

## **Study on Improvement of Cassava Value Chain in Quang Binh Province, Vietnam**

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**Abstract:** *Cassava is a cash crop for rural households in Quang Binh province, where cassava plays an important role for farmer's livelihoods, contribution to income increasing. Cassava planting area in the province has increased from 4,659 ha in 2011 to 5,819 ha in 2014. At the present, within the province, there are two cassava dry starch factories namely Song Dinh and Long Giang located at the districts of Bo Trach and Quang Ninh respectively. In addition, there is small-scale wet starch processors focused in craft villages at the districts of Bo Trach, Quang Ninh, Le Thuy and Dong Hoi city for food production such as "Bot loc cake", "Trang cake" and other famous foods, contributing the diversification of food culture in the province. For cassava production, in some targeted communes, there are over 97.2% of the households growing cassava, with averagely cassava area is 0.79 ha per household and cassava contributes biggest income (61%) to household's income, next is rice 10%, sugarcane 10%, millet 10% and other 9%. Diversified cassava production system (included mostly cassava mono-cropping and some intercropping with peanuts, bean, water melon and rubber during two first years) is considered as high competition and benefit. In cassava selling, almost fresh roots (98%) are sold directly to 2 mentioned cassava factories and only 2% of the total fresh roots are used to produce dried slides for animal feeding. Of which, 80% of the fresh roots are sold to 100-140 local collectors, 13% sold by individual farmers directly to factory and 5% fresh roots are sold to wet starch processors at districts of Bo Trach, Le Thuy and Dong Hoi city. Collection team in Nam Trach commune (Bo Trach district) managed by commune People's Committee is considered as a model and plays as middleman or bridge in linking cassava farmers to factories. Market consumption mostly is exported to China by Lang Son border gate, 12% for domestic consumption in producing instant noodles, cakes and other foods and products. Cassava processing conversional rate from fresh root to dried chip is 50%, by fresh root to wet starch is 38-40% up to variety, starch content and harvesting time. Conversional rate from fresh root to dried starch is 30-31%. Prices are varied by year; mostly depend on international market in China. In processing years of 2012-2013 and 2013-2014, the fresh root price is averagely 1,600 VND per kg, dried starch price is 7.8-8.5 million VND per tons (1 \$ US = 22,200 VND). In processing year of 2014-2015, the price of fresh root is 1,700 VND per kg, dried starch price is 7.8-8.9 million VND/tons, the price of wet starch is 7,000-8,000 VND/kg. Generally if input price nowadays, cassava fresh root price is 1,300 VND/kg in minimum, so cassava farmers can get benefit, and if dried starch price is 7.8-8.0 million VND per tons, the factory can also get benefit. Unsustainable prices and it is up to international market, especially Chinese market, therefore when there is any conflict or political changes occur, such unsustainable market will be seriously affected to cassava system and cassava production actors, including cassava farmers, collectors and processors. Therefore, it is needed to diversify the consumption market with other international markets avoiding risky and ensuring sustainable development for mentioned cassava value chain in the study.*

**Keywords:** *Cassava value chain; value chain actor; cassava price; cassava market; fresh root; dried starch; wet starch*

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### **1. INTRODUCTION**

Quang Binh is a province located in central region of Vietnam, where cassava plays a critical role in farmers' livelihood. Cassava production area has growing gradually from 4,659 ha in 2011 to 5,819 ha in 2014. Currently, there are two starch processing-for-export factories in Bo Trach and Quang Ninh. In addition, Quang Binh province also have some wet starch processing factories in Bo Trach,

Quang Ninh, Le Thuy districts and one in Dong Hoi city to produce food, dumpling cake, cassava paper wrappers and some other well-known food.

As defined by Kaplinsky (2000), the value chain describes the full range of activities which are required to bring a product for service from conception, through the different phases of production (i.e. involving a combination of physical transformation and the input of various producer services), delivery to final consumers and final disposal after use. The value chain analysis seeks to understand the various factors that drive the incentives, growth, and competitiveness within a particular industry and to identify opportunities and constraints to increasing benefits for stakeholders operating throughout the industry.

In value chain analysis of cassava, it is necessary to identify and study on current situations of involving factors namely producers, collectors, processors and final consumers. In order to increase income of small-scale cassava production by improving sustainable cassava production, one of the critical goals is to increase revenue of long-time relationship between cassava growers across processing enterprises and factories. Therefore, this research aims to identify and study actors involved in cassava value chain, their characteristics, their strength, weakness and also formulate recommendations to continue and developed sustainable value chain of cassava in Quang Binh province.

## **2. APPROACH AND RESEARCH METHODOLOGY**

### **2.1. Approach**

This research inherited from the *Inclusive Business Models to Promote Sustainable Smallholder Cassava Production* (IBC), a regional Project, covering Cambodia, Laos and Vietnam, which is funded by International Fund for Agriculture Development (IFAD) and managed by SNV Netherlands Development Organisation, collaborated with Center for International Agriculture Tropical (CIAT), implemented from January 2013 and ended in June 2015. In Vietnam, IBC project was carried out in Truong Xuan, Hien Ninh and Van Ninh of Quang Ninh district and Hung Trach, Nam Trach and Phu Dinh in Bo Trach district. In addition, this Project shares interest and links with the Food, Feed, Fibre and Fuel for a Greener Future (4FGF) Project, carried out from 2011 to 2013 in Xuan Trach (Bo Trach district), through relevant technical interventions of producing and utilizing cassavas' by-product. The authors use the combination of desk information review and primary data collection. We also combine research in either micro- or macro- level to show the whole picture on real situation with the Project's intervention and formulate recommendations to improve cassava value chain in Quang Binh province.

### **2.2. Research Methodology**

This research is done mainly by using following methods: (1) Deep interview the key informers, including leaders of Song Dinh and Long Giang cassava starch/tapioca factories, collectors, supply dealers, cassava growers in Truong Xuan, Hien Ninh and Van Ninh (Quang Ninh district) and Hoa Trach, Hung Trach, Nam Trach, and Phu Dinh (Bo Trach district), Hai Thanh (Dong Hoi city). We developed diverse checklists and questionnaires for different target informant. At least 20 deep-interviews were taken place during 2013 till 2015. (2) Focus group discussion of cassava growers were carried out in six different communes, of which 10 discussions were done in 2014 and 2015. (3) We adopted direct observations for data collection, and (4) Furthermore, survey questionnaire to collect relevant data and information during years of 2011 - 2012 in Xuan Trach (Bo Trach district).

## **3. RESULTS AND DISCUSSIONS**

### **3.1. Cassava in Livelihoods and Cassava Value Chain Analysis in Quang Binh Province**

Cassava is considered as one of the most important cash crop in livelihood of rural households in Quang Binh district (Table 1). Data collected from Khe Ngan (Truong Xuan commune, Quang Ninh, Quang Binh) shows that in total of 105 rural households, there are 35 cassava growers with total of 25 hectare (33.3 percent). On average, each household grows 7,100 meter square of cassava, contributing approximately 35 percent of plantation income. Nam Trach commune (Bo Trach district) has 700 cassava growers with total of 550 hectares, the percentage of cassava growers is 97.2%, and 7,900

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meter square of land is devoted to cassava production which then delivers 61% of their total crops income. In Hung Trach commune (Bo Trach district), approximately 40% of households is growing cassava, contributing 15% to their total crops income. For Xuan Trach (Bo Trach), according to the data from 4FGF (implemented by CIAT during 2010-2011), in total of 48 surveyed households, 91.7% of those were growing cassava with more than 1,700 meter square of land per household, on average, contribute significantly of 53,2% to their total crops income, preceded by peanut [3].

According to the statistics of the Provincial Department of Agriculture and Rural Development (DARD) [5], land for cassava growing ranges from 0.13 to 3.0 hectares, each household grow 0.83 hectares on average. The number of percentage of households grows less than 0.5 hectares, 0.6 to 1 hectare, and more than 1 hectare are 56 percent, 17 percent, and 27 percent respectively. In terms of income, cassava is the biggest contributor to household income (51%), followed by rice (25%), rental and other sources of income (24%). Those households that devote for either on-farm or off-farm receive 25 percent of income from cassava, 7 percent from rice, 43 percent from off-farm activities and the rest 25 percent of income from other possible sources.

**Table1.** Cassava in Livelihoods of Sample Households

Crops	Xuan Trach*		Hung Trach**		Nam Trach**		Truong Xuan**	
	Growers (%)	% income	Growers (%)	% income	Growers (%)	% income	Growers (%)	% income
Cassava	91.7	53.2	40.0	15	97.2	61	33.3	35
Rice	2.1	10.0	90.0	20	90.1	10	76.2	40
Maize	87.5	25.7	18.0	10	2.1	4	4.5	5
Sugarcane	-	-	-	-	13.9	10	-	-
Millet	10.5	15.0	5.0	5	4.2	10	-	-
Others	10.5	12.0	23.0	10	6.9	5	49.2	20

**Note:** \*Data from Survey of 48 Households in 2011,

\*\*Data From Farmers' Focus Group Discussion 2014-2015

Cassava production exhibited increasing trend from year 2011 with 4,659 hectares until 2014 of 5,819 hectare. The increase in the production of cassava is attributed to various storms and typhoons in 2013 that trucked and made a large number of rubber tree collapsed. Moreover, due to the decreasing of the rubber price in the global market, farmers switched to grow cassava as an alternative. The increase in the quantity of cassava is believed due to the expansion of cassava growing area (Table 2).

**Table2.** Cassava area, yield and production at Quang Binh province

Indicators	2011	2012	2013	2014
Area (ha)	4,659	5,573	5,215	5,819
Yield (100kg/ha)	179	164	165	178
Production (tons)	83,704	91,512	85,868	103,641

Cassava value chain begins with input supply, production, collection, processing and consumer market (Figure 1). Basically, the input supply system satisfies cassava production requirements, consist of cassava varieties, fertilizer, input and credit support. Cassava is grown mainly in Bo Trach district (approximately 3,000 ha). It is estimated that the potential to expand the cassava production area is from 2,000 up to 3,000 ha, primarily in Quang Ninh, Le Thuy, Tuyen Hoa and Minh Hoa districts of Quang Binh province.

The current status of cassava production is considered to have economic efficiency, high level of competitiveness, deliver higher income compared to other crops. Data from fertilizer trials in 6 communes in districts of Bo Trach and Quang Ninh in 2014 shows that the farmer's practice in cassava fertilization (including 10 tones of manures + 75 N + 50 P<sub>2</sub>O<sub>5</sub> + 100 K<sub>2</sub>O, or 10 tons of manure + 300 kg NPK Sao Viet + 46 kg Urea + 188 kg super phosphate + 108 kg potassium per hectare) yields 29.6 tons per hectare of fresh roots on average, made up a total income of VND 41,487 million per hectare. Total cost for fertilizer is VND 11.8 millions (note: 1 \$US = 22,200 VND), accounting for 28.59% of total income, thus the net return on fertilizer investment (NROI) still reach 0.3. It means that if cassava grower made a VND 100,000 of fertilizer investment, they would receive VND 30,000 in return (1 \$ US = 22,200 VND).

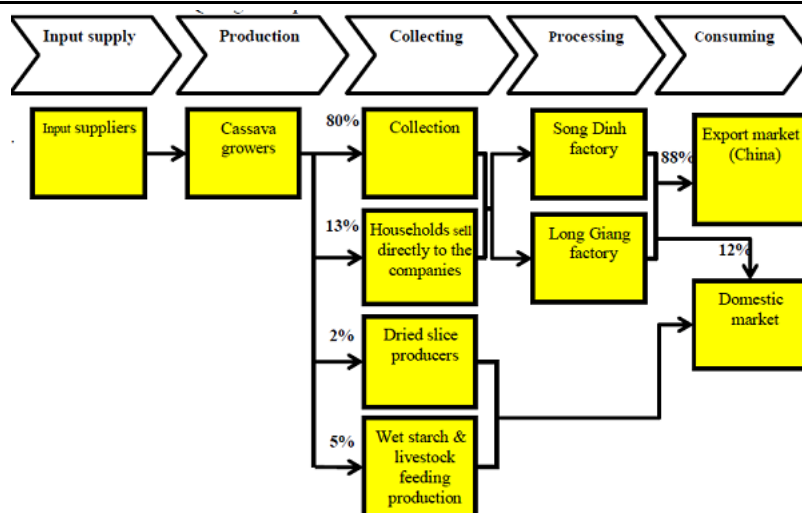


Figure1. Cassava Value Chain in Quang Binh

Annually, it is estimated that 98% of the total cassava production is sold under fresh roots form, in which 80% is sold through collectors, 13% is sold directly to two processing factories. These two factories will then process fresh roots to dried starch. Only 2% for dried slices, and 5% of fresh roots is used for wet starch processing, targeting at some craft villages in Bo Trach, Quang Ninh, Le Thuy districts and Hong Hoi city. Wet starch is used in food processing, making dumpling cake, and other food, which are becoming famous food, contribute to enriching the culinary culture of the Dong Hoi city and of Quang Binh province as a whole. Some households in Con town and in Bac Nghia and Nghia Ninh wards (Dong Hoi city), Dong Trach commune (Bo Trach district) have grinders for processing of fresh roots to wet flour, and also make the dumpling cake and sell directly to the local markets. Some other households in Hoa Trach commune (Bo Trach district) have intensively produced wet flour for dumpling makers in Hai Thanh ward (Dong Hoi city). A small number of cassava is used for livestock feeding through chipping, sun drying, grinding, and then mixing with some other food for piglet and poultry feeding. The main export market of dried starch is China (88%) and the rest (12%) is consumed in domestic markets. Specifically, 100% of the cassava starch from Song Dinh factory is exported whereas only 15% of cassava starch from Long Giang factory is used for domestic market, making instant noodles or produce packaging, cardboard boxes in Hanoi and Vinh Phuc province.

Table3. Conversion Rate in Cassava Processing

Raw material		Processed products		
Product	Quantity (kg)	Product	Quantity (kg)	Conversion rate (%)
Fresh roots	100	Dried slices	50	50
Fresh roots	100	Wet starch	38-40	38-40
Fresh roots	100	Dried starch	30-31	30-31
Wet starch	100	“Bot loc” cake	6,000	-

The conversion rates from fresh to dried slices is normally 50% and remain 38-40% for vice versa, depending on the variability on varieties, the quality of flour/starch, and the time of harvesting. The conversion rates from fresh roots to dried starch is 30-31%, depend on varieties and the time of harvesting. Wet starch after refined in filter tank using filter fabrics is then used for making dumpling cake. On average, giving 1kg of fine flour can make 6,000 tapioca puddings [4].

In terms of cassava price, there is a great variability depend on the price of exported starch. During period of 2012-2013 and 2013-2014, the average fresh roots price is VND 1,600 per kilo, starch for export ranges from VND 7.8 to 8.5 million per tons. In 2014-2015 seasons, the average price for fresh roots is VND 1,700 per kilo, price of cassava starch ranges from VND 7.8-8.9 million per tons, price of wet starch ranges from VND 7,000 to VND 10,000 per kilo; depend on the cleanliness of flour/starch (1 \$ US = 22,200 VND). Price of modified starches exported to Taiwan is \$ US 420/tons. Generally, to the cassava growers’ perspective, with the current input prices, if cassava fresh roots are sold from 1,300 VND/kg or higher, then the cassava growers will gain the incentives. For the

processing factories, if the price of starch is from VND 7.8-8.0 million or higher, then they will get surplus.

Due to the instability of the cassava price in the global market, especially in China, whenever any conflict or political changes occurs, this would considerably affect to the whole production system, including cassava growers, and processing factories. Therefore, there is a need to diversify consumer market and expand the consumer market for cassava starch to other international partners around the globe to avoid risks and insure the sustainable development for the whole value chain.

### **3.2. Analysis Involved Actors in the Cassava Value Chain in Quang Binh**

#### *3.2.1. Input Supply*

In general, input supply plays a pivotal role in agriculture production and cassava production in particular. Data from direct observation and interview households and input suppliers, agricultural supplies and services for agriculture production and cassava production is considered as good enough. The usage of this mixed fertilizer NPK has many advantages of which saving fertilizer and improving fertilizer efficiency. Notwithstanding, this type of fertilizer has not fully meet nutritional requirements of cassava (as cassava requires more potassium, nitrogen and phosphorus).

In regard to cassava varieties: prior to 2014, local cassava farmers used to grow KM94, NA and some other already degenerated varieties with low productivity. Since the introduction of Rayong72 in 2014 as a technical intervention of the IBC project, this was followed by the present of new varieties with high potential of starch productivity such as KM21-12, Rayong72,... The demand for new cassava varieties is enormous. Long Giang cassava factory was initially assisted propagation cost of KM21-12 and Rayong72 as a credit support for cassava growers.

#### *3.2.2. Cassava Growers*

As mentioned above, cassava plays a critical role in livelihood of rural households. In general, cassava production/cultivation system in Quang Binh including cassava is grown either in monoculture or inter-cropping with groundnut, corn, and melon in subsidiary land or arable land and cassava inter-cropping with rubber in the very first years as a method of land utilization. A small number of cassava inter-cropped with rubber focused particularly in Bo Trach district while cassava inter-cropped with groundnut, melons and corn, mostly grown in Quang Ninh, Le Thuy districts, where there is a few of land devoted for cassava production. Due to the climatic conditions in Quang Binh and some other neighbor provinces, cassava is typically grown from December onward (3-4 months earlier compared to northern mountainous provinces) and lasts until the end of January before entering the stage of drought (normally stated at March and April). This is an experience-based react of local famers in response to severe climate conditions. Cassava in Quang Binh is normally harvested in September till October. Notably, there is a frequency of heavy rain which causes widespread flooding during September and October. Consequently, it is recommended that cassava should be harvested before that period, especially in low land areas including Hien Ninh (Quang Ninh district), Nam Trach, Hung Trach, Phu Dinh (Bo Trach district) and others in Le Thuy district.

The majority of land for growing cassava is flat, 70% of that is slope land less than 15%, so, and there is no problem with respect to soil erosion. Cassava growing has not affected by free grazing as each cassava field has fences or trenching guard. Local farmers have experienced over 10 years of growing cassava. However, farming practice is accumulated merely through learning from each other process.

Under intensive cultivation, most cassava fields are plowed twice then cassava beds were made by by hand or with cattle. Application of basal fertilizing includes manure and NPK with 10 tons manure and 500 kg NPK per hectare. Cassava cuttings are chopped with 12-18 centimeters long, 12-14 thousands cuttings per hectare, higher density than many other localities in northern mountainous area. Weeding and top-dressing combining with bebs soil complement. Top dressing application consists of urea at a rate of 100-140 kg urea/ha. Production costs analysis shows that land preparation costs accounts for 25-26%, variety: 1%, fertilizers: 28-30%, weeding and top dressing: 17-20%, harvesting: 13-15%. Giving average yield of 20-25 tons/ha, cassava growers can earn approximately VND 18-20 millions revenue or income per hectare.

**Table4.** Training Courses for Cassava Farmers in Project Site

Content of the training	Venue	Time	No. of participants
ToT on cassava growing technique	1 class in Truong Xuan commune (Quang Ninh district), 1 class in Hung Trach (Bo Trach district)	From 10-11/1/2014	78
Technical training on cassava growing	2 in Hien Ninh and Van Ninh (Quang Ninh district), 2 classes in Nam Trach and Phu Dinh (Bo Trach district)	From 11-14/1/2014	66
Trainings on post-harvest, market and cassava value chain	3 in Truong Xuan, Hien Ninh and Van Ninh (Quang Ninh district), 3 classes in Hung Trach, Nam Trach and Phu Dinh (Bo Trach district)	From 3-6/12/2014	500
ToT Farmer Field Days at groundnuts harvest intercropped with cassava	1 in Truong Xuan (Quang Ninh district), 1 in Hung Trach (Bo Trach district)	From 15-16/5/2014	44
Farmer Field Days at cassava harvest	3 in Truong Xuan, Hien Ninh and Van Ninh (Quang Ninh district), 3 in Hung Trach, Nam Trach and Phu Dinh (Bo Trach district)	From 13-16/10/2014	118

Farmers have experienced in land preparation, cassava bed making, planting density, variety selection and use, weeding, fertilization (including manure and NPK application,...), intercropping 2 peanut rows on cassava bed, higher planting density, harvesting time,... We recognize that, under sandy, slight clay condition, especially hot whether like Quang Binh, cassava beds can be able to create differences on temperature between under-soil and surface, maybe mostly protecting the heat from air for the soil, so it is good for facilitation for the root development and hydrate carbon transportation within the cassava plan and avoiding flood. This is a good practice, contributing promotion of the cassava production in Quang Binh.

Table 4 describes ToT trainings on cassava planting, farmer field days peanut harvesting intercropped with cassava and cassava harvest. Table 5 indicates cassava trials and demonstrations within IBC Project implanted at six communes of Truong Xuan, Hien Ninh, Van Ninh (Bo Trach district), Hung Trach, Nam Trach and Phu Dinh (Quang Ninh district) in the year of 2014. Dissemination of new cassava varieties of KM21-12 and Rayong72 in 2015 combining with application of new technologies on fertilization, peanut intercropping successful piloted in 2014. We can see, if in 2014 only 10 farmers conducted interventions on variety, fertilization and intercropping with total area of 1 ha at 6 communes of 2 mentioned districts, in this year of 2015, there are more 56 farmers at 10 communes of 3 districts namely Quang Ninh, Bo Trach and Le Thuy applying new successful cassava technologies piloted in 2014 with total planting areas of 5.93 ha.

**Table5.** Cassava Trials Demonstration in 2014-2015

Year	Content	Venue	Area (ha)	No of participated households
2014	Demonstration of varieties, fertilizer and intercropping cassava with groundnut	6 communes: Truong Xuan, Hien Ninh, Van Ninh (Bo Trach district), Hung Trach, Nam Trach, Phu Dinh (Quang Ninh district)	1.0	10
2015	Cassava breeding KM21-12 and Rayong72	10 communes: Truong Xuan, Hien Ninh, Van Ninh, Vinh Ninh, Truong Son (Quang Ninh district), Hung Trach, Nam Trach, Phu Dinh, Cu Nam (Bo Trach district), Duong Thuy (Le Thuy district)	5.93	56
<b>Total</b>			<b>6.93</b>	<b>66</b>

However, cassava production in Quang Binh province still has some disadvantages and problems such as: small planting area, sporadically location and small field size. Some areas, cassava were planted on exhausted and bare lands. In addition, hot climate, regularly draught and flooding effecting to cassava production in Quang Binh province.

*3.2.3. Collectons and Traders*

Cassava fresh root collection supplies factories by collectors and traders, including existing private collectors, traders and colection team established by the IBC Project.

The Song Dinh factory, annually 70-100 collectors and traders mostly collecting fresh roots from Bo Trach and selling to that factory nearby. In Long Giang factory, among of 30-50 collectors and traders of which only 10 big collectors and traders, but supplied 65% of fresh roots, while 30-40 small collectors and traders supplied 35% of fresh roots to the Long Giang factory.

At Song Dinh factory, in processing year of 2014-2015, there are 60% of fresh roots provided by private collectors and traders, and the 40% remainder provided by factory directly bought from cassava producers. At Long Giang factory, in processing year of 2014-2015 there are 80% of fresh roots supplied by collectors and traders, only 20% remainder by facory, of which 90% transported by factory lorry and 10% remainder transported by cassava producer their own lory. Local collectors could be able to buy cassava field before harvesting, then they hired labour for harvesting, therefore they will be easy to coordinate in selling frest roots to factory when they received the ticket from factory. Local collectors also buy fresh roots harvested by cassava farmers. At Hung Trach commune (Bo Trach district), there are 2 familiar collectors based at the commune, mostly selling fresh roots to the Song Dinh factory.

**Table6.** *Collectors and Traders in 2014-2015*

<b>Factory</b>	<b>Number of collectors/traders</b>	<b>Supply (%)</b>	<b>Buying directly from cassava growers (%)</b>
Song Dinh	70-100	60	40
Long Giang	30-50	80	20

Regarding collection team of fresh roots, the IBC Project has estblished 4 collection teams at communes of Truong Xuan, Vinh Ninh, Nam Trach and Hung Trach. All 4 mentioned collection teams were operated based on the control of commune people’s committee. All collection team members were trained on capacity building, value chain, planning and bussiness, business plan development, negotiation and contract drafting as well as cassava value chain and market. To support development of cassava production plans, cassava consumption plan is consistent in the whole commune to avoid excess production/ harvest, leading to unstable production. The duties of collection team are: (1) To support contract negotiation with processing factories in terms of outputs and prices and providing price information for cassava farmers; (2) To provide technical advice for cassava farmers during production; (3) To create close and strong linkages among commune People’s Committees, farmers’ group business, farmers and factories.

Annually, collection team signs contracts with the factory with commitments on the time of purchase, quantity, purchase prices. However, linking for cassava production and sale under contract is still new for local cassava farmers in Quang Binh province, so it really needs technical assistance and capacity building for cassava growers to gradually change their traditional cassava production practices.

Observation indicates that collector teams in Nam Trach commune and other sites as well have some burdensome and difficulties as follow: (1) The cordination between the factory and the collector organizations is not really tight, lack of investment. (2) Funding support for collector group is limited. Song Dinh factory, under the FOCOCEV Quang Binh Corporation almost have no financial support for their collector groups. (3) Linking producers to the markets through contract farming sitll in the early stage in the eyes of cassava growers. It is necessary to offer technical assistant and empowering capacity for either cassava growers or cassava processing enterprises, and (4) There is a room for future research to consolidate the link between the traders and dealers, traders with collection teams to consolidate available resources to promote sustainable cassava production.

### 3.2.4. Cassava processing

#### a. Cassava Processing Enterprises

The biggest cassava processing enterprises are the Song Dinh cassava dried starch factory (belongs to FOCOCEV Quang Binh Corporation) and the Long Giang cassava starch factory (Long Giang Think Jointock Investment Company). Time of processing operation in 2 both factories is 6 months on average, normally started from current September to the next March. Processing season 2014-2015 lasted longer due to the abundant of fresh roots from surrounding provinces such as Quang Tri, Ha Tinh, and Nghe An provinces. Cassava is ideally produce from early July to the end of March. Four months of development is adequate for machinery maintenance. Winter season is right after the rainy season, once land is dried, that is time for cassava cultivation. After more than 10 months, cassava is then harvested. Imbalance of supply and demand is common figure of cassava processing at Quang Binh province.

##### *The Song Dinh Factory*

*Address:* Cau Da Mai, Viet Trung farm town, Bo Trach district, Quang Binh province. The establishment: Song Dinh tapioca starch processing factory is established since 2004, working with capacity of processing of 350 tons fresh roots per day, equivalent to 120 tons tapioca per day. Each season lasts continuously for about 7 months, from September to March of the following year. The factory has 92 full-time workers and 106 seasonal workers. This company has a cassava material area of 3,700 ha – 3,800 ha, primarily focused in Bo Trach (approximately 3,000 ha) and the rest in districts of Quang Trach, Tuyen Hoa and Minh Hoa.

##### *The Long Giang Factory*

*Address:* Le Ky 1 Village, Vinh Ninh Commune. Quang Ninh District, Quang Binh province. Establishment: Long Giang factory is established since 2009 with a total of 110 staffs, including more than 50 long-term staffs, and the rest working as contracted workers. Initially, the factory works with cassava starch and canna starch, then entirely switched to cassava production. The production capacity is 75 tones/day (24 hours), and more than 60 tones starch/day in 6 months.

The main material source (cassava fresh roots) comes from Dong Hoi city (3 communes), Quang Ninh district (15 communes) and Le Thuy (19 communes). Demand for cassava material area is about 3,000 ha. However, nowadays cassava fresh roots only supply 70-75% of the processing demand of the factory. Production of the factory, if processing year of 2012-2013 the factory only produces 1,200 tons of dried starch, processing year of 2013-2014 produces 4,600 tons and in processing year of 2014-2015 the factory produces 35,000 tons of fresh roots with 9,000 tons of dried starch and 300 tons of modified starch for food production exporting to Taiwan. The Long Giang factory begins providing input credit for cassava producers.

If in processing years of 2012-2013 and 2013-2014, there is imbalanced competition in fresh root supply among 2 mentioned cassava processing factories, then in year of 2014-2015, relationship between these 2 factories in the province now has been improved due to the IBC project. All 2 cassava processing factories have established their agricultural sections (including 2-3 technical staff) to provide guidance for the farmers on seasonal crops, seed selection, and intensive farming to improve productivity and efficiency.

##### *Small-Scale wet Starch Processors*

There are some small-scale wet starch processing units (production capacity from 0.2-1.5 tons of fresh roots per day or group of households' scale (5-30 tons of fresh roots per day), concentrated mostly in Dong Trach, Hoa Trach (Bo Trach district), communes/towns/wards of Nghia Linh, Con, Bac Nghia (Dong Hoi city) and some other communes in Quang Ninh and Le Thuy districts. Wet starch is used mainly for making 'Bot loc' cake, 'Banh Trang' cake and other food, contributing the diversification of cassava processing products.

#### b. Cassava Consumption Contract

In crop season of 2014-2015, 70% of fresh roots are bought without contract. Yet in 2015-2016 cropping season, there have 11 contracts been signed between processing factory and collector teams



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at 4,500 households. In which, Song Dinh factory signed with 5 communes with total cassava area of 1,550 ha. The Long Giang factory signed contracts with 6 communes with total area of 794 ha, providing 30% fresh roots for processing.

**Table7.** Cassava Starch Processing at Quang Binh

Cassava starch processing units	Address	Designed capacity (tons/year)	Actual operated capacity (tons/year)	Target markets (%)	
				Domestic	Export
Song Dinh company	FOCOCEV Quang Binh Corp	55,000-60,000	45,000-50,000	5	95
Long Giang company	Long Giang Thinh Jointstock Investment Company	40,000-45,000	35,000-35,000	20	80
Small-scale wet starch processors	Districts of Bo Trach, Le Thuy, and Dong Hoi city	-	-	100	0

There are 2 study tours to provinces of Tay Ninh, Binh Phuoc and Yen Bai with the participation of 30 participants from Quang Binh Department of Agriculture & Rural Development (DARD), cassava factories, district Department of Agriculture & Rural Development and commune extension officers. The active participation of all managers, processors and extension officers play an important role in coordinating, promoting and strengthening the linkage between actors in cassava value chain Quang Binh province.

**Table8.** Signing Contract of Fresh Root Consumption in 2015-2016

Factory	Company	Contracted communes	Area (ha)
Song Dinh	FOCOCEV Quang Binh	5	1,550
Long Giang	Long Giang Thinh	6	794
<b>Total</b>		<b>11</b>	<b>2,344</b>

## 4. CONCLUSION AND RECOMMENDATION

Through, according under market mechanism, Quang Binh cassava's value chains has been formed and developed accompanying with active participation of value chain actors, contribute to the development of cassava production, brings benefits to all producers, middlemen, collectors, processors, and consumers. This is a vivid example of the so-called "Four Linkages": Enterprises – Scientists – Managers – Farmers. Therefore, it is necessary to consolidate the intimate ties among cassava chain actors.

For cassava production, it is needed to disseminate 2 new cassava varieties namely KM21-12, Rayong72 replacing old and low yield of KM94. Improvement and change of cassava planting time earlier in October, November or later in March, April for harvesting later aims at reduction season-off processing of the factory which needs short duration variety and upper land for planting, avoiding floods aims at increased processing months.

Regarding cassava farmers, collectors and factories, it is needed to have consumption contract, but contract still is new to cassava farmers, therefore it needs to build trust among cassava producers and processors. Agreements under contract sign quantities, timing and price at commune level. Farmer groups or collection teams sign the contract not individual then the farmers need to follow the agreement. Support from the government to ensure the effectiveness of the contract. Building trust between buyers and sellers could be beneficial to both but trust is the most important factor in developing successful inclusive business models. Strengthening the linkages between factories and farmers by guide parties to implement terms of contract signed and sign new contracts with new communes. Harmonize profit of farmers and manufactories. Maintain and promote cassava collecting team and forming and development of cooperatives in cassava production.

Unsustainable prices and it is up to international market, especially Chinese market, therefore when there is any conflict or political changes occur, such unsustainable market will be seriously affected to

cassava system and cassava production actors, including cassava farmers, collectors and processors. Therefore, it is needed to diversify the consumption market with other international markets and partners avoiding risky and ensuring sustainable development for mentioned cassava value chain in the study.

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