

The Mapping of Agroindustry Based on Cassava

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Abstract. Agroindustry based on cassava has important roles in Indonesia economic structure. Cassava is known as well as staple food and also agroindustrial materials. It is gaining the value addition, rural labor preoccupation, income enhancement, and rural prosperity improvement. Agroindustry is the primary activity on value chain business. The development of agroindustry based on cassava in supporting the rural economic multiplier needs to be recognized. This research conducted to analyze the contribution of agroindustry based on cassava to the agricultural sector and mapping the stakeholders of cassava agroindustry in Lampung, Indonesia. Data were analyzed by the descriptive statistic. The map of cassava agroindustry was developed based on the database of industries by Lampung Industrial Office. The analysis concluded that Central of Lampung region was the highest cassava production in Lampung. The production contribution achieved more than thirty four percent since 2011. This finding was supported that the medium-high scale cassava manufactories were established mostly in this region. On the other hand, the small scale and medium enterprises of cassava were developed in several regions were concentrated in Pesawaran, Pringsewu, East of Lampung, and Central Lampung District. The chain activities in cassava industries involved many stakeholders from the rural, sub-urban, and urban communities. This condition became the opportunity to strengthen the cassava industry to grow the domestic market. The value chain of cassava industry has driven the rural economic and involved many actors from various scales.

1. Introduction

The development of agroindustry based on cassava in supporting the rural economic needs to be recognized. Agroindustry based on cassava has important roles in Indonesia. Cassava is produced broadly in almost all provinces, especially in rural area. Cassava is one of the main food sources in Indonesian society. It is important in gaining the food security establishment in the rural development. Dominantly, farmer's households in rural are depended on the upstream agricultural production activity. Unfortunately, there is a lack of productivity and the lower farming gate price that still face by a farmer in rural. Agricultural primary activity is needed to link with processing and downstream activities. Agroindustry as the processing activities will increase the production value. Agroindustry is the primary activity on value chain business. The empowerment and development of institutions in the form of coaching and training to improve knowledge and skills of human resources in the manufacture of processed products are needed for the development of processed products in rural area. Therefore, transformation and empowerment of agricultural institutions in rural areas is needed to support the acquisition of added value of cassava processed products (1)



The value addition will impact the rural income enhancement. Furthermore, with the market linkage activities it will provide the rural labor preoccupation, income enhancement, and increase rural prosperity. Cassava production linked the processing activity and market linkage is strategic as sustainable rural empowerment. The occurrence of synergy in overcoming obstacles include: local agro-climatic conditions, site-specific technologies, availability of biomass, economic incentives, product markets, information access, land tenure, institutional, extension, and political support will be necessary in reaching the sustainable rural agricultural development (2). The governance has a responsibility to ensure that the concept of sustainable food security among smallholders in the country. Agricultural development will go a long way in enhancing the performance (3).

The quality of fresh cassava is determined by harvesting at optimal age. Optimal age of cassava harvesting enhance the production, starch content, and reduce the level of price cut. The better quality, the better price from the factory will get and farmer's income can increase (4). The quality of fresh cassava will affect the quality of starch, and also the quality of finished product industries. Starch from cassava is an important substitution for wheat flour which 100% is from import. Strengthening the cassava industries chain is also a part to fulfill national food sufficiency.

The delivery process of fresh cassava production center from rural to industries will gain the efficiency of the finished product of cassava. Then the market center which connecting with the finished of manufactured processing both of small-scale or manufacture can get more advantages to strength the sustainable business. The volume and regularity demand of cassava finished products from rural is massive with the enormous transaction. It is important to enhance business advantages. Consumption of fresh cassava for home industry regularly in rural will develop balancing in fresh cassava price in the farming gate (5). Entrepreneurs need to explore widely the prospective market line networks as an opportunity of businesses. It is important to have comprehension overview of cassava from the upstream to the downstream. It included the flow of commodities, the stakeholders involves, and the value chain connection. The interconnection within cassava shareholders is vital to strengthen the business sustainability. Furthermore, it drove an economic multiplier in rural community (6), and the recognition the cassava shareholders interconnection was important.

Despite the fact, there were a lack of information related to the interconnection cassava stakeholders from the upstream to market downstream as an integrated business. The discussions are still dominantly at the level demand, processing and supply activities as partially (4)(7)(8)(1)(9). Therefore this research was conducted to analyze the contribution of agroindustry based on cassava to the agriculture sector and generate the mapping of shareholders of cassava industry in Lampung.

2. Methods

The research was conducted trough survey and literature study. The cassava situation in Lampung Province as the largest national production center purposively represent as location case. Cassava production center, factory, small-scale cassava processing, and also linkage of the market center in Lampung was arranged to describe the mapping of cassava industries. The research was conducted from April until November 2017. Secondary data from the statistical bureau, Ministry of Industry, and Ministry of Agriculture of the cassava database was used. The primary data was obtained by snowball sampling started from the retail/grocery traders, intermediary traders until the production center locations. It involved 60 cassava processing SME (small-medium enterprises), 60 intermediary traders, and 60 consumers as respondent. The coordinate location of the SME of cassava center and tapioca industries in Lampung was set into the Lampung map. The contribution of the cassava industry in agricultural development was analyzed by descriptive statistic.

3. Results and Discussions

3.1 Recognition of cassava on Lampung economy

The top three national cassava production in Indonesia was Lampung, Central Java, and East Java. In situation between 2012 until 2016, cassava was concentrated in 8 (eight) provinces with production contribution achieved 91.21%. Lampung contributed in average production reached 7.74 million tons with the share of production attained 33.93%, followed by Central Java Province by 16.68% and East Java 15.71% (Figure1) (Data Center and Information Systems, Ministry of Agriculture, 2017). Figure 2 described the land area of cassava cultivation. Lampung was the highest share of land area cultivation reached 27.71%, followed by East Java, and Central Java. However, the productivity of cassava in Lampung was placed as the third (Figure 3). The lower productivity of cassava in Lampung revealed the fact that the cassava farming needs to be optimized.

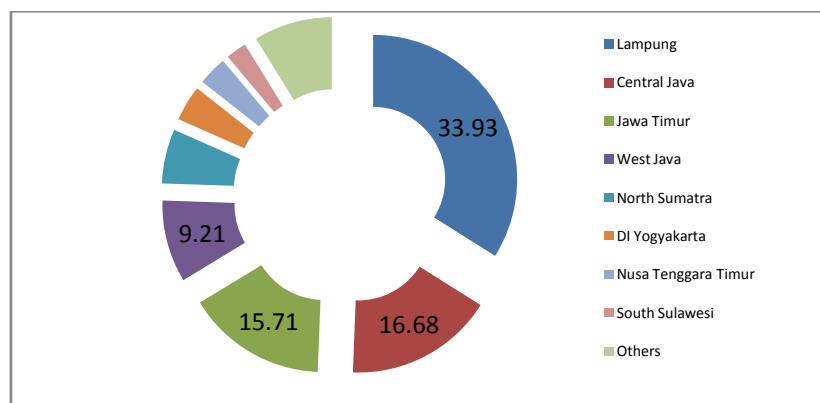


Figure 1. National cassava production, 2017

Resources: Data Center and Information Systems, Ministry of Agriculture, 2017

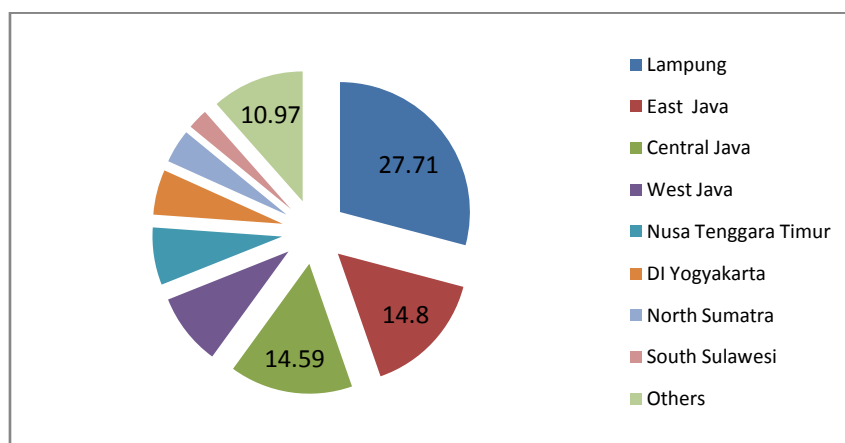


Figure 2. National cassava harvesting area, 2017

Resources: Data Center and Information Systems, Ministry of Agriculture, 2017

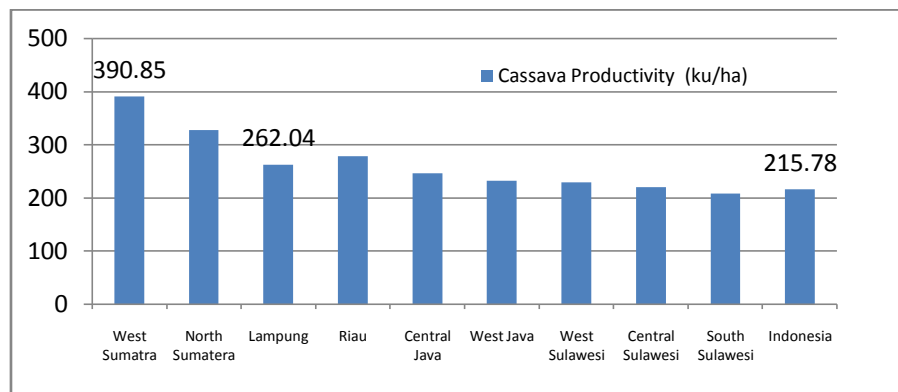


Figure 3. National cassava productivity, 2017

Resources: Data Center and Information Systems, Ministry of Agriculture, 2017

Based on Figure 3, there is an opportunity for improving cassava productivity and farming performance. Optimizing the cassava farming is associated with the technology input application. It was reported that the efficiency of input allocation on cassava farming in Lampung was not efficient yet, and placed on increasing the return to scale level (4). This fact means that cassava farming needs to improve the cultivation technology with the sufficient input allocation. However, improvement of the productivity is not enough. The effort to link with farming price gate improvement and also the interconnection between cassava industries were necessary for assuring the better price for farmers. Farming gate price of cassava needs to be accelerated.

Cassava is the third commodity after paddy and maize that highly contributed to food crop sub-sectors in Lampung Domestic Regional Bruto (PDRB). Food crop was the second sector that has a large contribution to the supply and supply composition, after food and beverage industries. Based on the Input Output Lampung 2010 (11), the largest domestic output generated by the largest economic sectors is the food and beverage industry (17.82%). The food crop contributed 9.99% followed by trade sector 9.34%, and fisheries 6.60%. Gross value addition generated by economic sectors reached IDR 149,207 billion. The largest were generated by the food crop sector (13.89%), food and beverage industry (13.05%), trade (10.68%), fisheries (9%) and plantation (4.74%). Demand for goods and services production is dominated by finished product demand. Domestic demand reached IDR 146,807 billion (44.14%) and for exports reached IDR 66,740 billion (20.07%). The demand for the intermediate product or for production process sectors reached IDR 119.019 billion (35.79%) (10)(11).

The relationship between primary sectors with the others sector can be described as forwarding linkage and backward linkage. The relationship with the sale of finished goods is called forward linkage. The magnitude is namely as the degree of sensitivity. Relationship with the raw materials or materials backward is called backward linkage. The magnitude of this level of linkage is called spreading power. Both indexes informed the key sectors as a determinant in economic development region. Food crop sector revealed the degree of sensitivity attained to 1,0493 and dispersion power reached 0.8618. This value of sensitivity degree indicated that due to an increase of 1 unit of final demand for sectors (53 economic sectors) led to food sector increased by 1.0493 units. The dispersion power (DP) reached 0.8618. It means that for an increase of 1 unit of output, the power sector will cause an increase in output of other sectors (including its own sector) as a whole increased by 0.8618 units. If the value was higher than 1, it was categorized as high level if less it was classified as low level. Based on the data, the food sector placed at Group II (low DP index and high DS index) with others sectors i.e. horticultural crops, plantation, and fishery (11).

The economical contribution of cassava in food crop sector is important. The impact of cassava economic improvement will distribute broadly which involved many stakeholders. The biggest contributors were cassava farmers and the small-scale processing in rural area. Medium-high industries and intermediary traders have an important part to enhance the forward linkage. The effective demand for finished goods based on cassava is important as the economic driver. Unfortunately, not all of the rural agricultural community could develop towards an orientation of value added improvement. The processing industry of agricultural products (agro-industry) or rural bio-industries still underdeveloped, thus this causes added value to flow out of the region (2).

The cassava consumption per capita per month indicated that it is dominantly consumed as fresh cassava and dried cassava. Cassava intermediary products as food source represented the food availability in the community. The consumption was significant to achieve the regional food security. The contribution of energy consumption from cassava in rural is presented in Figure 4. West Lampung and Central Lampung were indicated as the highest energy source from a tuber, the most from cassava. This fact indicated that the consumption pattern of cassava consumption was also developed by the availability of cassava at the production center. Enhancement of the substitution of tapioca flour toward wheat flour is the strategic agenda in implementing the food sovereignty policy.

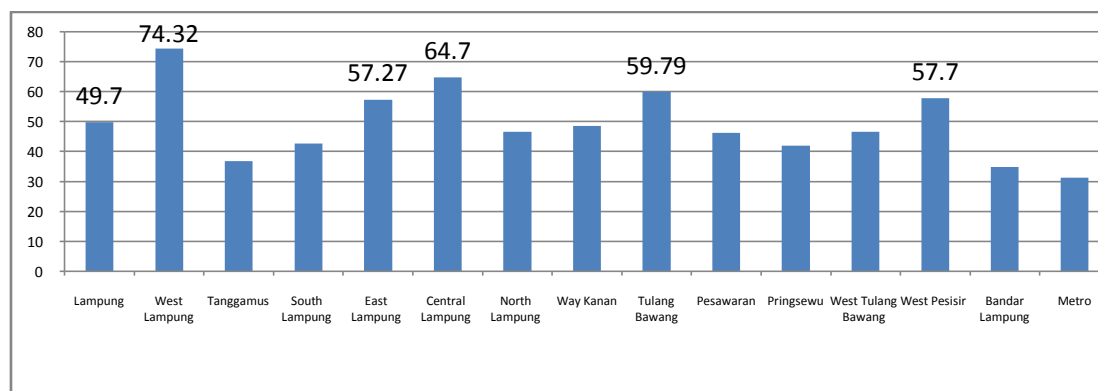


Figure 4. Daily calorie intake per capita from tuber sources, 2017.

Resources: BPS Indonesia, 2017

3.2 The mapping of cassava industries in Lampung

Data collection of the cassava finished product in form of small scale home industry started from the market center in region/district/city to intermediary traders until the home industry location. The identified market center of cassava small-scale industry in Lampung is presented in Table 1. The map of the consumer of finished cassava product from small-scale home industry is shown in Figure 5.

Table1. Market center of cassava small-scale industry in Lampung.

No	Product	Sub-district	Region/district
1	Kelanting	Gedung Tataan	Pesawaran
		Negeri Katon	Pesawaran
		Punggur	Central Lampung
		Kalirejo	Central Lampung
		Sukoharjo	Pringsewu
		Gading Rejo	Pringsewu
		Kalianda	South Lampung
		Baradatu	Way Kanan
		Metro	Metro
		Kedaton	Bandar Lampung
		Panjang	Bandar Lampung

2	Chips	GedungTataan Punggur Sukoharjo Way Jepara Metro Kedaton Panjang	Pesawaran Central Lampung Pringsewu East Lampung Metro Bandar Lampung Bandar Lampung
3	Crackers	Kalirejo Punggur Way Jepara Metro	Central Lampung Central Lampung Central Lampung Metro
4	Analog rice/tiwul/berassiger	Way Jepara LabuhanRatu Sekampung Rumbia JatiAgung Tumijajar	Central Lampung Central Lampung Central Lampung South Lampung Tulangbawang
5	Mocav(modified cassava flour)	Way Jepara Sekampung Metro	East Lampung East Lampung Metro

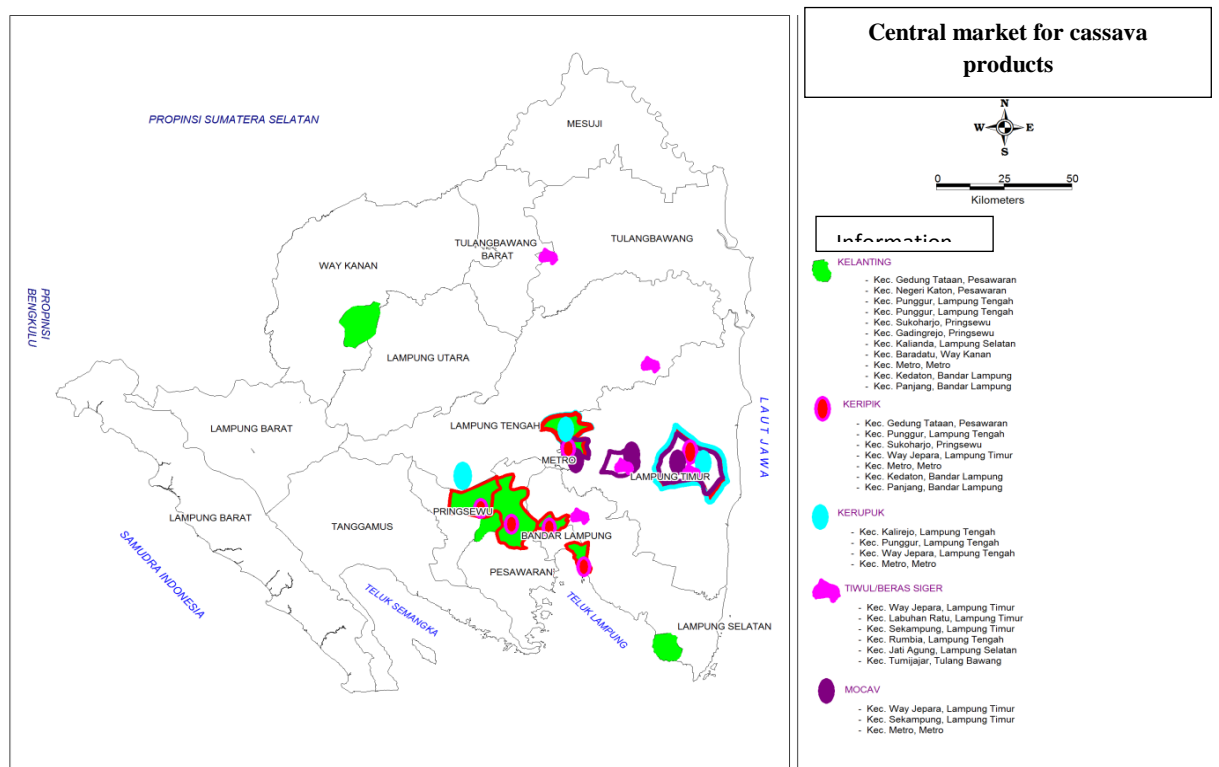


Figure 5. The mapping of central market for cassava products from small-scale home industry (5).

Figure 5 described the trigger market of local food based cassava from small-scale home industries. The market represented the demand of cassava finished product. The circulation of cassava finished product from small-scale home industries can be revealed. Based on the previous analysis, the demand cassava production was 24,716.56 kg until 28,773.5 kg/month. Urban consumers prefer to consume as snacks form (chips, cracker/crums, and opak). The consumption frequency was 2-5 times per week and the volume reached 1-3 kg purchases. Daily consumption of the pattern is frequent more for consumers in rural than urban (5). The market mapping of local food based cassava was important as a starting node for business activities. The effectiveness of the sustainable business chain was depended on the market information. Recognition of the business cycles, chain interconnection, also the flow of

product, price, and information in integrating circulation will determine the strength of business strategic growth. It will support small-scale industry to survive and develop the market share. The continuous demand of consumers of cassava finished products will lead the sustainability of cassava products' production. Producers of product cassava will consume fresh cassava for the farmer. Consumption of fresh cassava for home industry regularly in rural will develop balancing in fresh cassava price in the farming gate (12).

The information of fresh cassava production in Lampung was collected from the secondary data that release by Lampung Regional Planning Board. The area was categorized as lowest, low, medium, high, and the highest region (Figure 6). The production of cassava as raw material food/industry is plentiful as local food in Lampung. Value addition activities based cassava is one of strategies and a key to creating income source enrichment in rural area (5).

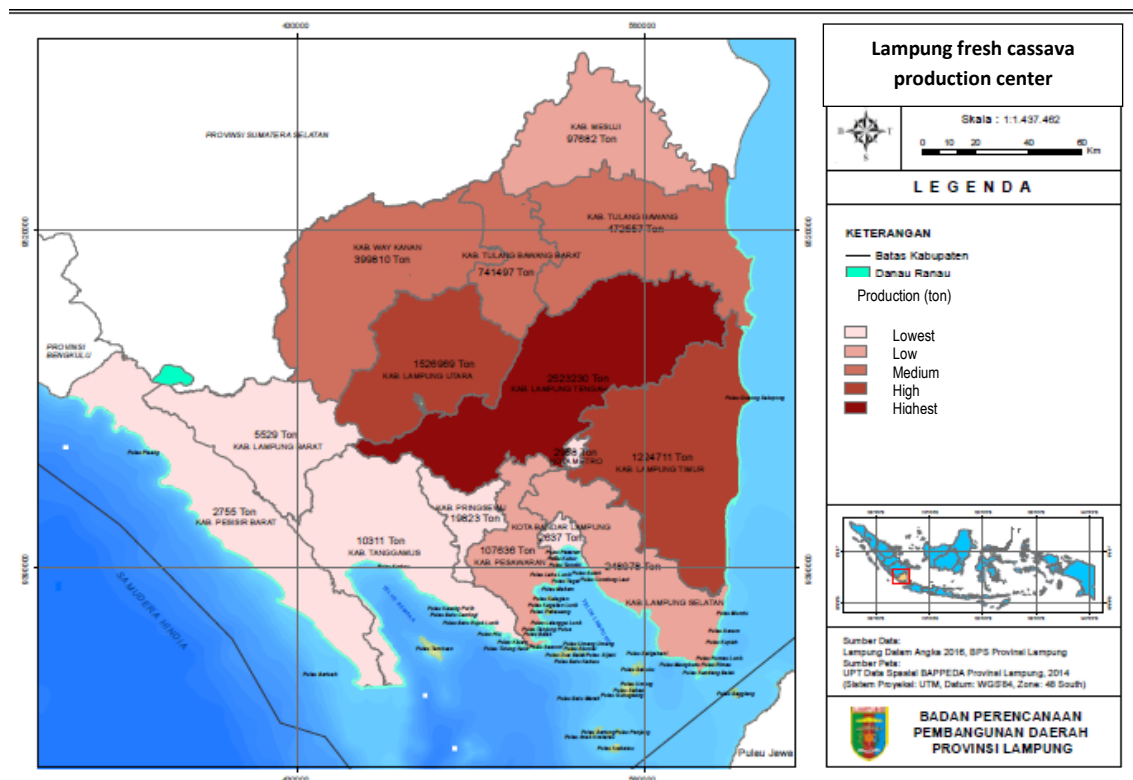


Figure 6. Fresh cassava production center in Lampung, 2015

Source: Lampung Regional Planning Board, 2015

Based on Figure 6, Metro and Bandar Lampung were recognized as the lowest region on fresh cassava production. The low region represented by Tanggamus, Lampung Barat, and Pringsewu District. Afterwards, the cassava production medium level region was Mesuji and South Lampung. North Lampung and East Lampung were categorized as the high level regions of cassava production. The last as the highest region was Central Lampung.

The fresh cassava as raw material for small-scale industry in rural area was spread followed by the production center location. The flow of fresh cassava from the production center to the small-scale industry location contributes to economic multiplier in rural area. It involved the transportation service, rural worker, intermediary cassava trader, and rural market stakeholders. The information of actors of cassava processing in rural area was identified in Table 2.

Table 2. Small-scale industry based on cassava.

No	Product type	Village	Sub-district	Region/District
1	Kelanting	KarangAnyar	GedungTataan	Pesawaran
		Lumbirejo	NegeriKaton	Pesawaran
		Astomulyo	Punggur	Central Lampung
		Sidomulyo	Punggur	Central Lampung
2	Chips	Waringinsari	Sukoharjo	Pringsewu
		KarangAnyar	GedungTataan	Pesawaran
		Astomulyo	Punggur	Central Lampung
		Sidomulyo	Punggur	Central Lampung
3	Cracker	Waringinsari	Sukoharjo	Pringsewu
		Sri Rejosari	Way Jepara	East Lampung
		Sukosari	Kalirejo	Central Lampung
		Astomulyo	Punggur	Central Lampung
4	Analog rice/Tiwul/beras siger	Sidomulyo	Punggur	Central Lampung
		LabuhanRatu	Way Jepara	East Lampung
		Pulosari	LabuhanRatu	East Lampung
		Jembatserong	Sekampung	East Lampung
6	Mocav (modified cassava flour)	ReksoBinangun	Rumbia	Central Lampung
		Margomulyo	JatiAgung	South Lampung
		Makarti	Tumijajar	Tulangbawang
		Brajasari	Way Jepara	East Lampung
		LabuhanRatu	Way Jepara	East Lampung
		BrajaSelebah	Way Jepara	East Lampung

Table 2 showed that the location center of cassava small-scale industries was mostly located in Central Lampung and Pesawaran. The capacity of production among the SMEs was various within industries. Based on the production capacity, the smallest was household/home-industries with production of 12 kg/period/twice a week. The maximum production capacity reached 900 kg, and the average was 207 kg. The categorization divided by four levels i.e. Home-industries, Micro, Small, and Medium (Table 3). The performance of SMEs in Central Lampung was well established. The SMEs from the home-industry to the medium level have been sustained. Home-industries level was performed in Pesawaran and East Lampung. The production capacity of SMEs categorized as follows.

Table 3. Small-medium scale enterprises of cassava production.

Category (range 222 kg/ period twice a weeks)		Central Lampung	East Lampung	Pesawaran
Home-industries	12-234	4	12	18
Micro	235-456	12	1	4
Small	457-690	4		
Medium	691-913	3		1
Total	59	23	13	23

The SMEs production capacity described the condition of supply side from producer at the production center. The chain of cassava processing represented the second line forward the upstream cassava farming. The existing of the location center became important information to get the access toward the main sources of cassava processing production. The map of small-scale home industry based cassava is presented in Figure 7. Central Lampung and East Lampung region were well developed in the growth of small-scale cassava home industry. The sustainability of business was supported by the availability of the cassava as raw material from production center. In contrast, Pesawaran and Pringsewu region were noted at low level to get the fresh cassava form East Lampung and Central Lampung.

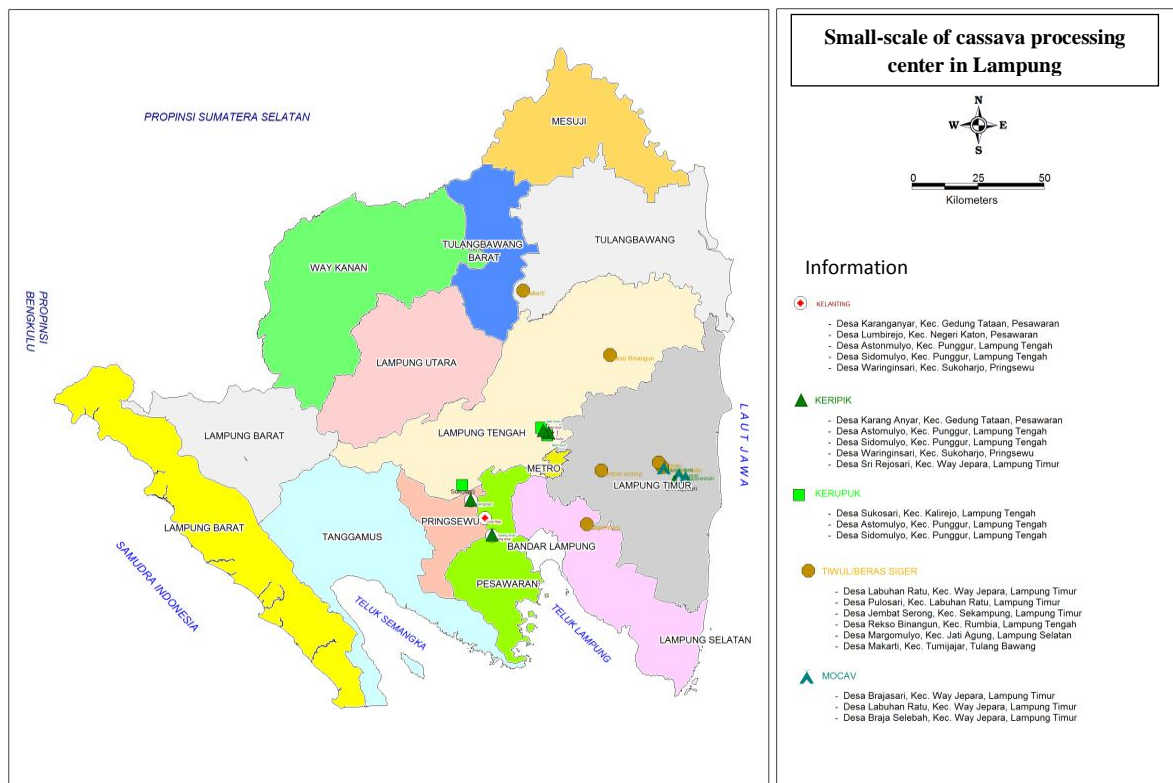


Figure 7. Small-scale of cassava processing center in Lampung, 2017.

The share of fresh cassava for the medium-high industry in Lampung was the highest. Processed cassava as intermediary production for industry was more than 98%. Based on the Ministry of Industry data, it is revealed that the tapioca factory that established attained to 137 manufacture companies. Figure 8 describes the tapioca factories that were dominantly located in Lampung (60 companies), followed by Central Java (35), West Java (18), then East Java (12) and North Sumatera (12).

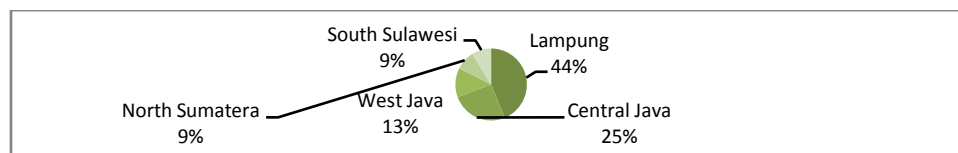


Figure8. Medium-high tapioca factory in Indonesia, 2017

Source: Indonesian Ministry of Industry, 2017

The location of tapioca factory in Lampung Province was presented in the Table 4. The data source was from the Lampung Industrial Office. Based on the data, it is recognized that there were 45 tapioca industries that still sustain and run the business well. Some of the industries with various problems were stopped or idle the operations. There were 23 tapioca factories located in Central Lampung region (Table 4). Figure 9 describes the map of tapioca factory locations in Lampung.

Table3. Medium-high tapioca factory in Lampung, 2017.

No	Village location	Region/district
1	DesaBinaKaryaUtamaSaktiBuanaSb 15	Central Lampung (23 tapioca factory)
2	DesaSidakerto	
3	DesaSiswoBangun	
4	DesaSriwijaya	
5	Dusun Gaya BaruIlir	
6	DesaGunungAgung Km 87, Sukajadi	
7	DesaSanggaBuanaDusun 6	
8	Dusun 4 Rt 19 Rw 8WatuAgung	
9	Desa Gaya Baru IV	
10	DesaBinjaiNgagung	
11	SeputihBanyak	
12	Desa Gaya Baru I,	
13	DesaBuyutIlir	
14	SriwijayaMataram	
15	Gaya Baru V	
16	Reno Basuki	East Lampung (5)
17	Gaya Baru 2	
18	DesaRuktiBasuki	
19	Rama Nirwana	
20	DesaRantau Jaya Baru	
21	Desa Sri Kencono	
22	DesaGunungBatinUdik	
23	GunungBatinIlir	
24	DesaSumberAgung	
25	Desa Raman Finishedra	TulangBawang(4)
26	DesaLabuhanRatu	
27	DesaMuara Jaya Sukadana	
28	Sribawono Km 36	
29	DesaKedaton	
30	DesaRejomulyo	Lampung Utara(4)
31	DesaBujukAgung	
32	DesaSetiaBumi	
33	DesaBanjarAgung	
34	BanjarNegeri	TulangBawang Barat(3)
35	DesaGedungKetapang	
36	PakuonAgung Jl. Raya Trans Sumatra Km19, SpPerungung	
37	DesaSukajaya	Way Kanan(2)
38	DesaKibangYekti Unit VI	
39	DesaPenumangan	Lampung Selatan(2)
40	Desa Way GihamBlambanganUmpu	
41	Negara Tama, Sp7	Pesawaran(1)
42	DesaKarangRejo,	
43	DesaSidoHarjo	Kota Bandar Lampung(1)
44	DesaBangun Sari	
45	JlYosSudarso, Bandar Lampung	

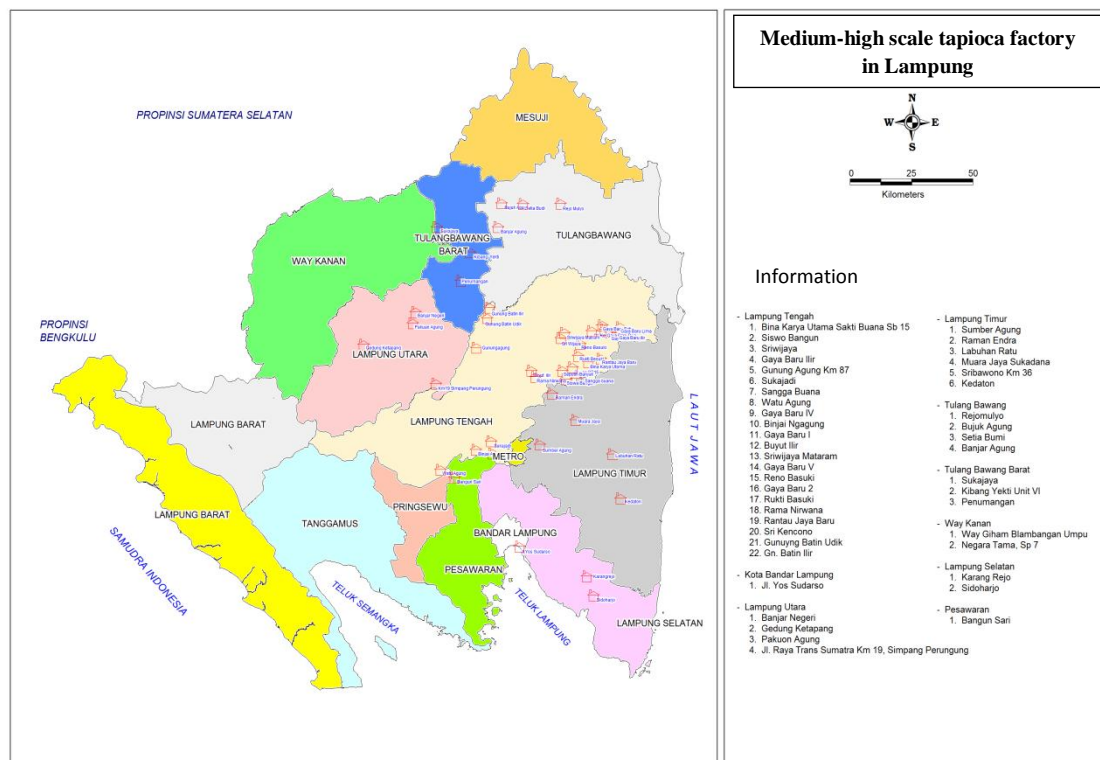


Figure 9. Medium-high scale tapioca factories in Lampung, 2017.

Figure 9 describes the location of medium-high tapioca factories in Lampung. The fact that the location was concentrated in Central Lampung region was reasonable. The contribution of cassava production was achieved more than 34% since 2011. This fact supported that the medium-high scale cassava factory were established mostly in this region. The fresh cassava was characterized as a perishable product. The important decision in development of industry based on fresh cassava was to build the industry near the production center location. The primary consideration of efficiency was the sustainability of raw material supplies, transportation costs, and the rural labor availability.

On the other hand, the small scale and medium enterprises of cassava were developed in several regions concentrated in Pesawaran, Pringsewu, East of Lampung, and Central Lampung Districts. The chain activities in cassava industries involved many stakeholders from the rural, sub-urban, and urban communities. From the demand side, the consumption of food and beverages goods including the cassava processed products was up to IDR 70,000.capita⁻¹.month⁻¹ or attained almost 19% of total per capita consumption. This condition became the opportunity to strengthen the cassava industries to grow in the domestic markets. The value chain of cassava industries have driven the rural economics, and involved many actors from various scales. The recognition the business chain activity was a key step to gain the advantages, competitiveness, and sustainability. The local entrepreneur needs to explore and also involve in an integrated business chain. The business chain activity was very strategic in empowering the local businesses.

4. Conclusions

Cassava industries contribute to the economic gain in the food crop sector. Cassava economy was spread broadly and involved many stakeholders in business chain activities. Cassava farmers and the small-scale processing in rural areas as the most involved actors must get the adequate benefits. Medium-high industries and intermediary traders have an important part in the forward linkage enhancement. The effective demand for finished goods based on cassava is important as economic

drivers. The cassava consumption per capita per month indicated that it was dominantly consumed as fresh cassava and dried cassava. Cassava intermediary products as food source represented the food availability in the community. The consumption was significant to achieve the regional food security. The mapping of cassava production center, cassava small-scale home industry linkage with the market node and medium-high scale tapioca industry provided information sources from upstream cassava farming to intermediary factory, finished cassava products, the logistic and marketing chains. The information is necessary to strengthen the entrepreneur capacity and capability, especially in rural areas. The adequate information was a key to gain advantage and enhance the business competitiveness.

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