STRENGTHENING GRASSROOTS INNOVATION TO PRODUCE ESSENTIAL OIL IN TANAH DATAR

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ABSTRACT

Tanah Datar district has the potential for people's kaffir lime plantations of ±750 hectares located in Kanagarian Tanjung Barulak & Padang Gantiang. Currently, the community has only benefited from selling kaffir lime leaves. In addition, the community tried to process kaffir lime leaves but had not succeeded. Therefore, they asked the university for support to increase their capacity, knowledge, skills, and technology to process the leaves, fruit, and twigs of kaffir lime to produce kaffir lime oil. The strengthening of grassroots innovation is carried out in three stages, namely the introduction of Multi-Function Equipment of Essential Oil Distiller with a Combination of Ultrasonic Treatment, installation and testing of equipment on flat ground, and exploration of potential consumers for the development of essential oil products. The results obtained from the trial showed that the chopped kaffir lime leaves first gave better results than kaffir lime oil. However, further process is needed through fractional distillation to separate the components of kaffir lime oil into several compounds, such as Citronellal, Citronellol, and Linalool. The separation of kaffir lime oil needs to be done to produce various aromas that can be used in the fragrance industry. Besides that, it is necessary to make customer development efforts by building a network of various parties, starting at the local, national, and international levels, so that kaffir lime oil and its derivatives can be used as raw materials for the fragrance industry.

Keywords: grassroots innovation, essential oil, customer development, the fragrance industry

1. INTRODUCTION

Tanah Datar Regency is located in a unique geographical area at the foot of Mount Merapi, Mount Singgalang, and Mount Sago, and is also enriched by five rivers. This condition makes Tanah Datar district a potential area for agriculture and plantations. In line with the advantages of this region, most of the population works in the agricultural sector. Tanah Datar's agricultural sector produces rice, secondary crops, vegetables, and, fruits. Furthermore, fruit production in Tanah Datar Regency in 2021 is dominated by avocados, oranges, sapodilla, and bananas (BPS. 2022). Currently, the productivity of oranges is 42.9 tons/ha.

Therefore, the Tanah Datar district government developed an orange area to increase the productivity of the Tanah Datar citrus plant. In line with this policy, the Tanah Datar Government is also expanding the development of citrus areas by cultivating lime (*Citrus Aurantiifolia)* and kaffir lime (Citrus Hystrix). Currently, there is potential for people's kaffir lime plantations of ±750 hectares located in Kanagarian Tanjung Barulak & Padang Gantiang.

Currently, the community has only benefited from selling kaffir lime leaves. Meanwhile, fruit and twigs are still wasted and have not been processed to get added value. Nevertheless, the community has made innovations to process leaves, fruit, and, twigs to produce kaffir lime essential oil. However, the results obtained are not economically optimal both in quality and quantity.

Therefore, it is necessary to strengthen the community to produce quality kaffir lime oil so that it can be used as a raw material for the fragrance industry. Furthermore, the strengthening of grassroots innovation is carried out by introducing and applying the Multi-Function Equipment of Essential Oil Distiller with Combination of Ultrasonic Treatment (No Patent: IDP000077784) to the community. The purpose of these activities is to increase the added value of kaffir lime and improve the quality of kaffir lime essential oil so that it can be used as raw material for the fragrance industry.

Grassroots Innovation

Grassroots innovation is a network of activists and organizations that produce new bottom-up solutions to realize sustainable development. The solutions offered are by local situations and interests, and based on community values (Seyfang and Smith (2007). Thus, grassroots innovation focuses on innovation generated by society (Tang et al., 2011), derived from the knowledge, experience, and skills embedded in the community and individuals who are for (Reinsberger et al., 2015), experimental efforts using technological change to bring about broad social change wide (Hess, 2007).

Grassroots innovation is considered different from mainstream innovation because innovation comes from the bottom-up to respond to problems at the local level by considering the interests of the community (Seyfang and Smith, 2007), emphasizing local social, cultural, and ethical values that are different from mainstream innovation. (Monaghan, 2009). Although grassroots innovation prioritizes local knowledge and skills, grassroots innovation is open to knowledge originating from outside the local community by making collaborative innovations necessary (Smith et al., 2014). For example, community energy projects, organic food supermarkets, recycling of local materials, and community-based sanitation (Smith et al., 2014).

Grassroots innovation is a bottom-up approach to sustainable development (Hossain, 2016), so innovation arises from the innovation of citizens, unorganized ordinary people, hobbyists, craftsmen, or local entrepreneurs (Ornetzeder and Rohracher, 2013). However, over time grassroots innovation will lead to product commercialization. Therefore, grassroots innovation requires increasing their ability to mobilize resources and build a wider network (Smith, 2000). This condition encourages grassroots innovation to network with various stakeholders (government, academics, etc.) to provide support for strengthening innovation organizations.

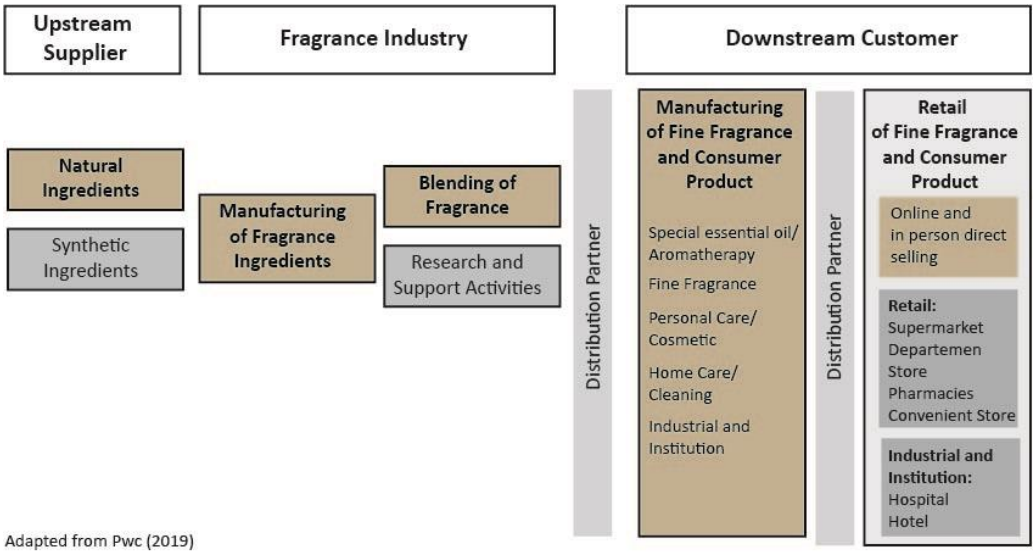

Figure 1. Value Chain Fragrance Industry

From Essential Oil to the Fragrance Industry

Kaffir lime (Citrus hystrix) is a type of citrus that is commonly found in Southeast Asia. Kaffir lime has long been used in traditional medicine as a medicinal plant to treat flu, fever, hypertension, abdominal pain, and infant diarrhea (Fortin, et. al, 2002). Preclinical studies show that kaffir lime contains several phytochemicals with antimicrobial, antioxidant, and cytotoxic properties (Chowdhury, et. al, 2009). However, the phytochemical compounds in kaffir lime have not been used optimally (Arumugam, Gunasekaran, & Perumal, 2014)

Research results show that kaffir lime leaf oil contains Citronellal, Citronellol, and Linalool (Omar, 1999; Loh, et al., 2011; Astuti et. al, 2022). While the kaffir lime peel oil contains -Pinene, D-Limonene, L-α-Terpineol, sabinene, and Citronellal (An, et. Al, 2021, Astuti et al, 2022). Citronellal and Citronellol are compounds that are widely used for the manufacture of soaps, fragrances, cosmetics, and fragrance industries throughout the world. Therefore, kaffir lime can be a superior product for developing the fragrance industry in the Tanah Datar district.

A study by Price Waterhouse Coopers (2019) estimates the contribution of manufacturing and fragrance blending to GDP globally at €2.5 billion (including the US and Canada). In addition, the fragrance industry requires workers who are proficient in Science, Technology, Engineering, and Mathematics (STEM), so the fragrance industry plays an important role in improving the skills of the workforce. Furthermore, the fragrance industry is the main link in the fragrance value chain, starting from raw material suppliers to retailers and consumers. The fragrance industry, therefore, benefits its suppliers and customers and generates value and supporting jobs for farmers, the chemical sector, consumer goods manufacturers, and retailers (Price Waterhouse Coopers, 2019)

The fragrance industry value chain from raw material production to consumer use consists of three areas, namely upstream suppliers, the fragrance industry, and downstream customers (Price Waterhouse Coopers, 2019). Suppliers include suppliers of natural materials and bio-chemicals, synthetic manufacturers, and companies that provide goods and services that assist the production process, such as suppliers of machinery and equipment, logistics, and packaging. The fragrance industry produces fragrance ingredients and creates exclusive fragrance blends. The downstream market

consists of several categories, namely, subtle fragrances, personal care, including cosmetics, home care/cleaning, industrial and institutional (non-residential and professional applications), and special essential oils. Then, the products are distributed to retailers and consumers through various retail channels, such as online sales, in-store sales, and industrial trade (figure 1).

Customer Development is Product Development

Entrepreneurs encounter the challenge of developing new products. The progress of the internet and social media provide challenges for business actors to develop new products. First, competitors easily imitate their products, and second, social media gives consumers a strong influence to provide reviews, recommendations, and ratings for the products made. Therefore, the traditional approach to product development applies to the current situation. The weakness of the product development approach is that it does not involve consumers in the product development process. Thus, Blank (2007) introduced the concept of "customer development" to complement the product development process (Figure 2).

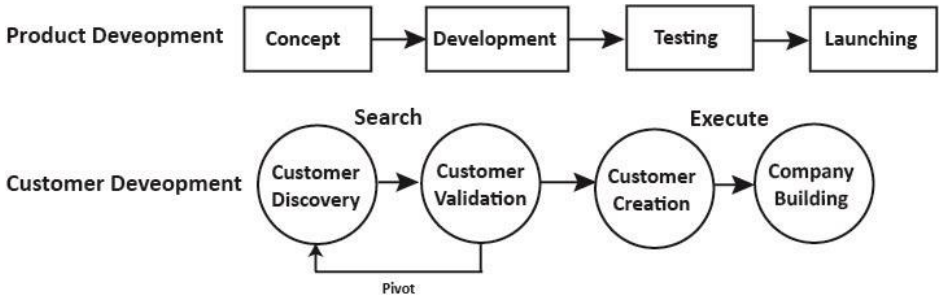

Figure 2. Product Development and Customer Development

The customer development model comprises four interrelated and circular stages, namely: 1) customer discovery, focusing on understanding customer problems and needs, 2) customer validation, identification of appropriate and extensible sales models, 3) customer creation, creating demand and end users, and 4) Company building, the organizational transition from learning and discovery to efficient implementation (Blank, 2007).

In customer development, entrepreneurs design products and business models based on the process of direct contact with customers and other parties to gain knowledge and test hypotheses, not just following hunches (Blank & Dorf, 2012). This step is carried out at the Customer Discovery stage, all assumptions about the product and business model are tested directly to consumers to obtain feedback (Blank, 2007). An important point in customer development is to test hypotheses related to consumer problems and needs, minimum product features, product/market suitability, and product improvement (York & Danes, 2014). In addition, customer discovery tests hypotheses related to channels & prices, demand creation, market types, and competition (Blank, 2007).

2. METHOD

Studies related to grassroots innovation found learning by doing or learning by seeing to be more effective than formal learning for sustainable practices (Bradbury and Middlemiss, 2015). In addition, direct discussions with consumers, potential customers, and other parties to gain knowledge and test hypotheses are important in product development (Blank & Dorf, 2012). Therefore, strengthening grassroots innovation is carried out in three stages, are: (1) the introduction of Multi-Function Equipment of Essential Oil Distiller with a Combination of Ultrasonic Treatment, (2) installation and testing of equipment on flat ground, and (3) exploration of potential consumers for the development of essential oil products.

3. RESULT AND DISCUSSION

Introducing Multi-Function Equipment of Essential Oil Distiller with the Combination of Ultrasonic Treatment

The community has distilled kaffir lime leaves to obtain belly orange oil by using hydro distillation. This traditional way involves direct contact between kaffir lime leaves and boiling water. The lime leaves float on or are completely submerged and then the water is heated by the direct heating method. This method produces a small amount of kaffir lime oil with low levels. In addition, the refining process requires a long time and high fuel consumption. Therefore, it is necessary to increase the knowledge and skills of the community to extract kaffir lime with the Multi-Function Equipment of an Essential Oil Distiller with the combination of Ultrasonic Treatment.

Figure 3. Introducing Multi-function Equipment of Essential Oil Distiller

The introduction of these technologies and tools is done through face-to-face meetings with the community so that it is easier for them to understand how it works and the quality it produces. At this meeting, it was conveyed that the use of this tool should be chopped kaffir lime leaves first so that it will produce good citronella oil (Figure 3).

Installing and Testing Multi-Function Equipment of Essential Oil Distiller

The assembly and testing of the distiller were carried out together with farmer groups as actors in grassroots innovation (figure 4). In line with the findings of Pattnaik and Dhal (2015) which revealed that training and the use of hands-on practice are fundamental to introducing innovation, especially in rural areas. Experiment with several parameters of kaffir lime leaf size and temperature. The trial results showed that kaffir lime leaves that were chopped first gave better yields of kaffir lime oil.

Figure 4. Testing Multi-function Equipment of Essential Oil Distiller

However, further process is needed through fractional distillation to separate the components of kaffir lime oil into several compounds, such as Citronellal, Citronellol, and Linalool. The separation of kaffir lime oil needs to be done to produce various aromas that can be used in the fragrance industry.

Customer Development

Grassroots innovation is a spontaneous innovation that people do to solve their problems. Therefore, grassroots innovation needs to strengthen itself with an entrepreneurial culture and innovative spirit so that it has an adventurous spirit and tolerates failure (Hua et al., 2010). In addition, grassroots innovations that act as entrepreneurs must be able to scan the environment, collect information, and form and evaluate assumptions to make accurate judgments and decisions (York & Danes, 2014). Therefore, steps to strengthen grassroots innovation are to build networks at local, national, and international levels to be able to explore product development and, at the same time, customer development. Customer development activities are carried out by holding meetings with the regent and SKPD of the

Tanah Datar Regency, participating in exhibitions organized by the Regional Government Association (at the Jakarta Convention Center), and participating in the 32nd Annual EAIE Conference and Exhibition (Barcelona, Spain).

Figure 5. Meeting with Bupati Tanah Datar

The meeting with the Regent and SKPD of Tanah Datar Regency was an effort to explore the needs and problems related to the development of kaffir lime oil products (Figure 5). At this meeting, they discussed the development of kaffir lime cultivation, the development of derivative products from kaffir lime oil, and the development of digital marketing for kaffir lime oil products and their derivative products. In addition to discussing, the regent tried a sample of massage oil derived from a mixture of catechins and kaffir lime oil.

Figure 6. Exhibition in Jakarta

Furthermore, participating in the exhibition organized by the Association of Local Governments is an effort to introduce kaffir lime oil products at the national level (Figure 6). This activity is a means of building partnerships with various parties to develop kaffir lime products in the Tanah Datar district. In this event, "Karo Fit" was introduced, which is a mixture of catechin (derived from Uncaria gambier) and Citronellal (derived from kaffir lime). This product mix is an example of a superior product collaboration between gambir from Pakpak Bharat district and kaffir lime from the Tanah Datar district.

Furthermore, participated in the Annual EAIE Conference and Exhibition as an effort to introduce kaffir lime products at the international level (Figure 7). This activity also exchanges information and technology to develop essential oil products with green technology.

Figure 7. Exhibition in Barcelona (Spain)

4. CONCLUSION

Grassroots innovation is a network of activists to generate bottom-up solutions according to local needs and based on community values. However, grassroots innovation has limited knowledge, skills, and resources. Therefore, grassroots innovation requires strengthening in terms of knowledge and skills, technology, and networks.

Furthermore, the development of kaffir lime oil products is accompanied by customer development efforts by networking with various parties starting at the district, national and international levels. This effort needs to be made so that kaffir lime oil products and their derivative products can be used as raw materials for the fragrance industry and, at the same time, develop the fragrance industry in the Tanah Datar district. Therefore, the Tanah Datar district government is important in fostering and supporting grassroots innovation, including licensing capital and market access. On the other hand, the University with the Merdeka Campus program can grow the grassroots innovation movement by sharing knowledge, skills, and technology with the community.

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