Innovative post-harvested processing activation program for potential local agro-based food commodity using design thinking approach (Case Study: Keladi Tuber (Caladium bicolor Vent.) commodity in Manokwari, West Papua)

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Abstract. Sustainable product development in the rural area has different challenges that need to discuss, such as the condition of the culture of the community, nature and the context of its locality. Manokwari, Papua, in eastern Indonesia, has a high complexity in advancing its human resources with the potential of local food commodity. This research used Participatory Action Research (PAR) methods. Action Research was done by activating the community to grow prosperity through product development using Design Thinking approach through six stages; 1) observe, 2) define, 3) ideation, 4) prototyping and 5) storytelling or testing and 6) validation, which presents an accurate information, begin with a human-oriented approach to capture the real basic needs of the community that must be addressed. This research was carried out for trial local commodity development, Keladi tuber (Caladium bicolor Vent.) in Manokwari, West Papua, which processed with minimal added value, so the challenge is to increase community's capacity and innovation in processing it. This research captures trends and society's dynamics map from people's daily experiences as information for synthesizing problems and organize creative solutions. The result forms activation plans for post-harvest commodity processing: 1) recommendations for strategic development steps, 2) post-harvest processing, 3) raw material stocks system, 4) diversification of derivative product and formulations, 5) activation of village-city hubs as a link with potential marketing area, and 6) downstream activation in the marketing area for wider market penetration.

Keywords: local food, social innovation, Design Thinking, postharvest, Keladi tuber

1. Introductions
Neney District is one of the districts in South Manokwari, West Papua Province. Like other areas in South Manokwari, Neney District, precisely Aryawenmoho village has an abundant and popular amount of Keladi production and has been the staple food of the people for centuries. Neney District is one of the districts in South Manokwari, West Papua Province. The Neney district, located in the southern area of Manokwari, requires three hours to the border district and continued by four hours to
reach the village of Aryawenmoho using a double cabin car because the terrain is in the form of rivers, steep roads, and forests. These transportation facilities are only available at certain times.

The Aryawenmoho village community lives surrounded by mountains and valleys in the South Manokwari district with the main activities of gardening and hunting. Sometimes they worked together to build public facilities or help each other make one of the residents' houses. Based on the investigation conducted, the level of happiness of the people of Aryawenmoho village is very high. They feel that life is sufficient because their needs can be helped with forest products. The spirit of cooperation reflects a high level of community solidarity, including in terms of gardening, hunting, or harvesting of forest products. In terms of technological exposure, several people in Kampung Aryawenmoho have started to recognize communication technology. But they have not been able to be used optimally due to the condition of Aryawenmoho village which has not yet provided signals. Electricity is available in just a few houses.

Keladi is the main food ingredient of the Neney district, including Aryawenmoho village, which is used to be burned or boiled. Also, Keladi is used by the community as their animal feed. Planting Keladi is itself a cultural heritage of the previous generation that has been passed down from generation to generation. Keladi that grows in Neney district has advantages compared to keladi in other regions. The resulting Keladi size is 3–4 times more massive and grows 1–2 times higher than the Keladi plants in general. This advantage makes keladi as the primary raw material for Manokwari.

The abundance of Keladi resources does not necessarily have a positive impact on life in Aryawenmoho village. The Keladi has not been able to be used optimally. Aryawenmoho village community because they do not know of any raw material processing technology, so they have never processed Keladi into any derivative product. Keladi has not been able to be used as additional income. So that people still find it challenging to obtain daily necessities because transportation access in and out of the village is complicated. To get the items they need or to sell goods to the nearest market, people have to rent a double-cabin car at a high price of Rp 600,000 for one trip. The difficulty of means of transportation and the distance of travel caused the cost of daily necessities to be very high. Aryawenmoho community found it difficult to develop Keladi into a profitable business. Actually some of recent researches already reveal the potency of Keladi, for example that researched the possibility of Keladi to be used as ethanol production feedstock [1].

Design thinking is an approach that is suitable to do ideation and explore right innovation while take a commodity into high value added product. Design thinking approach was used by UNPAD to select the right product to be developed by West Java 40 agro based social enterprises [2] and also to explored innovation of essential oil startup industry development [3] and [4].

2. Method
This research used Participatory Action Research (PAR) methods. The intervention was carried out in the research activities, so as to produce solutions that could be applied in accordance with the socio-cultural and socio-economic aspects of the community that made the object of this research. The community is actively involved, not just being the target group as a 'subject' in the activity process, and not as an 'object'.

Researchers in this matter designed tools, instruments, data collection, processing, data analysis until compiling reports always with the community or target groups using Participatory Action Research. This model is used so that empowerment interventions grow and have an impact on: a) The emergence of processes of active participation, both technical and political from the people who are the target groups in the overall program of activities. b) The growing atmosphere of partisanship for those who have felt marginalized, neglected in the development process, in this case the community involved. More in this PAR, sharpened by Tools and the stages used in this study refer to the Design Thinking Approach, namely 1) Observe, 2) Define, 3) Ideate, 4) Prototyping and 5) Storytelling 6) Validation. These stages are used because insists are focused on humans and human needs, relies on both creativity and logic, Promotes a learn-by-doing approach. Suggests that failure is a good way to
learn and it's crazy collaborative. The PAR and Design Thinking approach is expected to be more effective in producing good solutions that can be applied in the community.

The PAR method and design thinking approach used in the process of activating the social entrepreneurship ecosystem conducted in Aryawenmoho village, Neney district, South Manokwari district involved various parties including Mnukwar Papua as a local NGO who became an activity facilitator, University of Papua Faculty of Business Economics students, figures and society. PAR methods and the design thinking approach used are indeed designed to involve the community in making decisions actively.

3. Results and discussion

3.1. Maps of changes

Through the Design Thinking approach, observations were made to the Aryawenmoho village community. This observation aims to find out the empathy of the local community about Keladi and then find the potential and challenges. Observations were made through meetings with leaders, the community, visiting Keladi gardens. Observation also visiting population samples to explore the community condition, environmental conditions, and culture habits, to the wishes of the community. People live by utilizing forests as a means of fulfilling their daily needs. The location of the remote village of Aryawenmoho and in the hinterland of the mountains makes the nature of cooperation and solidarity strong enough. The community also has a high potential for conflict because social jealousy is natural. This jealousy was caused by the progress of some people who returned from the city. The high level of jealousy often causes a war between ethnic group or between villages. The positive side found is that the spirit of great learning grows fast when you see the success of other communities in processing Keladi in the Neney district.

One exciting thing that was discovered was that the Aryawenmoho villagers felt psychologically adequate with food needs that could be fulfilled, but one side had the desire that this tad can increase its economic value so that the community could get additional income. The public wants electricity to be used by all people. This desire made people excited when told that the potential of Keladi could be used as a profitable business. The Aryawenmoho village community is familiar with simple storage technology so that the Keladi can still be used for a particular time. But the public does not yet know how to process Keladi. They have never made any effort to process keladi as well as to being burned or boiled as their primary food.

People plant Keladi in the forest around where they live. This system of opening a garden or land must be given education because it produces long-term effects of deforestation that will endanger the community in the future. Keladi not only grows in Aryawenmoho village but is also available in various villages in the Neney district. High social jealousy sometimes creates several obstacles. For example, people from other communities blocked road access because they were jealous of Aryawenmoho villagers.

3.2. User experience mapping

In the observation stage, community experience mapping is also conducted to capture the obstacles faced and the advantages that the community has. This observation is to capture what people feel in the process of planting, harvesting, and processing Keladi. This result was then continued by define stage to see the main problems perceived by the community.

3.3. Value proposition

The next step is to design solutions to solve existing obstacles (Pain Reliever) and strategies to improve excellence (Gain Creator). The results of the synthesis of the two points will result in a Value Proposition or the value of excellence from local Keladi food sources in Aryawenmoho village, Neney District, South Manokwari Regency. This stage is part of the ideation.
Aryawenmoho villagers want to preserve Keladi as local food and have added value. People have tried to sell wet Keladi but failed because of many competitors in the traditional market. It is necessary to process post-harvest products. We made Keladi flour products and develop business models. The availability of large numbers of keladi becomes a good potential for developing the keladi business. People realize this potential by becoming tad has added value and can be preserved. Post-harvest management technology training is needed to overcome people's profound experience in managing keladi. The Aryawenmoho community has tried to sell wet keladi but failed because of the many competitors in the traditional market. Processing keladi requires a processing strategy based on the level of knowledge of the community, availability of equipment, and character of keladi that cannot last long. Based on the pain reliever and gain creator that has been formulated, business development is needed through developing a suitable business model, namely the business model of flour as a derivative product of keladi.

Table 1. Value proposition canvas.

| Value Proposition Canvas |
|---------------------------|
| **Pain**                  | **Pain Reliever**                  | **Gain**                  |
| • The ability and education of the community are still low. | • Technology and processing methods development | • Food processing market opportunities |
| • The high chance of social conflict | • Increase public awareness of community education and technical guidance. | • Abundant raw material |
| • Energy availability in the village is still limited. | • The existence of marketing training assistance and campaign Keladi as local and healthy snacks. | • The community is ready to supply raw materials |
| • The processing technology is still traditional | • Standard training & Quality Control for permit processes are easier. | • The diversification potential of derivative products |
| • Safety and hygiene of the production process | • Making processed food products based on Keladi. |
| • Low Production Scale | | • Cropping patterns have been prepared with topographic conditions |
| • Marketing and introduction to Keladi are lacking and difficult. | | • Planting Keladi is an inheritance |

3.4. Product derivatives business model

After formulating pain relievers and gain creators for problems and excellence in processing keladi and synthesizing it, it becomes a value proposition or value that can be offered. Then the next step is to develop an ideal business model as part of the prototyping stage for the business development of keladi products to be sustainable. In compiling our business model, we use a business model canvas. In this canvas, we map nine main elements that are related to the business that we are going to or are
running. The nine items include Market Segmentation, Value Proportions, Channels, Revenue Stream, Customer Relationships, Key Activities, Key Resources, and Cost Structure.

Keladi is an abundant raw material and is widely distributed in the area of South Manokwari, especially Aryawenmohoh village, and has been cultivated by local communities. Keladi has been widely consumed as a staple food by the community and has an abundant amount. Processing processed keladi can have a positive impact because it can empower farmers in the Neney district. Processing keladi flour can also be another source of income and can even be a primary income. The excellence of processed keladi is a value that can be offered because the competitors for wet keladi are already very much on the market.

This market segmentation of keladi flour products will focus on targeting the pastry and bakery processing industries as well as other food industries that use flour as the primary basic raw material. The marketing area coverage will target the local area as well as other big cities outside Manokwari. Some of the sources of income from this keladi flour processing business are from processed products and derivative products. Production waste can also be sold as animal feed. Collaborative industrial processes and community empowerment can also be used as educational tours and training facilities for people or businesses who want to learn processing keladi flour.

The key resource of the keladi flour processing business is the farmers in Aryawenmohoh village and agricultural land in the Neney district of Manokwari Regency who conduct keladi cultivation. The business process of processed keladi involves key partners, namely farmers in the Neney district keladi, local non-government organizations, and local governments. This business model is expected to be able to make the business run more structured and clear so that it can help and empower the people of Aryawenmohoh village.

4. Conclusion
The PAR method and design thinking approach succeeded in capturing the hidden pattern in Aryawenmohoh village and formulated keladi processing solutions that were suitable for application to the community. Efforts to preserve heritage, the local wisdom of Manokwari, the unique and superior product of Manokwari, empowering local communities is a value that characterizes the excellence of the keladi business from the Aryawenmohoh community. The business of processing selected keladi is keladi flour and flour processed products that target industrial bakery cake, healthy food industry, and typical tourist souvenirs of Manokwari.

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