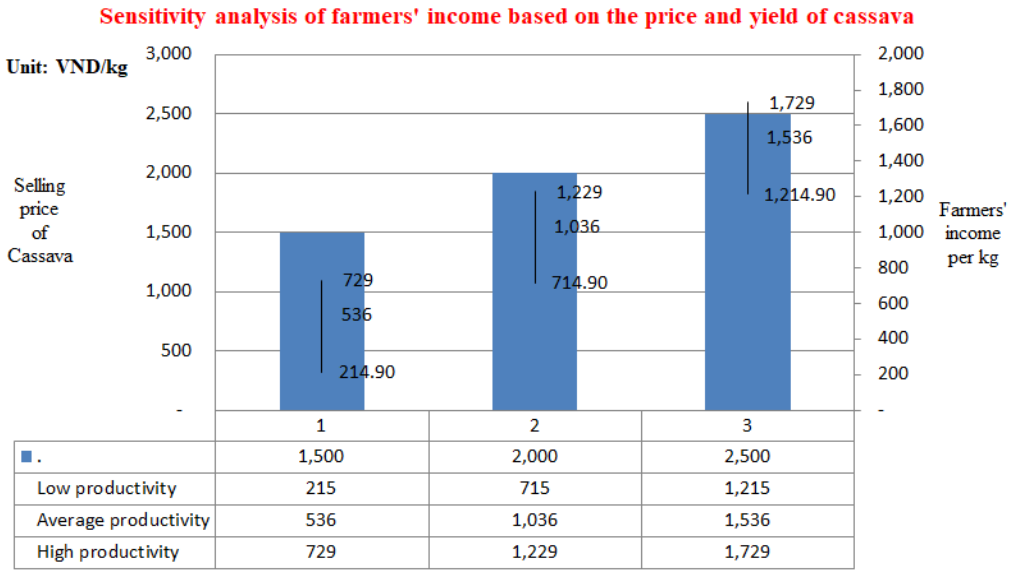

.	1	2	3
	1,500	2,000	2,500
Low productivity	215	715	1,215
Average productivity	536	1,036	1,536
High productivity	729	1,229	1,729

Figure 6. *The sensitivity analysis of farmers' income based on the price and yield of cassava*

The collector perspective

The analysis of the financial situation from the collectors perspective shown in, *Table 3* indicates that, the amount expended by collectors for fresh cassava was approximately VND2,338/kg of which, the cost of fresh cassava accounted for the highest proportion of approximately 85%, followed by transport costs accounting for 9.42%. At this stage, the value added was created less than farmer with 6.15% compared to mostly over 90% in dried chip cassavas. However, a large quantity of produce was purchased by the collectors and the GPr and NPr of VND62,650 and VND61,530 per ton respectively were both higher than those earned by the farmer. According to Viet et al. (2013), it is normal for an amount to be deducted from the price paid by collectors to cover impurities in the cassava supplied by the farmer. This ranges from 7 to 10% of the purchase price depending on the time after harvesting as well as the moisture content and this finding was supported by our study. The quality of cassava tubers deteriorates depending on the harvesting season, the length of cultivation and the time to storage. Moreover, the collector is usually faced with having to provide finance due to delays in payment by the starch factories and this will also affect the purchase price paid to the farmer. The business pattern is also similar for the sale of dried chips by farmers to traders, and starch and ethanol factories. The GPr and NPr are actually little different from the fresh root model at VND62,550 (US$2.67) and VND57,550 (US$2.46) per tonne, respectively. However, in the case of dried chips, the collectors have more opportunity to locate the best market for their produce. The quality of cassava tubers depends on the harvesting time and length of storage. Generally, the percentage of starch reduces proportionally based on the length of storage by as much as 10% after a matter of days. In addition, the processing factories often postpone payments to collectors for several weeks because the factories face short-term financial constraints. The collectors do not have any other options although their business activities are affected by this problem. One of the reasons is that the purchasing system in this area has not yet developed and the local market for cassava is excessively dependent on demand from the processing factories (*Fig. 7*).

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Table 3. *Major indicator analysis of fresh cassava value chain per ton from the collectors' perspective*

Item	Value (VND1,000)	Value USD	Proportion %
Output	**2,400.00**	**102.61**	**100.00**
Intermediate input	**2,252.00**	**96.28**	**93.83**
Cassava root	2,025.00	86.58	84.38
Transportation	226.00	9.66	9.42
Communication	1.00	0.04	0.04
Value added	**148.00**	**6.33**	**6.17**
Labour wages	47.50	2.03	1.98
Interest	12.85	0.55	0.54
Handling	25.00	1.07	1.04
Gross profit (GPr)	**62.65**	**2.68**	**2.61**
Depreciation	1.12	0.05	0.05
Net profit (NPr)	**61.53**	**2.63**	**2.56**

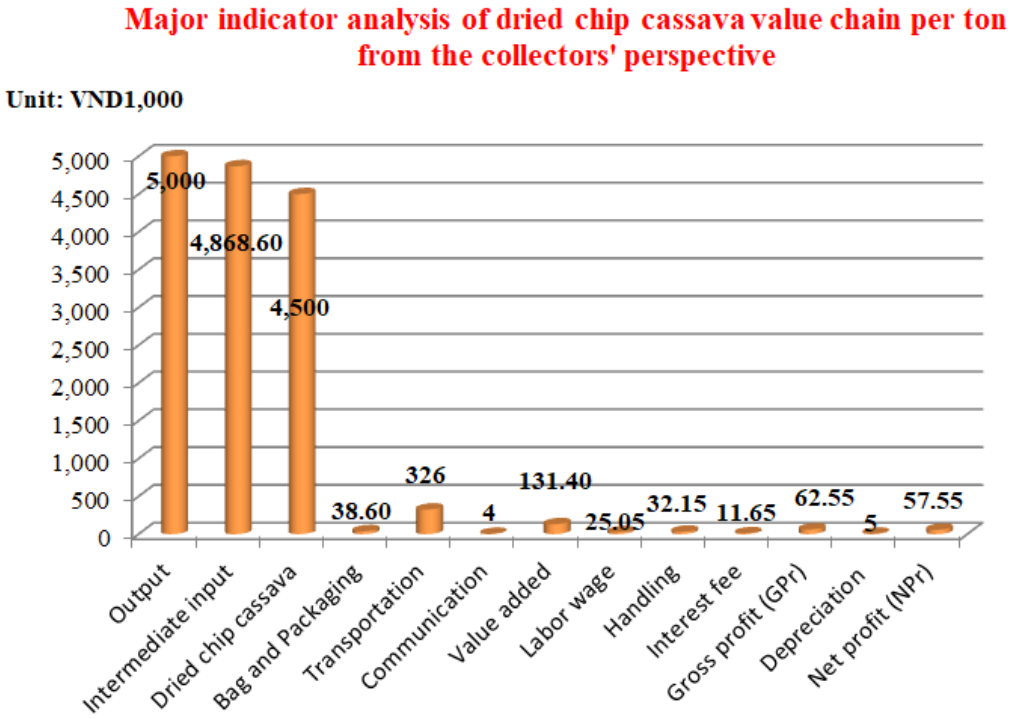

Figure 7. *The major indicators analysis of dried chip cassava per ton from the collectors' perspective*

The trader perspective

The traders' business pattern is similar to that of collectors, with traders buying some fresh cassava as well as dried chip from producers in February and March but also obtaining most (95%) of their cassava from collectors in both root and chip forms (*Fig. 4*). The quantity purchased ranges between 20 and 25 tons per day with this figure reaching a peak of 40 to 50 tons per day during the harvesting season. It is notable that

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the purchase price paid by traders is very similar to that paid by collectors who buy cassava directly from farmers.

Furthermore, traders usually negotiate with farmers in order to fix the price of cassava before it is harvested. However, changes in the market can affect this practice and, for instance, if the market price is greater than the price fixed before harvesting, then the purchase of the cassava will be concluded based on the market price. In contrast, if the market price is lower, the sale will be concluded based on the price fixed which represents a fair trading relationship between these actors in the cassava value chain. The average selling price of fresh and dried chip cassava were VND2.85 million (US$121.85) and VND5.5 million (US$235.14) per ton, respectively, and the gross profit gained was VND75,930 (US$3.25) (*Table 4*) per ton for cassava root and VND75,040 (US$3.21) per ton for dried chip cassava (*Fig. 8*). Nevertheless, traders play a vital role through their relationship with the farmer because they usually facilitate the supply of intermediate inputs, such as fertilizer, pesticide and herbicide, as well as financing the living costs of household farmers. The farmers can borrow money from the traders in order to deal with day-to-day demands which they have to face, including the cost of food, education and health care.

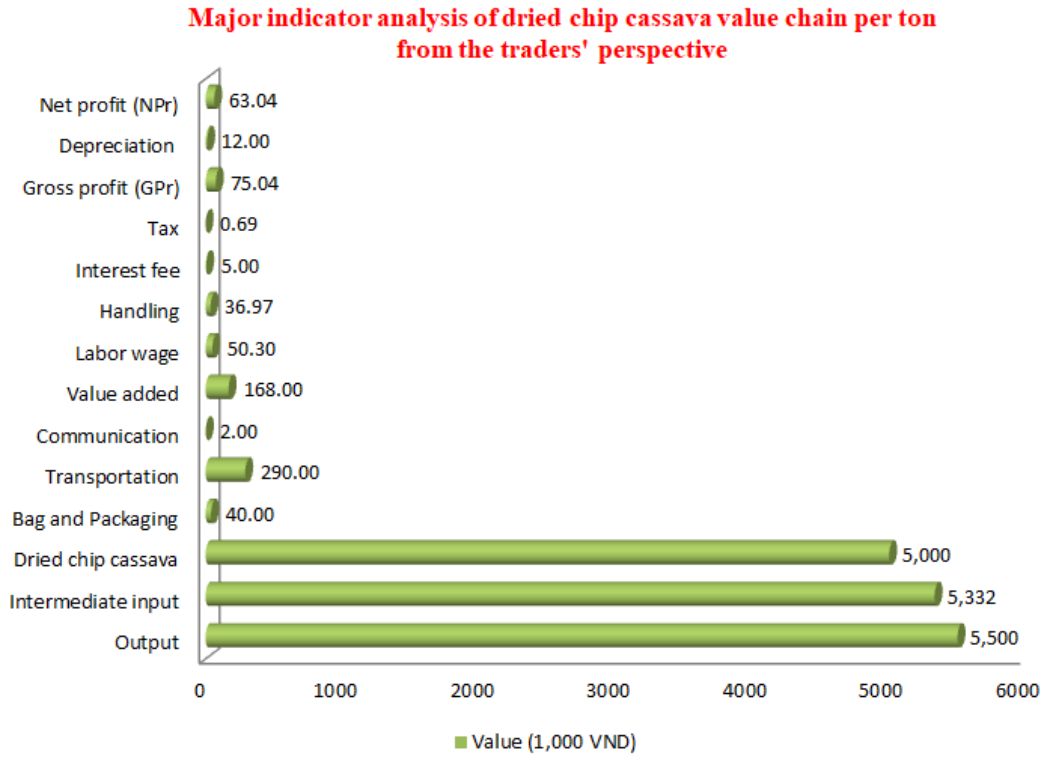

Figure 8. *The major indicators analysis of dried chip cassava per ton from the trader' perspective*

The starch factory perspective

The feedstock used by starch factories is mostly derived from traders (77%) as well as directly from producers (32% their production). The intermediate cost to produce 1 ton of cassava starch is approximately VND11.2 million (US$479.5) (*Fig. 9*). The conversion rate for fresh cassava is approximately 3.5 tons of cassava to produce 1 ton

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of cassava starch (Viet et al., 2013) and the factory is also left with a pulp residue for which there is a market after processing. Hence, the gross profit derived by the factory was found to be approximately VND1.14 million per ton (US$48.57) including the revenue from both cassava starch and pulp residue. However, there is great variability in the price of cassava starch depending on the export price of starch (Son et al., 2016). Thus, the total cost and profit have been unstable over the years. This is a difficulty that most cassava starch factories are currently facing.

Table 4. *Major indicator analysis of fresh cassava value chain per ton from the traders' perspective*

Item	Value (VND1,000)	Value USD	Proportion %
Output	**2,850.00**	**121.85**	**100.00**
Intermediate input	**2,676.50**	**114.43**	**93.91**
Cassava root	2,400.00	102.61	84.21
Transportation	275.00	11.76	9.65
Communication	1.50	0.06	0.05
Value added	**173.50**	**7.42**	**6.09**
Labour wages	69.00	2.95	2.42
Interest	0.65	0.03	0.02
Tax	0.42	0.02	0.01
Handling	27.50	1.18	0.96
Gross profit (GPr)	**75.93**	**3.25**	**2.66**
Depreciation	10.00	0.43	0.35
Net profit (NPr)	**65.93**	**2.82**	**2.31**

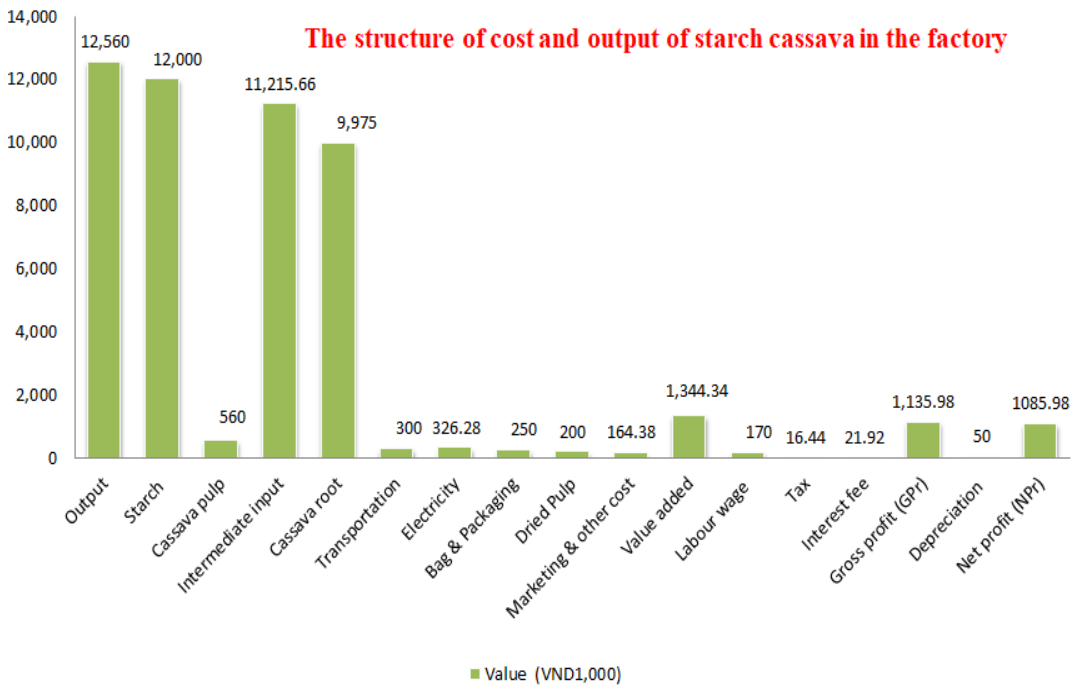

Figure 9. *The structure of cost and output of starch cassava per ton from starch factory perspective*

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The ethanol factory perspective

The production capacity of the ethanol factory in this area is approximately 54,000 tons per year or around 4,500 tons per month based on market demand. The ethanol produced is used for numerous purposes in industries including food, cosmetics, and pharmaceuticals as well as others. There is a large quantity of cassava available to the factory and there is the potential to export its product to the Chinese market as well as to other overseas markets. However, currently, the total production of the ethanol factory is used domestically since its current processing costs are not competitive with that of similar products from other countries, particularly with those in Brazil which dominates world ethanol processing. *Table 5* shows that the production cost in the Dak Lak ethanol factory is around VND15.74 million (approximately US$673) per ton while the price of ethanol processed in Brazil is currently US$600 per ton at Ho Chi Minh City port in Vietnam. Therefore while the factory currently earns a GPr of nearly US$29 per ton based on current production costs, according to Mr. Dao Trong Tuan (personal communication), who is the Chairman of the board of directors of the Dak Lak ethanol factory, it will be very difficult to be competitive with prices in the global market in the near future without government support.

Table 5. *Financial analysis of the operation of the Dak Lak ethanol factory per ton*

Item	Value (VND1,000)	Value (USD)	Proportion %
Output	**16,565.26**	**708.22**	**100.00**
Ethanol	15,900.00	679.78	95.98
Cassava pulp	560.00	23.94	3.38
CO2	105.26	4.50	0.64
Intermediate input	**15,200.00**	**649.85**	**91.76**
Cassava root	12,540.00	536.13	75.70
Transportation	500.00	21.38	3.02
Electricity	480.00	20.52	2.90
Energy	1,200.00	51.30	7.24
Dried pulp	180.00	7.70	1.09
Marketing and other cost	300.00	12.83	1.81
Value added	**1,365.26**	**58.37**	**8.24**
Labour wages	420.00	17.96	2.54
Interest	277.78	11.88	1.68
Tax	22.22	0.95	0.13
Gross profit (GPr)	**667.48**	**28.54**	**4.03**
Depreciation	324.69	13.88	1.96
Net profit (NPr)	**342.79**	**14.66**	**2.07**

The ethanol products produced in the ethanol factory are therefore at a disadvantage compared to ethanol at the global market scale, largely because of the small scale farming by which the raw material is produced, a lack of advance cultivation technology, and the provision of short-term subsidies from the Vietnamese government. *Table 5* indicates how the value added is shared among the stakeholders comprising the farmers, the ethanol and starch factories, and the collectors and traders who obtain approximately 38%, 28%, 27%, 4% and 3% respectively. From these figures, it can be

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seen that the greatest value-added is created by the farmers which is fair based on their contribution to the value chain among the stakeholders. Shifting to cassava cultivation from other crops is considered as an appropriate strategy in poverty alleviation for household farmers in rural areas. In the cultivation phase, it is the farmers who as the producers commit almost all the resources required to produce fresh and dried chip cassava. In addition, the farmers are also the stakeholders who gain the highest percentage of the NPr (48%). However, the absolute value of both their GPr and NPr was the lowest among the stakeholders in the chain due to the volume of cassava that is provided by each farmer. In contrast, while the value added by collectors and traders accounted for less than 5% of the cassava value chain their absolute profit was higher than that of the farmers since they are undertaking cassava transactions representing from 30 to 40 tons per day while most household farmers harvest less than 30 tons per hectare per year (*Figs. 10* and *11*).

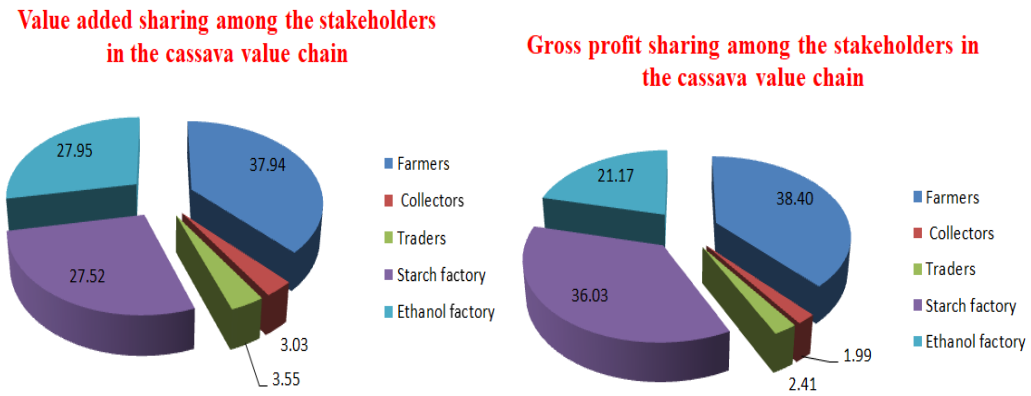

Figure 10. *Value added and gross profit sharing among the stakeholder in cassava value chain*

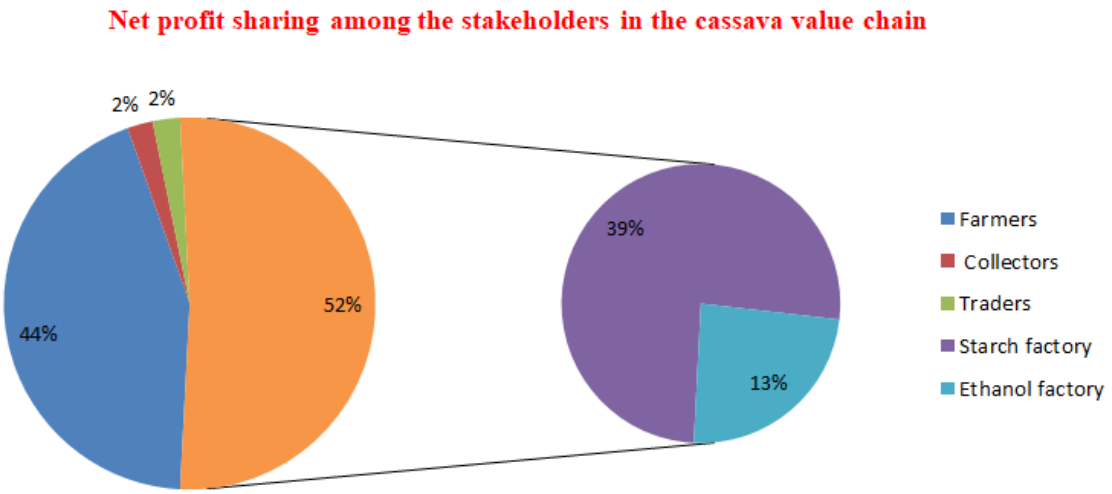

Figure 11. *The net profit sharing among stakeholder in cassava value chain*

With regard to the starch and ethanol processing factories, it is undeniable that they obtain the greatest absolute benefit from the cassava value chain since they are responsible for processing the largest volumes of cassava into products which they can

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sell. Moreover, they must meet the market demands of consumers and the value of the cassava will be increased through processing it as a raw material into starch, ethanol and other products. Hence, in order to increase the value of cassava, appropriate strategies involving linkages and collaboration among these actors is vital.

The relationships and linkages among cassava value chain stakeholders

Relationships exist amongst actors at different process stages in the cassava value chain by which input providers are connected with producers (farmers), farmers are connected with intermediaries and finally by which farmers and processors in the guise of both starch and ethanol factories are linked. Further, each of the actors has indirect relationships at each stage of the chain. The findings, of this study, identify a local relationship between input suppliers and farmers, which manifests its importance in the cassava planting season. However, this relationship does not solidify linkages since farmers generally prefer to change the location of their purchases every year. In addition, poor farmers cannot afford to buy input materials such as fertilizer and pesticide which might improve cassava productivity. Linkages between farmers and intermediaries are manifested as both spot-market and persistent relationships. On the one hand, the farmers can sell their products to any collector or trader who will pay the highest price. However, there is a potential risk in cassava value chain transactions that the selling price may be unstable over time. Buyers will always try to find any reason to reduce the purchasing price and sellers are under pressure to sell since the quality of cassava deteriorates rapidly and fresh cassava can only be preserved for two days after harvesting (El Bassam et al., 2010). This is a disadvantage for farmers who live far from the market particularly if the local infrastructure in their area is poor. On the other hand, the intermediaries can assist farmers not only by providing necessary input materials but also by extending informal credit to them. This, therefore, creates a persistent linkage; and generally, the buyer and seller meet, come to an agreement which is confirmed in a contract. In this relationship, therefore, there is a higher level of trust and some level of interdependence. Hence, the farmer and collector or trader are responsible for agreeing both the quantity of cassava and the price to be paid which is formalized by a contract agreed for each succeeding season. This linkage, therefore, tends to ensure a sufficient volume of cassava for forward actors in the value chain (i.e. end users). Moreover, the farmers will be assured of a sufficient volume of production from which they can support their occupation and that of their families. Thus, both actors gain benefit from persistent relationships.

Discussion

Our results concurred with the finding of Naziri and Bennett (2014) in both African and Southeast Asia that Cassava is mostly cultivated as a mono-crop by household farmers in small plots but was somewhat at variance with, the findings of Njukwe et al., 2014 that in Cameroon, cassava is cultivated by over 90% of the farming population, mostly as an intercrop in small plots of between 0.4 to 12 hectares. Further, the study reported herein revealed that the education status of the respondents was different from those studied by Njukwe et al. who found that 21% of the farmers had only primary education while the present study found that the majority of the participants (76.67%) had received at least secondary school education which may represent an advantage when cultivating cassava. Further, some previous studies found that not only were

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cassava tubers consumed but the leaves of the cassava planted were also used as a foodstuff constituting a part in the daily food intake of some African people (Andersson et al., 2016). However, in our study, the cassava leaves were left in the field after harvesting. Son et al. (2016) found that the percentage of cassava converted to dried chip in Quang Binh province was 50% of the fresh cassava harvested. However, this rate depended on various factors such as the variety grown as well as the period that the cassava was kept post-harvest. This finding is in accord with the findings of our research. Additionally, our findings suggest that in order to improve the value chain the first priority is to ensure that the products meet the needs of the market, which was also suggested by (Thanh et al., 2017) as a means of enhancing the value chain for exported agricultural products. These researchers also suggested that particular solutions need to be adopted to overcome individual problems to ensure that exported agricultural products meet the needs of the export market in order to create a sustainable value chain. The present study also reveals that low productivity and competitiveness in the cassava value chain may be due to various factors such as poor infrastructure, lack of farmer skills and limited capital resources, as well as a lack of synchronized mechanisms amongst competent authorities (Fonji et al., 2017). Our results agreed with those of Fonji et al. (2017) relating to cassava cultivation in the central region of Cameroon. Moreover, the results of the present study were in agreement with those reported by Leo (2015) with regard to the effect of growing cassava on the income of small-scale farmers in Abia State, Nigeria which suggested that in order to increases the income level of farmers, they should apply advanced technologies and enhance the capacity of buildings (Leo, 2015). Further, as some previous studies have noted, in order to be successful, all partnerships should be formalized by appropriate contracts which clearly state the roles and responsibilities of the actors across the value chain (Njukwe et al., 2014). Our findings also determined that improving the cassava value chain can be achieved by cooperation among the stakeholders. Other scholars have emphasized farmers' participation in profitable stages of the cassava value chain by strengthening coordination, growing new cassava varieties and applying novel processing technologies (Sewando, 2012). Most previous studies have observed that the most common means by which farmers transport cassava involves the farmer carrying the cassava from the field to their home, and Njukwe et al. (2014) found that transportation from the growing area in Cameroon was dominated by head or back-loads, and that 32.5% of the cassava grown was consumed in fresh form due to inadequate infrastructure. This agrees with research by Tshiunza et al. (1997) in six major African cassava producing countries where transportation from field to home was accomplished by various means but most (70%) was by head-load or back-load and that women accounted for over 80% of that form of transport. In our study, it was found that currently, more than 90% of the cassava is sold as cassava root and that most of the farmers bring their products home as well as supply it to their market using the local vehicle known as the xe cay (*Fig. 3*). In addition, our study also found that almost all (97%) of the cassava tubers are consumed as raw material for starch and ethanol production, either based on direct sales or sales facilitated through collectors or traders, with only 3% processed for other purposes. This is important and quite different from some previous studies, for instance that of Nweke (1994) who found that an average of 40% of the cassava in South and Centre, West and North West and East regions in Cameroon as provided for sale in the market while Tshiunza et al. (1997) discovered that 85% of the farm production in six major African cassava producing countries was

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consumed in households while 10% was sold directly in markets with only 5% being used for processing purposes (Njukwe et al., 2014).

Conclusion

This research used structured and semi-structured interviews with numerous cassava value chain actors, focus group discussions with farmers (Andersson et al., 2016), and in-depth interviews with key informants to construct a comprehensive overview of the cassava value chain which was also supplemented by direct participant observations in Krong Bong, Ea Kar and Ea H'leo districts in Dak Lak province. Our findings revealed that activities in the cassava value chain are dominated by males and that it is the farmers who create the highest value added while the role of intermediaries is the most profitable. It was also found that the household farmers from among the ethnic minority groups suffered most physical losses at the stage of selling their products because they tend to keep the fresh cassava for some days after harvesting it and then sell it to a collector or trader. Additionally, most of the farmers lack sufficient capital for investment in technologies etc. to improve cassava productivity and they, therefore, obtain less profit than other groups who trade in or process cassava. In the light of the foregoing result, improving the profitability of household farmers is a major challenge that will require critical and specialized budgetary and political support at national and global levels (Sattar et al., 2017). In particular, the household farmers in the Dak Lak cassava production areas have limited resources although the household farmers' incomes are improving because of the currently increasing cassava price. The study found that intermediaries play an important role in the relationship between the cultivation and consumption step and they not only provide input material but also supply informal credit that can help farmers conduct good cassava cultivation. However, these intermediaries purchase cassava at low prices from household farmers depending on the contracts they sign with them. Depending on their financial capacity, cassava is collected either as fresh cassava or as dried chips. In either case, however, most of the profits from the cassava value chain accrue to the intermediaries.

With regard to the processors, the factories who were the end users of 97% of the cassava currently grown specialize in the production of starch and ethanol. It would be beneficial for them to diversify into other cassava products to meet different market demands in the future. Our findings suggest that these actors currently receive less profit than before because of increasing input-material costs. It is undeniable that the demand from factories makes the cassava market more competitive and it is also leading to the price of the fresh cassava produced by Vietnamese farmers becoming dependent on the Chinese market, which is a very volatile and risky market. Therefore, processing factories play a vital role in the cassava value chain and their demand has led to the enhancement of the value of cassava root, which in turn has mitigated hazards inherent in the traditional market by diversifying the uses to which cassava is put to include products such as starch, flour and ethanol. On the other hand, this study revealed that although there are various distribution channels, there are, in fact, two major channels which dominate the cassava value chain. Therefore, addressing the emerging opportunities and challenges in the cassava market requires cross-sectorial participation from the full range of stakeholders in the value chain notably the government through the Ministry of Agriculture and rural development which can supply credit in the form of soft loans for fertilizer or pesticide. This would probably represent a cheaper form of

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capital financing that is currently available through intermediaries. Once interdisciplinary cooperation is committed from all sides, this will improve the operation of the cassava value chain in this region.

Finally, this finding has just focused on value added and financial cost as gross and net profit of stakeholders in the cassava value chain. It has not yet referred to the role of gender in the household such as females' decision to participate and level of participation cassava production as well as market participants. In addition, this study has not clearly analysed the role of government policy in reducing the risk of cassava market (such as price subsidy, rural credit policy). Thus, it is highly recommended for further researches regarding inequality gender and, or improving females' role in the cassava value chain as well as policy reform in order to give a boost to cassava value chain for both farmer and the rest of stakeholders.

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Conflict of interests. The authors confirm that there is no conflict of interests related to the content of this article.

REFERENCES

[1] Andersson, K., Lodin, J. B., Chiwona-Karltun, L. (2016): Gender dynamics in cassava leaves value chains: the case of Tanzania. – J. Gender, Agric. Food Secur. 1: 84–109.

[2] Apata, T. G. (2013): Analysis of cassava value chain in Nigeria, from a pro-poor and gender perspective of farming households in Southwest, Nigeria [WWW Document]. – http://www.agrodep.org/sites/default/files/annualmeeting/RV_Apata_T_final.pdf (accessed 11.15.18).

[3] Coulibaly, O., Arinloye, A. D., Faye, M., Abdoulaye, T. (2014a): Regional cassava value chains analysis in West Africa. Case study of Liberia. – Technical Report. DOI: 10.13140/2.1.4076.9605

[4] Coulibaly, O., Arinloye, A. D., Faye, M., Abdoulaye, T. (2014b): Regional cassava value chains analysis in West Africa. Case study of Nigeria. – Technical Report. DOI: 10.13140/2.1.3421.6001

[5] Dak Lak (2018): Natural and Socio-economic condition [WWW Document]. – Dak Lak Prov. People Comm. Portal. http://www.webcitation.org/73ocKf727 (accessed 11.10.18).

[6] Ea H'leo (2018): Overview [WWW Document]. – People's Comm. Ea H'leo Dist. http://www.webcitation.org/73nUHqGas (accessed 11.9.18).

[7] Ea Kar (2017): Geographical location [WWW Document]. – People's Comm. Ea Kar Dist. Portal. http://www.webcitation.org/73ogIEtLO (accessed 11.10.18).

[8] Echato, P., Echato, K. (2018): Patterns of firewood use among ethnic minority communities and local forest management: a case study in Pu Hu nature reserve, Vietnam. – Appl. Ecol. Environ. Res. 16: 4229–4249.

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/1702_51935217

[9] El Bassam, N., Khanna, M., Scheffran, J., Zilberman, D. (2010): Handbook of Bioenergy Crops. – Earthscan, London.
[10] FAO (2018): Food and Agriculture Organization of the United Nations [WWW Document]. – Dep. Off. http://www.fao.org/faostat/en/#data/QC.
[11] Fonji, F., Temegne, C., Ngome, F. (2017): Quantitative analysis of cassava products and their impacts on the livelihood of value chain actors: case of the centre region of Cameroon. – Annu. Res. Rev. Biol. 15: 1–14.
[12] GIZ (2007): Valuelinks Manual. The Methodology of Value Chain Promotion. First Ed. – Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Bonn.
[13] GSO (2018a): Planted area of cassava by province [WWW Document]. – Internet Web Page Licens. number 172/GP-TTĐT, issued 13/08/2010 Stat. Doc. Serv. Cent. - Gen. Stat. Off. Vietnam Address 54 Nguyen Chi Thanh str, Dong Da, Ha Noi, Vietnam. https://www.gso.gov.vn/default_en.aspx?tabid=778 (accessed 11.3.18).
[14] GSO (2018b): The Yield of cassava by province [WWW Document]. – Internet Web Page Licens. number 172/GP-TTĐT, issued 13/08/2010 Stat. Doc. Serv. Cent. - Gen. Stat. Off. Vietnam. https://www.gso.gov.vn/default_en.aspx?tabid=778 (accessed 11.3.18).
[15] GSO (2018c): General statistics office of Vietnam [WWW Document]. – Gen. Stat. Off. Vietnam. https://www.gso.gov.vn/default_en.aspx?tabid=778.
[16] Hieu, D. T. (2016): Biofuel Development in Vietnam. – Presented at GBEP Bioenenrgy Week, 21-24 June, Budapest, Hungary.
[17] HSBC (2018): Exchange Rates [WWW Document]. – HSBC Bank. http://www.webcitation.org/7446UrTWo (accessed 11.20.18).
[18] Kaplinsky, R., Morris, M. (2000): A Handbook for Value Chain. An Important Health Warning or a Guide for Using this Handbook. – Inst. Dev. Stud., Bright, UK, pp. 4–7.
[19] Komen, J., Mutoko, C., Wanyama, J., Rono, S., Mose, L. (2010): Economics of post-harvest maize grain losses in Trans Nzoia and Uasin Gishu Districts of Northwest Kenya. – 12Th Kari Bienn. Sci. Conf., pp. 1228–1233.
[20] Kothari, C. R. (2004): Research Methodology: Methods & Techniques. 2nd Ed. – New Age International (P) Ltd., New Delhi.
[21] Krong Bong (2018): Natural and Socio-economic condition [WWW Document]. – People's Comm. Krong Bong Dist. Portal. http://www.webcitation.org/73oe6AtP5 (accessed 11.10.18).
[22] Leo, O. (2015): Effect of Cassava – Value Chain on Income of Small – Scale Farmers in Abia State, Nigeria. Discourse. – J. Agric. Food Sci. 3: 128–134.
[23] Mack, N., Woodsong, C., Macqueen, K., Guest, G., Namey, E. (2005): Qualitative Research Methods: A Data Collectors Field Guide. – Family Health International, Research Triangle Park, North Carolina, USA.
[24] Masamha, B., Uzokwe, V. N., Ntagwabira, F. E., Gabagambi, D., Mamiro, P. (2017): Gender influence on participation in cassava value chains in smallholder farming sectors: evidence from Kigoma Region, Tanzania. – Exp. Agric. http://dx.doi.org/10.1017/s0014479717000552.
[25] Masamha, B., Thebe, V., Uzokwe, V. N. (2018): Mapping cassava food value chains in Tanzania's smallholder farming sector: the implications of intra-household gender dynamics. – J. Rural Stud. 58: 82–92.
[26] McNulty, E., Oparinde, A. (2015): Cassava value chain in Nigeria: a review of the literature to inform the integration of vitamin A cassava. – Harvest. Res. Action 7: 8–12.
[27] Meaton, J., Abebe, B., Wood, A. P. (2015): Forest spice development: the use of value chain analysis to identify opportunities for the sustainable development of Ethiopian Cardamom (Korerima). – Sustain. Dev. 15: 1–15.
[28] Meridian Institute (2012): Innovations for Agricultural Value Chains in Africa. – Meridian Institute, Dillon, Colorado.

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
DOI: http://dx.doi.org/10.15666/aeer/1702_51935217

[29] Mukete, B., Sun, Y., Etongo, D., Ekoungoulou, R., Folega, F., Sajjad, S., Ngoe, M., Ndiaye, G. (2018): Household characteristics and forest resources dependence in the rumpi hills of Cameroon. – Appl. Ecol. Environ. Res. 16: 2755–2779.
[30] Naziri, D., Quaye, W., Siwoku, B., Wanlapatit, S., Phu, T. V., Bennett, B. (2014): The diversity of postharvest losses in cassava value chains in selected developing countries. – J. Agric. Rural Dev. Trop. Sub Trop. 115: 111–123.
[31] Njukwe, E., Rachid, H., Sarr, P. S., Shigeru, A., Holger, K., Andre, M., Thomas, N., Abdou, T. (2014): Cassava value chain development through partnership and stakeholders ' platform in Cameroon. – Int. J. Agric. Policy Res. 2: 383–392.
[32] Olukunle, T. O. (2013): Evaluation of income and employment generation from cassava value chain in the nigerian agricultural sector. – Asian J. Agric. Rural Dev. 3: 79–92.
[33] Ouma, E., Jagwe, J. (2010): Banana value chains in Central Africa : constraints and opportunities. – Jt. 3rd African Assoc. Agric. Econ. 48th Agric. Econ. Assoc. South Africa Conf, pp. 1–13.
[34] Phuc, T. X. (2015): Cassava development and forest protection in Vietnam. National policy, global market and citizen's livelihood. – Biology (Basel). 25: 3–6.
[35] Pingmuanglek, P., Jakrawatana, N., Gheewala, S. H. (2017): Supply chain analysis for cassava starch production: Cleaner production opportunities and benefits. – J. Clean. Prod. 162: 1075–1084.
[36] Purcell, T., Gniel, S., Gent, R. van, Anh, D. T., Janssen, N., Khiem, N. T., Psilos, P., Tuyen, T. Van, Ypma, P. (eds.) (2008): Making Value Chains Work Better for the Poor. Version 3. – Agricultural Development International, Orlando, FL.
[37] Rutherford, D. D., Burke, H. M., Cheung, K. K., Field, S. H. (2016): Impact of an Agricultural value chain project on smallholder farmers, households, and children in Liberia. – World Dev. 83: 70–83.
[38] Sattar, R. S., Wang, S., Tahir, M. N., Caldwell, C. (2017): Assessment of smallholder farmer's vulnerability due to climate change in arid areas of Pakistan. – Appl. Ecol. Environ. Res. 15: 291–312.
[39] Sewando, P. (2012): Urban markets-linked cassava value chain in Morogoro rural district, Tanzania. – J. Sustain. Dev. Africa 14: 86–97.
[40] SNV Cambodia (2015): Cassava Value Chain Analysis Inclusive Business Model for Promoting Sustainable Smallholder Cassava Production (IBC). – SNV, Cambodia.
[41] Son, D. Van, Lam, D. X., Fahrney, K., Thi, C., Thuy, L. (2016): Study on improvement of cassava value chain in Quang Binh. – Int. J. Polit. Sci. 2: 25–34.
[42] Thanh, P. C., Tan, V. P., Thu, P. X. (2017): Enhancing the value chain of exporting agricultural products in the southeastern Vietnam focus economic region. – SOFER 5: 1–13.
[43] Thao, N. T., Phu, T. V, Son, C. K., Nga, L. H., Duc, N. T. H., Ben, B., Diego, N., Anh, T. K. (2013): Application of value chain analysis in understanding the losses and wastes of cassava in Vietnam. – J. Sci. Technol. 51: 70–76.
[44] Trienekens, J. H. (2011): Agricultural value chains in developing countries a framework for analysis. – Int. Food Agribus. Manag. Rev. 14: 51–82.
[45] Viet, H. C., Quoc, H. T., Gia, L. Van, An, N. Van (2013): Value-Chain Analysis of Cassava in South-Central Coastal Vietnam. – In: Mann, S., Webb, M. C., Bell, R. W. (eds.) Sustainable and Profitable Crop and Livestock Systems in South-Central Coastal Vietnam. Proceedings of the Final Workshop Held in Quy Nhon, Vietnam, 5–6 March 2013. The Australian Centre for International Agricultural Research (ACIAR), Canberra, pp. 127–139.
[46] Yin, R. K., Rog, D. J., Copeland, A. P., White, K. M., Fowler, F. J., Cooper, H., Rosenthal, R., Bickman, L., Rog, D. J. (2009): Case Study Research Design and Methods Fourth Edition. 4th Ed. – SAGE Inc, Thousand Oaks, California.

http://www.aloki.hu ● ISSN 1589 1623 (Print) ● ISSN 1785 0037 (Online)
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APPENDIX

Figure A1. *Group discussion with farmers. (Photo by author)*

Figure A2. *Cassava field trip. (Photo by author)*

Figure A3. *In-depth interview with the director of the factory. (Photo by author)*

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