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RESEARCH ARTICLE

# A Lesson Learn from Empowerment Program of Integrated Cassava-Tapioca Agroindustry Actors in Pati District, Indonesia

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**Abstract** Frequently, empowering models for cassava farmers is programmed by government, but unsuitable to socio-geographic conditions, such as in Pati District. This study was aimed to depict social knowledge and lesson learn of cassava-tapioca agroindustry actors, and to understand the farmers' acceptance, before and after the empowering program. The cassava farmer's and tapioca producer's knowledge and lesson learn were collected from 35 farmers and 19 tapioca producers. After empowering program, farmers asked to cultivate Cassesart cassava variety (UJ-5). However, the UJ-5 productivity that was planted in 65.40 Ha were declined. While, tapioca industries were also not directly increased farmers' welfare. Farmers' perspective in farming process was not changed after empowerment programs. Thirty-four farmers were not ready to build up new information. While, 16 from 19 tapioca producers (84.21%) object to improve labor quality and welfare. The founded result was associated with conventional farming practices, low price product and education background in Pati District, and was increasingly weakened by limited knowledge transfer of modern farming.

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## 1. Introduction

Cassava is a high beneficial multipurpose agricultural product uses as a main material for carbohydrate source, paper production, fabric and plywood industries (Edhirej, Sapuan, Jawaid, & Nur Ismarrubie Zahari, 2015). In Indonesia, tapioca (cassava flour) production reaches 5 million tons per year, while domestic need reaches 7 million tons per year. The shortage of tapioca consumption is fulfilled from imported cassava, for stabilizing supply, lowering prices, and producing better quality than local resources (Hutabarat, Setiyanto, Kustiari, & Sulser, 2012; Magfiroh, Zainuddin, & Setyawati, 2018). High amount of imported tapioca lowering local tapioca selling prices and falling down farmer's motivation and interest that threaten food chain sustainability (Demartini, Gaviglio, & Pirani, 2017; Harris, Robinson, & Griffiths, 2016). These problems massively impact cassava production and lowering farmer's income, especially in Pati District, Central Java. It is the main cassava producer in Central Java, and one of the largest national cassava suppliers in the last five years (BPS, 2020). It caused of vast agricultural land, and cassava agriculture is a main substitution crop for paddies production. Cassava agriculture plays important role to help community increase their income during drought season (Widodo, 2018). The cassava-tapioca agroindustry in Pati District is long period interaction that increases the economic value of cassava and provides jobs for local people. In fact, the long period interaction, community bond and social value among actors (farmer, employers and business owners) are social capital that needs to be improved because it is a part of sustainable food security (Abass et al., 2018). One of the effective ways to increase farmer productivity is by empowering them about agricultural modernization and improvement to catch the global demand.

Furthermore, low knowledges of farmers toward modern agriculture, facilities and technology such as grinding machines or dryers, has decreasing cassava productivity year by year (Croppenstedt, AndreGoldstein & Rosas, 2013; Suryaningrat, Amilia, & Choiron, 2015). Besides that, human resources (HR) aspects need to be developed to gain the cassava industry output (Hamidi & Banowati, 2019). Hence, by empowering program, the farmers are freely accessed new information in cultivation, and actively involved in developing their business and social capital, which strengthen them to have better access to utilize the local resources (Hudayana, 2016)

The empowerment program (Luther, Mariyono, Purnagunawan, Satriatna, & Siyaranamual, 2018; Putra et al., 2019) and modernization are important to increase cassava farming capacities and productivity (Luther et al., 2018). Regarding to previous research, empowering cassava farmers to use high quality seedbeds and agricultural modernization is effectively increase their income (Banowati, Indriyanti, Anisykurlillah, Pratikto, & Sari, 2020), But, mostly, the empowerment program is conducted only for the farmers, and it is very rare for employer. The reason is because the business owners does not want to increase the production cost without direct profit. But the result of the empowering program for farmers should be monitored and evaluated

periodically and developed as a lesson learned. Hence, this study was aimed to depict social knowledge and lesson learn from cassava-tapioca agroindustry actors in Pati District, before and after the empowerment program.

## The Methods

This study was a case study report, which described using a phenomenological approach. The research locations were divided into two different areas, which were Morgoyoso and Tlogowungu Sub-districts, in Pati District (Figure 1).

The locations were chosen based on inclusion criteria: 1) both areas were main cassava producer area, 2) having the widest cassava farming areas in Pati District, and 3) there were tapioca production industries that directly integrated with cassava farming. The respondents were coming from 10 farmers from Margoyoso Ditrict and 25 farmers from Tlogowungu or 35 farmers in total, then as many as 19 tapioca producers consisted of 9 respondents from Margoyoso and 10 respondents from Tlogowungu District.

The social-science was assessed from respondent participation and actions in implementing five post-empowerment aspects: information access (X1), participation (X2), business interest (X3), post-harvest processing (X4), and formation association (X5). Data was collected by structured observation method and following respondents' activities on farming and tapioca producing before and after empowerment to determine cognitive, affective, psychomotor, and conative levels in cassava-tapioca agroindustry. Interviews and focus group discussions (FGD) was conducted using participatory rural appraisal (PRA) approaches regarding farmers' problems and solutions in facing unstable cassava prices. The FGD was conducted by involving relevant stakeholders: government representative, farmers, tapioca producers, entrepreneurs, and members of the Cassava Processing Association (PPSP).

During the empowering program, respondents were facilitated to access and understand about the modernization of cassava farming and sustainable production. Facilitation of empowerment promotes increased activity, knowledge integration and the introduction of mutual benefits. It also helps farmers to get information about mutual works in term of roles, authorities, responsibilities, reward systems and other attachments that result in collective action both in term of farming practices sector and tapioca production. The data obtained were then cross-tabulated and analyzed descriptively to find out social knowledge cassava-tapioca agroindustry.

## Result and Discussion

The cassava productivity in Pati District contribute for more than 6% in national, and more than 43% in province (Table 1). The cassava business existence is main economic backbone of local community, and most important after paddies production.

In addition, Pati District is also the second largest cassava producer in Central Java with location quotient (LQ) reaching 0.96 (potentially support local economic and income). Total 269 units of tapioca industry located in Margoyoso Sub-district which employs 3,617 people. Interpretation of the coverage of SPOT 6 satellite images in November 2014 showed that 83.7% cassava land was mostly located in the northern part of Margoyoso Sub-district, specifically upper-slope under Muria Mount covering Tlogowungu, Margoyoso, Cluwak, Gembong, Margorejo, and Tayu Sub-district (Banowati, Ngabiyanto, Syukurilah, & Danang Junior Trimasukmana, 2019). As well as 16.3% in the southern part, which is on the northern slope of Kendeng Mountains, covering Sukolilo, Kayen and Tambakromo Sub-district.

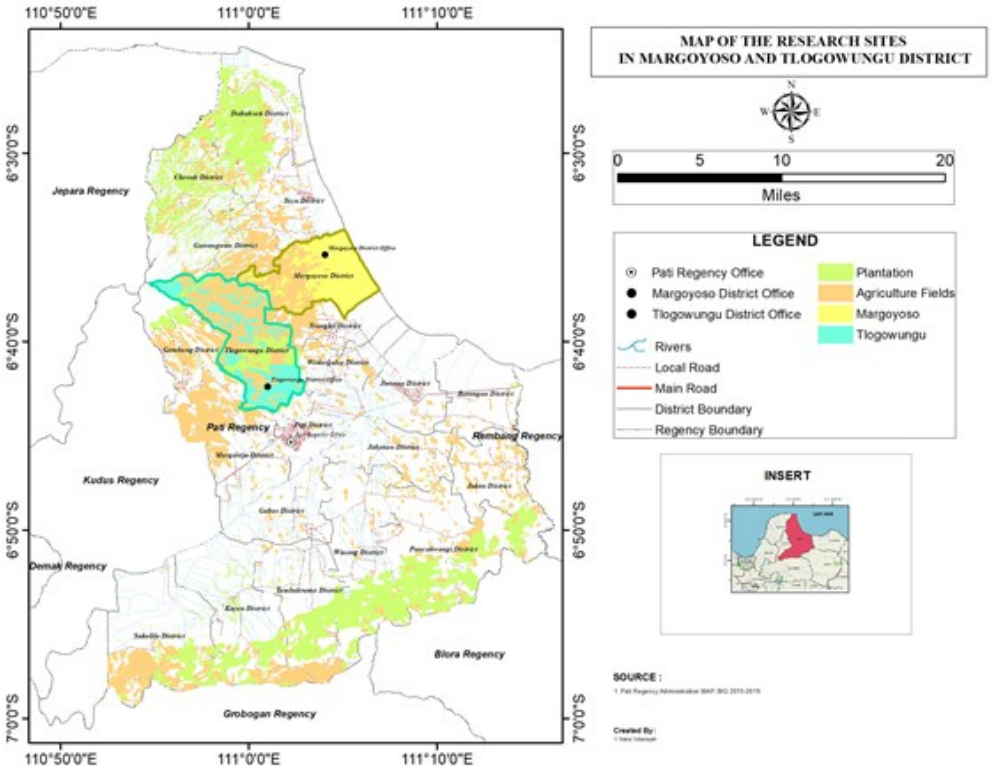


Figure 1. The map of the research sites (Margoyoso and Tlogowungu District) in Pati Region.

Table 1. Pati District's cassava production for province and national contribution in 2015.

| | Contribution (%) | |
|---|---|---|
| | Province | National |
| Land Area | 10,07 | 1,60 |
| Production | 18,53 | 3,04 |
| Productivity | 43,88 | 6,97 |

Sources: Statistic Indonesia or *Badan Pusat Statistik* (BPS) accessed in 2019.

Table 2. Environmental factor in cassava production fields of Pati District

| Indicator | Standard environment parameter for cassava planting | Existing condition in sample location |
|---|---|---|
| Climate and environment factors | | |
| Climate type | - | C2, D2, and E1-E4* |
| Temperature | More than 10 °C | 23 °C-39 °C |
| Humidity | 60-65% | 67-72% |
| Sun light period | 10 hours/day | 12 hours/day |
| Planting media | | |
| Soil texture | crumbs, loose, not too tough, and not too pivot | crumbs, loose, and high organic compounds |
| Soil type | Alluvial latosol, reddish-yellow podsolic, mediteran, grumosol, and andosol. | latosol, reddish-yellow podsolic, mediteran |
| pH | 4.5-8.0, ideally pH 5,8 | 6.3 |
| Drainage | - | Well drainage |
| Organic content | - | High content |
| Dolomite | - | Sudsy enough |
| | | |
| Existing demo plot | | |
| Altitude | 10–700 masl | masl. |
| Elevation | - | 137 |
| Slope | - | 10% |

Source: Field survey (2017-2018). *) Agro-climate criteria based on (Maru, Leo, & Rahim, 2016)

Pati District has various land topography, ranging from coastal area to karst mountain because of physiographic influences. The soil condition is fertile and suitable for farming because contain of a high organic compound with normal pH and full irradiation 12 hours/ day. The type of constituent soil is quite varied; latosol, red-yellow and Mediterranean which support the growth of cassava (Table 2).

## Human Resources in the Agriculture Sector

As many as 10 farmers with 36 family members in Margoyoso Sub-district worked on cassava farms covering 24.88 hectares or approximately 2.49 hectares/ farmer. The incomes from productive fields were used to support total of 46 people. Whereas in Tlogowungu sub-district, there were 25 cassava farmers, support total of 102 family members utilizes 40.52 ha or an average of 1.62 ha/ farmer as a livelihood. However, from the total productive fields, 40% of leased land (Table 3). Then, institutional status by the years of success in both sub-districts dominated by low-educated farmers.

The respondents were classified as middle-to-upper-income. However, the production of cassava farming that was carried out often loses because of unstable prices and even tends to be low over the past two years (Banowati & Nugraha, 2018).

Table 3. Farmers and tapioca producers profile in two sub-districts in Pati District.

| Profile | Cassava Farmers | | | | | Tapioca Producer | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Margoyoso | | Tlogowungu | | Total | Margoyoso | | Tlogowungu | | Total |
| | f | % | f | % | | f | % | f | % | |
| Ages | | | | | | | | | | |
| 43 – 53 | 7 | 25.93 | 20 | 74.07 | 27 | 5 | 35.71 | 9 | 64.29 | 14 |
| 54 – 64 | 3 | 37.50 | 5 | 62.50 | 8 | 4 | 80.00 | 1 | 20.00 | 5 |
| ∑ Family members | | | | | | | | | | |
| ≤ 3 | 0 | 0.00 | 2 | 100.00 | 2 | - | - | - | - | - |
| 4 – 5 | 10 | 30.30 | 23 | 69.70 | 33 | - | - | - | - | - |
| ∑ Staff/ Employers | | | | | | | | | | |
| ≤ 10 | - | - | - | - | - | 3 | 33.33 | 6 | 66.67 | 9 |
| 11-20 | - | - | - | - | - | 3 | 50.00 | 3 | 50.00 | 6 |
| 21-30 | - | - | - | - | - | 3 | 75.00 | 1 | 25.00 | 4 |
| Educational | | | | | | | | | | |
| 6 – 9 years (not finished) | 2 | 8.00 | 24 | 96.00 | 25 | 0 | 0.00 | 0 | 0.00 | 0 |
| 10 – 12 years (elementary) | 3 | 75.00 | 1 | 25.00 | 4 | 3 | 50.00 | 3 | 50.00 | 6 |
| 13 – 16 years (junior high) | 5 | 100.00 | 0 | 0.00 | 5 | 6 | 46.15 | 7 | 53.85 | 13 |
| Land areas (Ha) | | | | | | | | | | |
| < 1 | 1 | 12.50 | 7 | 87.50 | 8 | - | - | - | - | - |
| 1–1.55 | 2 | 33.33 | 4 | 66.67 | 6 | - | - | - | - | - |
| 1.5-2 | 1 | 12.50 | 7 | 87.50 | 8 | - | - | - | - | - |
| 2–2,5 | 0 | 0.00 | 2 | 100.00 | 2 | - | - | - | - | - |
| 2,5–3 | 3 | 37.50 | 5 | 62.50 | 8 | - | - | - | - | - |
| > 3 | 3 | 100.00 | 0 | 0.00 | 3 | - | - | - | - | - |
| Land/ Business Statues | | | | | | | | | | |
| Owner | 10 | 40.00 | 15 | 60.00 | 25 | 9 | 47.37 | 10 | 52.63 | 19 |
| Rent | 0 | 0.00 | 10 | 100.00 | 10 | 0 | 0.00 | 0 | 0.00 | 0 |
| Productivity | | | | | | | | | | |
| ≤ 20 | 3 | 21.43 | 11 | 78.57 | 14 | 1 | 50.00 | 1 | 50.00 | 2 |
| 21-40 | 1 | 33.33 | 2 | 66.67 | 3 | 3 | 37.50 | 5 | 62.50 | 8 |
| 41-60 | 3 | 30.00 | 7 | 70.00 | 10 | 1 | 50.00 | 1 | 50.00 | 2 |
| 61-80 | 3 | 37.50 | 5 | 62.50 | 8 | 2 | 66.67 | 1 | 33.33 | 3 |
| ≥81 | 0 | 0.00 | 0 | 0.00 | 0 | 2 | 50.00 | 2 | 50.00 | 4 |

Sources: field observation and survey in 2017-2018

The cassava farming practices in both sub-districts were still conventional, using traditional information and tools by working on hoes, rained irrigation systems, no pesticides use and modern fertilizers. In addition, there was no special treatment to grow cassava plants, which was indicated by abundant weeds. It was probably due to a lack understanding in farming utilization that triggered by low formal education of the farmers. The low education directly contributes to accepting knowledge of agricultural modernization (Aboajah, Onjewu, Chia, & Okeme, 2018). Cassava farmers in Pati District does not use modern technology to increase production. The carried-out farming processes are summarized in Table 4.

Table 4. The applied procedure shows perfunctory process in traditional cassava farming

| Activities | National Standard Parameters for cassava planning | Farmers' Procedures in Pati district (Applied) |
|---|---|---|
| Seed Preparation and planting | Seed is prepared from 10–12 months-old plant, homogenous, healthy, and normally growth.<br>Every seed has 30 cm length that cut from base to middle stem. | The farmers were used seeds from 10–12 months old-plant from previous breeds (G6, G7, G8 and Gn), so genetic quality is not considered by farmer. Normal, healthy, and same growth.<br>Stem seed was from bottom to middle and has different length. |
| Areas clearing | Land cleared from weeds (disturbing plants) and roots from previous crops. | Cleansing was done by hoeing the land and flipping the soil so that the part overgrown with grass and weeds were buried. |
| Seedbeds | The seedbeds are made when the land is 70% from the completion stage. | After planting, the land was just abandoned and immediately planted without any beds and fertilizers. So the planting area looks flat. |
| Calcification | To increase soil pH, especially in the peat land | No |
| *Planting techniques* | | |
| Planting | Planting depend on two factors: 1) planting adjusted to harvesting period. 2) planting areas adjusted to financial capital and needs.<br>Most suitable time for cassava planting is in early rainy season using monoculture pattern or some alternatives:<br>100 X 100 cm,<br>100 X 60 cm or 100 X 40 cm<br>Intercropping system: 150 X 100 cm, or<br>300 X 150 cm.<br>Embed 5-10 cm deep or ± 1/3 cuttings buried in the ground | Farmers was applied monoculture, and usually done in the late dry season at the end of September-early October. The planting distance was 100 × 100 cm and depths ranging from 5-10 cm cuttings buried in the ground |
| *Plant treatment* | | |
| Seedling replacement | The dead seed should be checked 2nd or 3rd week after planting, and as soon as possible to be replaced | Farmers generally replaces dead seed two week after planting, and conducts every morning or evening (the reason why is still unclear) |
| Weeding | Ideally, weeding is completed at least twice in one planting season. | Farmers in Pati Regency do not have a specific time or duration to clear the weeds. |
| Heaping | Ground up around the plant and after that it is made like a mound | No |
| Branching | at least each tree must have two or three branches | Cassava plants were observed, with three branches in average |
| Fertilization procedure | Balanced fertilization between N, P, K with 133–200 kg of urea; 60–100 kg of phosphate and 120–200 kg of Potassium. The fertilizer applies as same as planting time with a dose of N: P: K = 1/3: 1: 1/3 (basic fertilization) and increases to N: P: K = 2/3: 0: 2/3 after 2-3 months-old. | No. |
| Irrigating | The irrigation must be start at the beginning of planting until ±4-5 months -old and keep the soil humidity in 40-70%. | No, the irrigation relies on rain |

| | | |
|---|---|---|
| *Pests and diseases treatment* | | |
| Pesticides application | Fertilizing process should be conducted in the morning after haze disappear or in the afternoon | No, farmers were treated to remove pests manually by removing pests and diseased parts |
| Uret (*Xylenthropus*) | Clean up organic materials remnants from the land at the time of planting and/ or mixing sevin during soil crumbling. | Farmers was not cared about plant wounds, just getting rid of pests |
| Tungau merah/ two-spotted spider mite (*Tetranychus urticae* and *Tetranychus bimaculatus*) | UJ-5 varieties is tolerant, but farmers can spray a lot of water to avoid mites invasion. | The seeds used are UJ-5 varieties but there was no treatment taken to avoid the appearance of mites, |
| Bacterial blight disease | Farmers should cut or destroy infected parts, rotate and sanitize the plants. | No |
| Bacterial wilt (Pseudomonas solanacearum Smith) | The treatment can be applied is crop rotation, planting resistant varieties such as Adira 1, Adira 2 and Muara, removing or destroying plants | No |
| Brownie spot (*Cercospora henningsii*) | Widening plant spacing, planting resistant varieties, pruning sick leaves and doing garden sanitation | No |
| Concentric leaf spots disease (*Phoma phyllostica)* | Widen the plant spacing, organize garden sanitation and cut down parts of the sick plants | The infected part was trimmed and burned |
| Weeds | Nut grass (Cyperus sp.) can be cleared manually by weeding for 2-3 times in planting season | Eradicated by manual |
| *Harvest and post-harvest* | | |
| Harvest time | Cassava harvesting should be conducted for 6-8 months-old for the UJ-5 varieties and 9–12 months-old for the local variety. | The UJ-5 cassava was harvested at 9th-10th months to produce tapioca (resistant to Cassava Bacterial Blight disease) |
| Harvesting technique | Cassava tubers are pulled out and the remaining taken with a hoe or ground fork | firstly, the stem was cut, the remaining tubers are taken with a hoe or ground fork |
| Collecting | Collected in a strategic location, safe and easy to reach by transportation | Collected in a strategic location, safe and easy to reach by ankle trucks. |
| Quality shorting | Choose clean-colored bulbs visible from the skin of fresh tubers and those with defects especially seen from bulb size and no black spots / stripes on the flesh of the tuber | Cassava bulb was shorted as like as parameters and done when still in the field. |
| Storage processing | Make a hole in the ground for storage of fresh bulbs. | Cassava was harvested directly because it closes to tapioca industry. Cassava was distributed 87% for tapioca raw materials and 13% for processed food. |
| Packages and distribution | Cover the bottom of the hole with straw or leaves, for example with jackfruit leaves or cassava leaves themselves. | Cassava was only for local markets without packaging/ entering in the tailgate |

Sources: research primary data processing

The main barriers in increasing cassava production and productivity were various factors that declined farmer's interest in cassava cultivation. Low production has triggered massively imported tapioca entering Pati District. In addition, local cassava price declines because it losing competitiveness with imported cassava which has better quality as a raw material for tapioca production. Furthermore, it made productive land areas shrinkage up to 30%. Whereas the potential normative land in Pati District was far wider than productive land, while idle land was abandoned and disused.

In terms of biological plant sources, farmers using seventh generation (G7) and or more cassava seed as main plant breed. It was commonly found in the research site because it abundant, cheaper, and easier than certified seeds, and then low information of the cassava farmers to access high quality seed. The latter seed generation as plant breed decreases the genetic quality, especially in production-related-gene, which decrease quantity and quality of crop production from harvest to harvest (Kawuki, Nuwamanya, Herselman, & Ferguson, 2011). It can assume that low incomes, low information access and difficult access to seedling development centers are also driving factors of low cassava productivity. This shows that cassava farmers are in a weak position and do not have a bargaining position to increase their production. Assessment of the empowerment parameters was shown that cognition level of the farmer was still at knowing and understanding levels (Table 5).

Most of the farmers tend to apply the knowledge that they get from an empowering program, especially in the cassava farming business aspect. It caused by cassava farming is a main job/ livelihood. Mostly, the farmers earn their money depend on cassava production only, which effectively can be earned every eight months, after that they just collecting lumbers and banana leaf to sell to the market. However, only seven farmers tried to access and analyze information related to cassava management, while other farmers were limited to knowing and understanding these activities. Low access to information of modern agriculture in Pati District, caused by education levels, age, low income. Technology access is very uncommon for farmers to use as communication tools such as smartphones and internet. Though, access agriculture information is very important in term of promoting and determining the adoption of modern agricultural production technology (Akudugu, Guo, & Dadzie, 2012; Armstrong, Gandhi, & Lanjekar, 2012; Chhachhar, Qureshi, Khushk, & Maher, 2014; Hussain Awan, Ahmed, & Hashim, 2019; Nwafor, Ogundeji, & van der Westhuizen, 2020).

Meanwhile, managing human resource aspect was indicated that 16 people or 45.71% of cassava farmers were able to know the aspect, 9 people were passed applying process and 10 people were passed analyzing process of the effectiveness of paid labor. Because the process of farming depends on family business, there is no intention to establish a farmer group. Only around 5.71% of farmers have analyzed the sustainability of farmer groups while the rest were just recognized and not directly involved (Table 4). This information is in line with the fact that farmers in both sub-districts did not organize and there was no long-term planning in managing the business. The absence of structured planning is one of the things that inhibit sustainability and increased profits in the field of agro-industry (Ogunleye, Adeyemo, Bamire, & Kehinde, 2017).

Table 5 Cognitive achievement of human resource after community empowerment

| Parameters | Farmers (people) | | | |
|---|---|---|---|---|
| | Knowing | Understanding | Applying | Analyzing |
| Information access | 12 | 12 | 7 | 4 |
| Human resource participation | - | 16 | 9 | 10 |
| Business interest | - | - | 26 | 9 |
| Land processing | - | - | 35 | - |
| Association development | 33 | - | - | 2 |

Source: field observation and survey in 2017-2018

Table 6. Affective, psychometric, and conative achievement of human resource after community empowerment (35 respondents).

| Parameter | Affective | | | Psychometric | | Conative | |
|---|---|---|---|---|---|---|---|
| | Agree | NA | Disagree | Skilled | Unskilled | Accept | Reject |
| Information access | 8 | 27 | - | 1 | 34 | 11 | 24 |
| Human resource participation | 16 | 19 | - | 35 | - | 10 | 25 |
| Business interest | 30 | 3 | 2 | 35 | - | 8 | 27 |
| Land processing | - | 35 | - | 35 | - | 35 | - |
| Association establishment | 35 | - | - | 1 | 34 | 11 | 24 |

Source: field observation and survey. NA: Not answered

In addition, the analysis of affective, psychomotor, and conative domains shows the low response parameters of empowerment. Weaknesses in accessing information and reluctance to follow up in group formation are indicated by post-empowerment farmers (Table 6).

The affective domains were observed in this study include feelings, interests, attitudes, and values. Identification of attitudes and abilities to receive and respond shows that only 8 farmers (22.86%) actively access information, and rest of them was preferred to ignore information access. This is compatible with psychomotor values, where only one person cares and actively seeks information. Usually, information among farmers is generally spread by verbal messages. This information takes a long time to distribute, also decreases the quality. Even though, information plays an important role in the progress of innovation in agro-industry sector, especially related to modernization and facilities system development (Adekunle, Osazuwa, & Raghavan, 2016). The low flow of information will prevent farmers from developing instruments and or expertise to increase their cassava production and productivity (Ajayi, Muhammed, Olah, & Tsado, 2016; Ekanem & T, 2018; Wyche & Steinfield, 2016)

Whereas in human resource participation, it shows that most of the cassava farmers have low concern for labor management (Table 6). The low level of concern in managing the workforce is likely because farming activities only involve family members and rarely use laborers. The involvement of family members as laborers is considered cheaper and easier. The low awareness of managing labors also correlates with the formation of associations. Cassava farmers feel the need and care to develop the association if it benefits.

Behavioral changes in information access and association establishment aspect from conventional to modern farming was took long time, it was likely caused by conventional farming practices have been internalized into farmers. The formal education was accessed by the farmers was only up to elementary school and it became a limiting factor to the learning process (Aboajah et al., 2018; Mvodo & Liang, 2012). This explains that farmers likely still rely on and practices hereditary knowledge in managing agricultural businesses. Because of their confident on common method declines their need for updating information. Cassava farming both through expansion and intensification model by using standardized seeds and more competitive technology were still lacked. According to Akudugu et al (2012) several factors such as economic, institutional and social have a significant influence on slowing pace of agricultural modernization.

Another difficulty faced by farmers was the market flow. The cassava farmers in Pati District follows traditional market flow from farmers to wholesaler or brokers to tapioca producers in the same area, while it only 13% that sold to outside region as food raw material.

Based on the business prospect, majority, farmers interests in developing cassava farming because of easy cultivation process and low crop failure risk, unless the plant is damaged by external factors (other than pests) (Nassar & Ortiz, 2010). Because of the ability of cassava to grow easily, the farmers only carry out cultivation and do not do more effort to modernize farming management. However, in terms of the marketing process, farmers were constrained to find prospective markets, and depend on the presence of brokers (Figure 2). Whereas if the farmers were able to sell their cassava, they only sell it to small-scale tapioca producers at home industries.

## Knowledge of tapioca production industry (Downstream of tapioca products)

Tapioca industries in Pati District localized in one area with cassava farming creates an agro-industrial area site and supporting economic resilience. Tapioca is used for food and non-food industries that also referred to downstream agro-industry products (Banowati et al., 2020) The tapioca producers profile in Pati District is generally small industries, with approximately 15 workers. Compared to a dozen tons per week of capacity production, which was only about 10% of the industrial workforce was effective, the rest was not effective to support production.

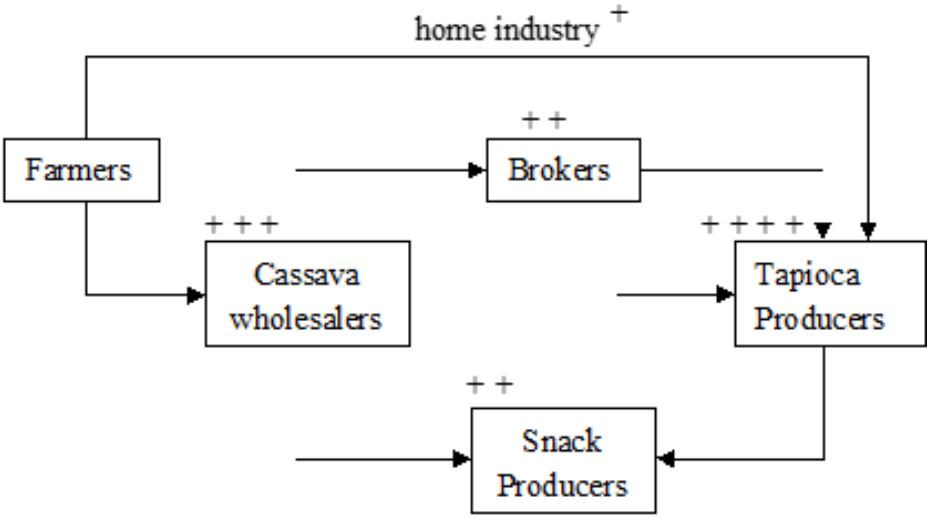


Figure 2. Current marketing flow of cassava and tapioca production. The plus mark (+) indicates the dominant distribution of cassava in the marketing flow (Source: field observation)

Excessed industrial labor was possible came from local worker around tapioca producers, with has low skilled in the tapioca industry. However, industrial management defends this and keeps the labor to continue working because of mutualism conditions. By using local people, the tapioca producers can take advantages in working duration, because the labors were not constrained by travel time, high positive neighboring relationships, helping each other and positive environmental dynamics. However, mostly labor has low capacity and skills in tapioca producing, there was no effort from managerial to increase labor's capacity through training or empowerment program.

In return, the tapioca industry provides benefits to local incomes by reducing unemployment/ absorbing local workers, there were 3,617 people working in this sector. It very important because in Pati District, the population growth rate is 0.63% and there is no urbanization. Over past three years, the population has come in greater than migration and mortality.

Average tapioca industrial production capability was 6.8 tons per unit/ day, so at least 1,829.2 tons/ day or 667.658 tons/ year of cassava needed by the producer to produce around 640.22 tons/ day of wet tapioca flour (Banowati et al., 2020). Bu t, to get high-quality tapioca both in quality and quantity, improvement in dry processing should be equipped, such as providing drying machines for tapioca producer. Recently, the drying process only relies on sunlight and is not stable, especially during the rainy season. Also, it takes a long time and reduces quality of the tapioca or called with "*grosok*" (brownie tapioca) lowering tapioca's prices. Generally, they sell *grosok* for IDR 9,000.00 - IDR 13,000 per kg or USD 0.62-0.90 per kg.

Basically, the tapioca industries in Pati District can be improved to get proper quality and quantity tapioca through agricultural and industrial revitalization. In addition, cassava agriculture and tapioca industries are competitive sectors with location quotient (LQ) value is 0.96, so that the presence of local tapioca producer is expected to fill local needs rather than exported to other regions.

The empowering program was carried out showed that cognitively, tapioca producers actively created a process for accessing information, concern on human resource participation and still passionate in tapioca business (Table 7). It is likely because of the tapioca producers require to enlarge market to sell their products and manage their business sustainable. These demands make business owners actively seek information and conduct business management, including in terms of managing human resources/ labor they have (Wijayanti, Novianti, Karim, Sudaryanto, & Carolina, 2017; Yulianto, Sukardi, Indrasti, & Raharja, 2020)

Whereas in processing activities which include handling cassava from farmers and processing cassava into tapioca, majority of business actors were at the evaluation stage. This is probably caused by decreasing raw materials from farmers, so tapioca producers must recalculate the available raw materials stock and look for alternative raw materials for running the tapioca production. In the aspect of association establishment, producers tend to be more caring than cassava farmers, indicated by most respondents has joined in a producer group. This aspect is considered as an important step to keep their business on the right track, because business association plays an important role in product commercialization activities and sharing information about product update (Forsythe, Posthumus, & Martin, 2016).

Table 7. Cognitive achievement of human resource after community empowerment in tapioca production sector

| Parameters | Producers (people) | | | |
|---|---|---|---|---|
| | Applying | Analyzing | Evaluating | Creating |
| Information access | - | - | - | 19 |
| Human resource participation | - | - | - | 19 |
| Business interest | - | - | 4 | 15 |
| Processing | - | - | 13 | 6 |
| Association establishment | - | - | 18 | 1 |

Table 8. Affective, psychometric, and conative achievement of human resource after community empowerment.

| Parameters | Affective | | Psychometric | | Conative | |
|---|---|---|---|---|---|---|
| | Agree | NA | Skilled | Unskilled | Accept | Reject |
| Information access | 19 | - | 17 | 2 | 17 | 2 |
| Human resource participation | 3 | 16 | 3 | 16 | 3 | 16 |
| Business interest | 19 | - | 19 | - | 19 | - |
| Processing | 19 | - | 19 | - | 19 | - |
| Association development | 19 | - | 19 | - | 19 | - |

Source: field observation and survey. NA: Not answered

Mostly, tapioca producers took concern in carrying out all empowerment activities except for the human resources participation aspect (Table 8). This is probably due to the production model that relies on local people as cheap-local labor. Abundant, inexpensive, and unskilled local workers are probably the reason for positive response in the low human resources participation aspect. Local workers tend to accept company decisions because they do not have a bargaining position, besides being the main business holder, the company has full authority over workers. In this part, tapioca producers tend to agree and follow up on all aspects or activities learned in empowerment except human resource management. The tapioca producers more prefer to reach daily target rather than provide labor training as an infestation. Planning for sustainable tapioca productivity is not too visible during observation. It is probably due to common practiced management of farming without modernizing the facilities and low knowledge on increasing tapioca quality and quantity. In addition, the low price of tapioca and the lack of market places is one of the main triggers that slowing productivity.

## Conclusion

The productivity of Cassesart varieties (UJ-5), which were planted on the land of 65.40 Ha in two sub-districts, was decreased because of low selling prices. Human resources empowerment in upstream and downstream leads to understanding farmers and producers' condition and behavior trend in four aspects: cognitive, conative, affective, and psychomotor. It related to the achievement of independence in the agro-industrial area. Identification of willingness in farmers in term of applying empowerment result was showed that the farmers in majority were still inclined to use agricultural models that have been used for generations. The main problems in implementing empowerment knowledge were caused by low income, education, and individual worker, based on habits in farming. Aspects of human resource participation, especially in the workers and modernization technology management need special attention to both agriculture and the tapioca industry. In the tapioca industry in Pati District, it is specifically necessary to revitalize machinery and production methods, especially in drying processing to increase productivity. Furthermore, the monitoring and evaluation of empowering program should be established frequently to collect better understanding of farmers and develop more appropriate approaches.

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## Author Contribution

This article was presented as a collaborative works from the authors. E. Banowati, as the main author contributes in core ideas development, social and geographical data collection and analysis, and article finalization and publication, then the second author D. R. Indrayati responsible in pest identification, biological and environmental data collection, also contributes in data analysis and presentation for publication. I. Anisyukurilah and H. H. Pratikto together contributes in social and economic analysis, demography data and cassava field mapping, also contributes in result and discussion arrangement and review.

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