Value-chain analysis of custard apple (*Annona squamosa*), with suggestions to improve farmers' incomes in Tay Ninh province

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Abstract

Value-chain analyses from the production to consumption stages of custard apple (Annona squamosa) are discussed in this paper. Limitations to small landholders' income through processes of the value chain and ways of improving the chain are described.

Value-chain methodology was applied on custard apple chain which include of actors in the Tay Ninh province in South-East (SE) Vietnam to assess limitations that occurred from the production to the consumption stage, then to develop strategies and make recommendations to enhance profitability for farmers in the chain.

The key findings of the custard apple value-chain analysis are: (a) Farmers and collectors/ wholesalers play a very important role in the chain; however, the processing factory is the primary factor that influences the whole custard apple chain; (b) Information about the market and prices governs farmers' benefits and income; (c) Cooperation and coordination among farmers are the best means to reduce risk and loss if the price were to depreciate; (d) Interaction between custard apple producers and processing enterprises is necessary for a sustainable consumption system; and (e) Small-scale farmers are dependent upon the price of custard apple to mitigate risks.

Keywords: *Custard apple (Annona squamosa), cost-benefit, farmers' incomes, Tay Ninh province, value chain*

1. Introduction

In recent years, custard apple has been a fast-growing crop in terms of area and output in Tay Ninh province, from 5,305 hectares in 2019 to 5,495 hectares in 2021, with an average output of 67,452 tons in the period 2019-2021 (Bureau of Statistics, Tay Ninh, 2022). The custard apple cultivated area covers on eight districts and one city in Tay Ninh province and generates main income for a large number of farmer households.

In Tay Ninh, custard apple fruit is not only consumed domestically but also exported to a number of countries in ASEAN, the Middle East, China, and North America with increasing export volume yearly. Custard apple has helped poor farmers get out of poverty and brought income for many actors such as local collectors, traders (local and external assemblers), agents inside and outside the province, providing raw materials for enterprises processing and exporting custard apple.

Previously, there have been some studies on custard apple value chain but have not fully assessed the strengths,

weaknesses, opportunities, and challenges of the custard apple value chain in Tay Ninh, actors participating in the chain, the contribution of the actors in the chain is not clearly understood. Therefore, suggestions for improving the Tay Ninh custard apple chain have not been made yet.

This study aims to describe and analyze in detail the custard apple value chain in Tay Ninh, evaluate the effectiveness and contribution of actors in the chain, identify opportunities and threats for the chain, strengths and weaknesses of the actors and outlines measures to improve the whole chain in order to bring benefits to each actor, particularly custard apple farmers. Moreover, the policy suggestions will also be given to improve the chain in the near future.

2. Literature review

There are different critical studies on different value chains of fruits in over the region in Vietnam such as: Tran Tien Khai et al. (2013): Estimate of financial benefits from value chain of Bến Tre Coconut; Ho Cao Viet et al. (2015): Analysis and improvement of beef-cattle value chains in south-central coastal Vietnam; Ho Cao Viet (2017): Integration to global value chain: case of Vietnamese Rice; Vo Thi Thanh Loc and Trinh Duc Tri (2015): Study on mango value chain in Mekong River Delta; Nguyen Duy Duc et al. (2015): Cashew value chain in South Coastal Central (SCC) Vietnam; Luong Ngoc Trung Lap and Nguyen Minh Chau (2015): Analysis of the value chain of mango in south-central coastal Vietnam; VSO ICS (2015): Value chain analysis of the fruit and vegetable market for smallholder farmers in Zanzibar; Plazibat et al. (2016): Analysis of fruit and vegetable value chains; Wondim (2021): Value chain analysis of vegetables (onion, tomato, potato) in Ethiopia.

3. Research methodology

Approached methods and methodologies were adopted from international organisations involved in evaluating and improving value chains, such as Making Markets Work Better for the Poor (M4P, 2008), Value Links (GTZ, 2007), and Commodity chain analysis: Financial analysis (Tallec and Bockel, 2005) were applied to develop the investigation framework in the context of custard apple value-chain study.

Qualitative methods: The participatory rural appraisal (Nguyen Duy Can and Nico Vromant, 2009), key informant panel (KIP) discussions, SWOT matrix analysis (strengths, weaknesses, opportunities and threats) were applied to identify the: (a) structure of the chain in different sub chains and actors; (b) interaction of each factor, including the actors in the chain; and (c) impact of institutions and policies on the chain. Collection and analysis of secondary data (annual reports of People's Committees, statistical data, scientific reports and information from the Ministry of Agriculture and Rural Development (MARD), Department of Agriculture and Rural Development (DARD) in each province, non-government organisations (NGOs), plus institutional and political papers) were also undertaken. Individual in-depth interviews, case studies and observations added to the data collection.

Quantitative methods: Face-to-face interviews or discussions were held with the value-chain actors to collect data which were subjected to statistical analysis, cost-

benefit analysis and added-value analysis for overall chain, including sub-chains. Survey sampling was selected by a non-probability sampling method (proportionate quota sampling combined with a convenience sampling approach). Surveying was carried out in 3 main areas: Tay Ninh city (Ba Den), Tan Chau and Duong Minh Chau district. There are 30 custard-apple farmer households who owned various farm-size were selected to carry out survey and face-to-face interview. The other actors included 5 collectors, 3 local assemblers, 3 external assemblers, 1 processing enterprise was chosen to compile cost-benefit data and describe value chain mapping.

Approached method: the approach method for mapping the chain, calculate and distribution of value-added along the chain was based the instruction of GTZ (2007) (Figure 1, Figure 2, Figure 3).

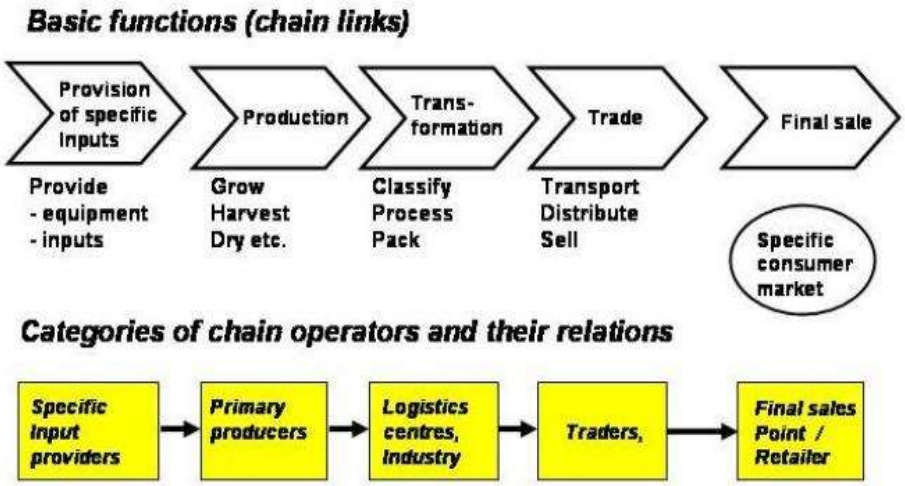

Figure 1. Concept: Generic elements of a basic linear value-chain map (GTZ, 2007: 6)

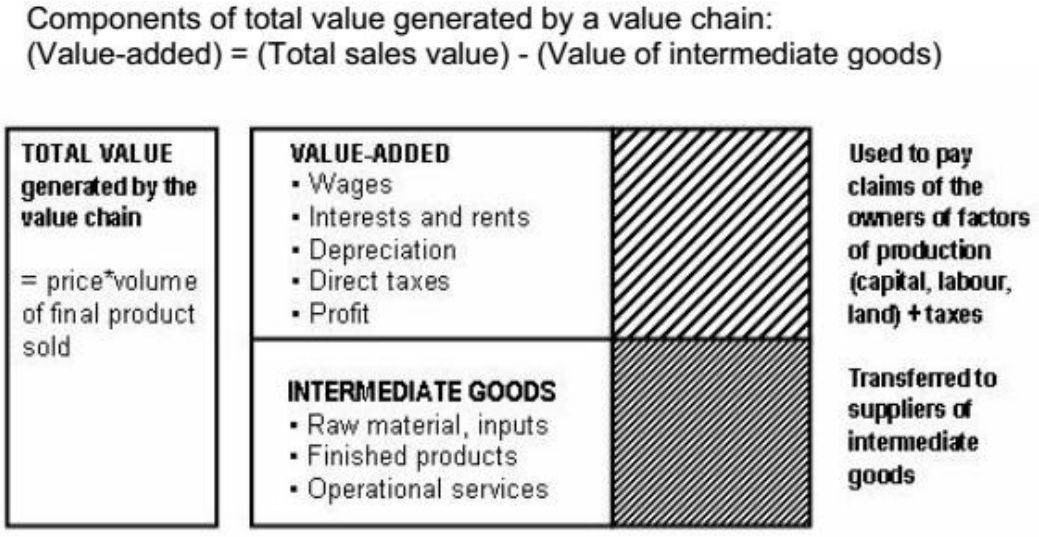

Figure 2. Concept of calculation of value-added (GTZ, 2007: 20)

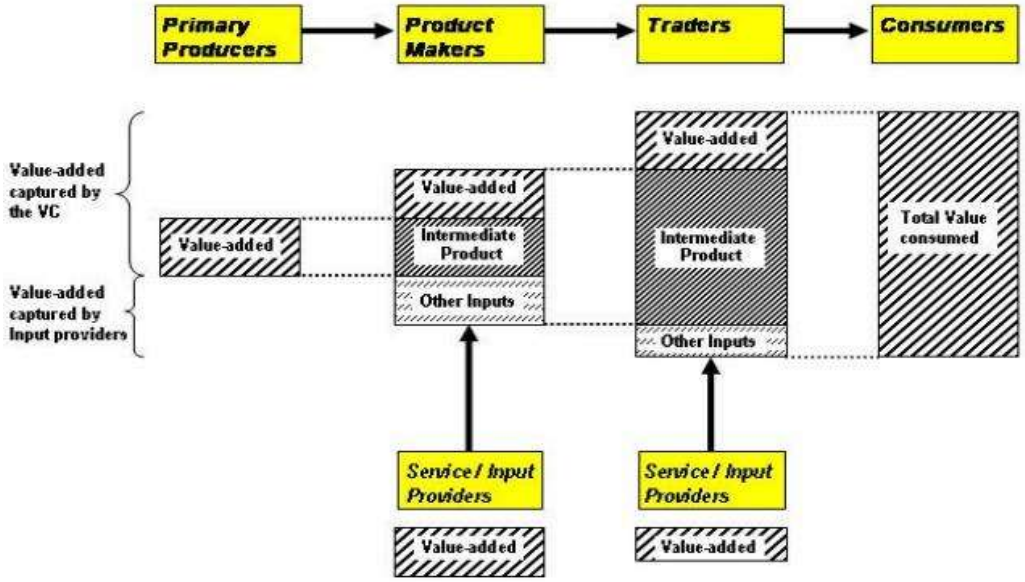

Figure 3. Concept of distribution of value-added along the chain (GTZ, 2007: 20)

4. Results and Discussion

4.1. Custard apple value chain mapping in Tay Ninh province

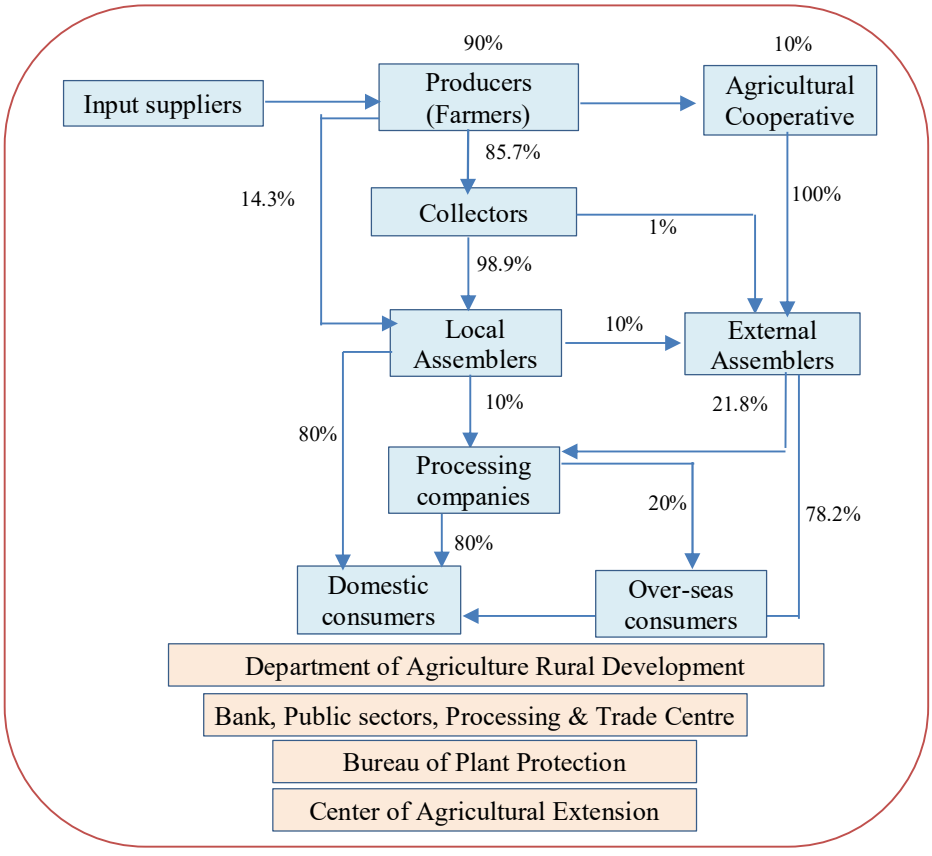

Figure 4. Description of sub-channels in custard-apple value-chain in Tay Ninh province

The sub-channels in custard-apple value-chain in Tay Ninh province is described in Figure 4. In recent years, the custard apple value chain in Tay Ninh province includes of these sub-channels (sub-chains) as following:

The main channels (channel 1 and channel 2): Custard apple fruit is mainly produced by farmers that accounting for 90% of total whole production in Tay Ninh province, the rest is produced by agricultural cooperatives. After harvesting, 85.7% of custard apple fruit is sold to local collectors who buy a small quantity from farmers households. When the quantity of custard apple collected is large enough (from a few hundred kilograms to less than one ton), collectors transport the mass of custard apple to sell to local assemblers (or local agents) at about 98.9% of whole buying in communes and districts. After that, 80% of custard apple quantity is sold in the domestic market in channel 1 (retail small markets, supermarkets and wholesale markets in Hoc Mon, Cu Chi or Binh Dien-Thu Duc district), and 78.2% of custard apple is traded by external assemblers in channel 2 (or external agents, who come from other provinces, cities, surrounding regions of Tay Ninh province) to over-sea consumers (Figure 4).

The sub-channels: Simultaneously with the main channel, some sub-channels are gradually forming as sub-channel 1: 14.3% of custard apples is sold directly by farmers to local assemblers (or local agents) in districts. Nearly 10% of the productivity is sold by local assemblers to enterprises for preliminary processing and deep processing (some products such as: custard apple jam, candy, vinegar, liquor, dried chip, cake, functional food). About 80% of the processing enterprises' output is consumed domestically (at grocery stores, supermarkets, mini markets, trade centers), and 20% is exported abroad (via Dubai, Singapore, Middle East markets, North America, China, Cambodia, Laos, Thailand). Sub-channel 2: about 10% of the province's custard apple production is produced by agricultural cooperatives. The harvested custard apple is consumed (under the contracts) by external assemblers (or external agents) who come from outside of Tay Ninh province, and then exported or supplied to processing enterprises. Sub-channel 3: In addition, about 10% of custard apple output is in transaction between local assemblers in the province and other traders outside of the province (Figure 4).

4.2. Actors participating in the chain

Major producers (Farmers): farmers grow and directly produce custard apple fruit in their farms. The area of custard apple cultivation in the whole province in 2021 is 5,485 hectares (Tay Ninh Statistical Department, 2021), an increase of more than 100 hectares compared to the period of 2019-2020. There are 3 main custard apple regions in Tay Ninh province: Tay Ninh city (37.67% of whole province area) (Ba Den Mountain), Tan Chau district (32.81%), and Duong Minh Chau district (15.97%). The total output of custard apple in 2021 is 69,579 tons, an increase of about 4,500 tons compared to 2019 (Tay Ninh Statistical Department, 2021). The farmers connect directly with small collectors and local assemblers or agents, consuming over 90% of custard apple fruit after harvest.

Local collectors: There is a small network of collectors who buy custard apples directly from farmer households and pay in-cash on delivery to farmers and

purchases are not based on contracts. There are an estimated 300 collectors across the province who collect about 90% quantity of the whole province's custard apple fruit, which is then sold through the main channels with rudimentary, small, compact, and maneuverable means of transport (motorbikes, tricycles) suitable with infrastructure of small and narrow roads in some communes. The collection capacity varies among individual collectors; each collector traded from 60 to 96 tonnes of custard apple fruit per year.

Agricultural cooperatives: In recent years, agricultural cooperatives have been involved in the cultivation and consumption of custard apple fruit. The number of custard apple farming cooperatives (such as Thanh Tan custard apple agricultural cooperative) accounts for less than 10% of the total 96 agricultural cooperatives (in 2021, there are 149 cooperatives in the province). Therefore, custard apple production and consumption by cooperatives is still low (accounting for about 10% of productivity). The main consumption channels of custard-apple cooperatives are external assemblers (or agents) outside the province, wholesale markets, and trade centers.

Local assemblers (Local agents): traders or agents in the province have purchasing points located in the communes and concentrated in growing areas. Over 90% quantity of custard apple fruit is bought from small collectors, then transported by small trucks or lorries to consumption places such as Hoc Mon, Cu Chi, Binh Dien wholesale market (in Ho Chi Minh City and surrounding areas), retail market, and fruit stall.

External assemblers (External agents): almost of them come from outside Tay Ninh province. They are the owners of fruit granaries in the vicinity of Tay Ninh province, places to buy fruits in large quantities, and fruit agents in wholesale markets. External traders consume large quantities of custard apple fruit from cooperatives, processing enterprises, to domestic consumers and exporters.

Processing enterprises: purchasing a total of 20% of custard apple from local and external traders (assemblers), then selecting, preliminarily processing, packing, or deep processing and distributing in a nationwide supermarket system, retail stalls, traditional markets, and trade - export centers. There are enterprises, such as Natani Company, that export custard apple and process products from it to meet demand of some markets such as Singapore, Dubai, the Middle East, China, and small-scale exports to Laos, Cambodia, and Thailand.

Domestic consumers: it's very diverse, including of grocery stores, supermarkets, small retail markets, wholesale fruit markets, trade centers.

International market (over-sea consumers): there are several countries that have imported custard apple fruit and processing products of Tay Ninh province such as: Singapore, Dubai, Canada, the Middle East, North America, Cambodia, Laos, Thailand, China, Korea, but the total export volume is still very low compared to the province's total custard apple output. The export price is always much higher than the price in the domestic market.

4.3. Other actors and support institutions in value chain (based on KIP discussion)

There are other actors and institutions that supported the value chain as following:

Local authorities: support the farmers the administrative procedures, connect farmers with market, and offer farmers information on agricultural extension and price of custard apple.

Agricultural extension agencies: provide extension services to farmers.

Banks and financial agencies: provide loan to farmers and local collectors.

Input suppliers: agricultural materials such as fertilizers, pesticides, fungicides, microelements and agricultural services (means of transportation, tractors, pumpers, sprayers).

4.4. Evaluation of custard apple value chain in Tay Ninh province (based on SWOT analysis)

Weaknesses:

There are four actors involved mainly in generating added-value for the whole chain, increasing the cost of intermediaries such as shipping, commissions, and marketing costs.

The time to reach products from the beginning of the chain (growers) to the final consumer is quite long (3-5 days for the domestic market, 5-10 days for the export market). That affects to quality of fresh custard apple fruit.

Actors that play an important role in consumption and added-value are local traders/ agents/ assemblers in the province, but they are exposed to many risks at price and buying power.

Strengths:

Custard apple fruit is a traditional product that has distinctive flavor, fragrant and delicious, suitable for Vietnamese consumers' taste.

Custard apple fruit is a unique product, less competitive with other similar products that are grown in Mekong delta region.

The linkage of each other actors in the chain is relatively tight.

Opportunity:

Develop sub-channels to replace or improve main channel.

Reduce the number of agents (intermediaries) and the cost of intermediaries.

Deeping products processing.

Optimize price and consumption risks through processing and export channels.

Mitigate against risks by adoption of Good Agricultural Practice (GAP) or high technical (Covering fruit in paper bags reduces pest damage, pesticide and spraying costs).

Threat:

Compete with similar products that grown in other regions.

Strict export standardization.

High production costs.

Weather conditions are changing and adding to production risks. Impacts of pests (trunk borer, branch borer, fruit flies and plant diseases).

4.5. Analysis of custard apple value chain in Tay Ninh province (based on cost-benefit analysis)

The survey on 2022 with 30 farmers who are growing custard-apple from the first year to 10^{th} year in Tay Ninh province has revealed that: in the first year, almost of production costs are paid for input materials, in which, the cost of fertilizers (manure and chemical) is about 24.6 million VND per ha. Pesticide cost is also very high at 6.9 million VND per ha and lastly is 5.3 million VND for energy buying. On the third year, farmers begin to harvest the first custard apple fruit, and expenditure for material investments along with 69.3 million VND per ha, double times higher than that of the first year (Table 1).

Table 1. Production costs in custard-apple farmer households

Cost of production	1st year	2nd year	3rd year	5th year	10th year
Input materials (1000VND/ha)	35.437	37.690	69.253	90.083	58.593
Manure	11.983	12.125	19.250	27.348	13.965
Chemical fertilizers	12.634	12.805	32.025	41.213	32.516
Pesticides	6.875	7.305	12.125	15.607	7.333
Energy	3.945	5.455	5.853	5.915	4.779
Labor (1000VND/ha)	5.305	6.890	24.500	31.790	21.514
Apply fertilizer	705	766	2.115	3.062	2.318
Spraying pesticides	0	0	725.0	954.0	716.0
Pruning branches, creating canopy	0	942	4.410	4.708	2.649
Pruning flowers & fruits	0	0	7.500	9.591	6.831
other expenditures	4.455	4.944	9.750	13.475	9.000
Total Cost (1000VND/ha)	40.742	44.580	93.753	121.873	80.107
Total Cost (1000VND/ton)	-	-	11.823	7.546	8.027

The farmers recognized that yield of custard apple fruit is mostly stable from the fifth to the eighth year at around 15 to nearly 19 tons per ha in good ecological and cultivation condition. Therefore, the farmers have to invest further material and labour costs at around total of 121.9 to 133.3 million VND (Table 2). The cost of production per ha of custard apple in the fifth and the tenth year are much lower than in the third year because of higher year getting in these times, at around 7.6 to 8.0 million VND, respectively (Table 1).

Table 2. Cost-benefit analysis of custard-apple farmer households (for per ha)

Year	Yield (ton/ha)	Selling price (1000VND/ton)	Total value (1000VND/ha)	Total Costs (1000VND/ha)	Gross Profit (1000VND/ha)
1st	0	0	0	40.742	-40.742
2nd	0	0	0	44.580	-44.580
3rd	7.9	25.000	198.250	93.753	104.497
4th	15.0	27.500	412.775	106.196	306.579
5th	16.2	26.010	420.062	121.873	298.189
6th	18.9	26.530	500.091	135.499	364.592
7th	18.7	27.061	505.229	134.388	370.841
8th	18.0	27.602	497.388	133.565	363.823
9th	13.7	28.154	384.302	96.969	287.333
10th	10.0	28.717	286.596	80.107	206.489
Total	118.3		3204.692	987.672	2217.020

The price of custard apple fruit that farmers get when selling to collector varies between 25,000 VND per kg in the third year to 27,000 in the seventh year and 28,700 VND in the tenth year. High selling price is an important factor that affects farmers' profit. They get around 104.5 million VND per ha in the third year, and it triples from the fifth to the eighth year of the production cycle (Table 2).

Table 3. Cost-benefit analysis of custard-apple farmer households (for per ton)

Year	Total value (1000VND/ton)	Total Costs (1000VND/ton)	Gross Profit (1000VND/ton)
3rd	25.000	11.823	13.177
4th	27.500	7.075	20.425
5th	26.010	7.546	18.464
6th	26.530	7.188	19.342
7th	27.061	7.198	19.863
8th	27.602	7.412	20.190
9th	28.154	7.104	21.050
10th	28.717	8.027	20.690
Total	216.574	63.373	153.201

The break-even point of custard apple fruit is around 11.8 million VND per ton in the third year and it reduces in the next years at nearly 7 million. In fact, in recent years, the selling price of fruit is always higher than 25 million VND per ton in domestic market. As a consequence, the gross profit that farmers earn at about 13.2 in the third year to 20.2 million in the eighth year of the production cycle (Table 3).

Table 4. Cost-benefit analysis of main channel of custard apple value chain

Actor	Unit	Farmer	Collector	Local assembler	External assembler	Domestic consumer
Total Value (1)	1,000 VND/ton	27.1	38.5	46.5	51.5	65.0
Value of Intermediate Goods (2)	1,000 VND/ton	1.1	27.1	38.5	46.5	51.5
Added-value (3=1-2)	1,000 VND/ton	25.9	11.4	8.0	5.0	13.5
Additional Costs (4)	1,000 VND/ton	7.6	2.3	2.5	2.8	1.7
Net Added-value (5=3-4)	1,000 VND/ton	18.3	9.2	5.5	2.3	11.8

Actor	Unit	Farmer	Collector	Local assembler	External assembler	Domestic consumer
Ratio of Total Value on Total Costs [1:(2+4)]	Times	3.09	1.31	1.13	1.05	1.22
Ratio of Profit on Total Costs [5:(2+4)]	Times	2.09	0.31	0.13	0.05	0.22
Ratio of Profit on Total Value [(3-4):1]	Times	0.68	0.24	0.12	0.04	0.18

Remark: The table was calculated basing on method of GTZ (2007).

In the whole chain, farmers contribute about 25.9 million VND per ton of custard apple fruit in added-value, then other actors, collectors generate 11.4 million VND, local assemblers and external assemblers contribute 8.0 and 5.0 million VND per ton, respectively (Table 4).

Table 5. Contribution of actors to added-value of whole custard-apple value chain

Actor	Unit	Farmer	Collector	Local assembler	External assembler	Domestic customer	Total Added-value	Remark
Added -value	%	44.1	19.4	13.6	-	22.9	58.9	Channel 1: Farmer-Collector-Local assembler-Domestic market
		40.6	17.9	12.5	7.8	21.1	63.9	Channel 2: Farmer-Collector-Local assembler-External assembler-Domestic market

Remark: The table was calculated basing on method of GTZ (2007).

In the whole chain, farmers' contribution of added-value occupied 44.1% (the highest), then 19.4% was generated by collectors; and 13.6% by local assemblers in channel 1. At the same time, farmers were also the main contributors of added-value in channel 2 (about 40.6%), 17.9% (collectors), 12.5% (local assemblers), and 7.8% (external assemblers) (Table 5).

5. Conclusion and Recommendation

By doing the survey and describing the actors that participate in the custard apple value chain in Tay Ninh through mapping the main channel and sub-channels, the key factors revealed that custard apple production may improve the income of famer households in Tay Ninh and support to alleviate the poverty of poor farmers. The average annual net income per household was 198.3 million VND (appropriately US$7,900) in the third year; 505.2 million (US$20,208) in the seventh year, much

higher than that of mango, rice crop production. Furthermore, there are many opportunities in the global custard apple because export value may increase by at least 10% per annum from 2023 to 2025, particularly in China under the ASEAN-China FTA, and EU under the EV-FTA. In addition, there are potential and opportunities to create agricultural services, business support facility to catalyse investment and support to custard apple producers (farmers) by exporters, processors and service providers.

However, fragmented, smallholder production with few agricultural cooperatives and farmer organisations, very weak linkages to export and processing enterprises make it is difficult to transfer model technology, relay market information, certify production, and increase productivity. Moreover, whereas current markets predominantly domestic as the main channel and informal Chinese border trade as the sub-channel, it is very risky, volatile, and low prices.

Interaction between custard apple producers and processing enterprises is necessary for a sustainable consumption system; and small-scale farmers are dependent upon the price of custard apple to mitigate risks. Besides, co-operation and co-ordination among farmers are the best means to reduce risk and loss if the price is depreciated.

Conflict of Interest

The authors declare no conflict of interest.

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