The role of innovation in the development of melinjo chips agro-industry in Aceh

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Abstract. Melinjo chips are commonly eaten by Indonesian people as a condiment when having the main course. Aceh is one of the well-known areas for producing melinjo chips which yield up to 60 tonnes melinjo seeds in 2017. This paper aims at identifying the current condition of the production of melinjo chips enterprises, quality of products, and production problems faced by melinjo chips SME in Aceh. This paper also proposes recommendations for technology adoption by SMEs. This research took place in Pidie Regency, Aceh Province. The participants were selected using purposive sampling. Production process steps were selecting raw materials, frying, peeling, pounding, and drying. Problems faced by the SMEs are the inconsistency of finished product quality, non-standardized production process, low level of GMP implementation and lack of adoption of new technology. The recommendations are to change the production equipment, apply GMP guidelines for food production, use SNI for grading, and form a cluster.

1. Introduction

Aceh, the most western province of Indonesia, has several top productive crops such as paddy, soybean, corn, and melinjo (Gnetum gnemon). Melinjo plant is native to South East Asia and the western Pacific Ocean Islands. Parts of the plant are widely used in Indonesian cuisine. For instance, melinjo leaves and seeds are cooked in sayur asem (traditional Javanese food) and kuah pliek (traditional Acehnese food), while its seeds are processed into melinjo chips. The chips are commonly eaten by Indonesian people as a condiment when having the main course. The chips are processed from red ripe melinjo seeds roasted in the hot sand to easily remove the shells, pounded flat with a hammer, and sun-dried for a day or two. According to Badan Pusat Statistik [1], in 2018, Pidie Regency yielded up to 7,167.6 tonnes of melinjo seeds and approximately 95% or as many as 2,652 units of the small industries produce melinjo chips that employ 5,304 labours. The data indicates that melinjo chips production is vital for the economic development there, but local communities only produce melinjo chips individually for additional income besides farming as their primary job. However, to increase the quality and competitiveness of small and medium enterprises (SMEs), particularly in the case of melinjo chips SMEs, the technology and innovation that can be adopted into their manufacturing practices should be studied. Hanna and Walsh [2] mention that an SME has to do

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transformations for its survival while has to acclimatise for technology advancing and new products creation for its growth.

SMEs have to innovate in order to survive and grow. Innovation is a process that iterates a business model to build a new market by selecting the right ideas and bring those ideas into the market [3]. Capacity in observing links, noticing opportunities, and using them to gain benefits push innovation to occur. Availability and quality of resources such as capital, knowledge, and people, as well as capabilities in resources management, play crucial roles for a successful innovation [4]. For food SMEs, developing a successful innovation is way more challenging. According to Traill and Grunert [5], it happens because food is a culture element (both in its taste and the way it is consumed), thus the alteration occurs slowly.

According to Hasibuan [6], SMEs face typical constraints such as lack of capital, difficulties in procuring raw materials, lack of access to relevant business information, difficulties in marketing and distribution; low technological capabilities; high transportation costs; communication problems; problems caused by cumbersome and costly bureaucratic procedures, especially in getting the required licenses; and both policies and regulations that generate market distortions. Isjoni [7] agrees with the statement and adds that weak organisation and business management, as well as low quality of human resources to develop innovation, contribute to the slow development of SMEs. Moreover, according to Hasibuan [6], food-producing SMEs, often ignore various standards such as food safety (as part of Good Manufacturing Practices or GMP) and Indonesian National Standard (SNI).

The improvement in technology and innovation application is not seen as critical from the view of the SMEs. The aims of this research are to identify the current products of the SMEs, analyse their problems, and recommend solutions to tackle the problems. The possible advantages of the innovation adoption would encourage the producer to innovate on their production and products. The recommendations to be adopted is to increase the rural economy, particularly for farmers and entrepreneurs in Aceh.

2. Research method
The qualitative research part was conducted using an exploratory approach in which three melinjo chips SMEs in Pidie Regency were selected as respondents using purposive sampling method. Data of current conditions, manufacturing process, and problems of the selected SMEs were acquired by direct observation and interview. Chips samples of all grades that are sold by the SMEs were assessed quantitatively, including moisture content, thickness, and broken chips. Thermogravimetric or oven-drying method (AOAC) was used to test the moisture content, a micrometre screw to measure the thickness, and a laboratory scale to calculate the percentage of the broken chips. Indonesian National Standard or SNI 01-3712-1995 regulates that the high quality of melinjo chips has at maximum 12% of moisture content and 5% of broken chips.

3. Result and discussions

3.1. The current condition of melinjo chips SMEs
Melinjo chips is a processed product from ripe melinjo seeds with a thin and transparent appearance. The equipment and production technology being used are still simple and manually operated by the workers. The production equipment are sands, dry woods, clay stove, pan, hammer, chisel, wooden platform, and drying woven mats from coconut leaves.

The first step of the production process is selecting the good (not rotten) melinjo seeds. The seeds are then roasted in the sand until both the soft and hard shells are able to be removed easily. Next, the seeds are pounded flat on the wooden platform with a hammer that is resulted in thin and transparent chips. These flat chips are then removed from the wooden platform with a chisel, arranged on drying mats, and sun-dried. The whole processes usually take a day to complete.
Figure 1. Production process of melinjo chips (a) Ripe and selected melinjo seeds (b) Frying melinjo seeds in sands (c) Pounding equipment (1) chisel (2) hammer (3) wooden platform (d) Wet melinjo chips.

3.2. Quality of melinjo chips

The dried melinjo chips are sold in nearby markets or stores. In the stores, the dried melinjo chips are sorted into different grades. The grading system does not follow any grading guidelines. The workers grade melinjo chips by rough visual estimation. The assessment results of melinjo chips samples are presented in Table 1.

Table 1. Quality of melinjo chips.

| Store | Sample | Content Of Moisture Content (%) | SNI Max 12% % Broken (w/w) | Sni Max 5% % Broken (w/w) | Thickness (mm) |
|-------|--------|----------------------------------|----------------------------|---------------------------|----------------|
| AD    | AD1    | 12.20 Unqualified                | 3.40 Qualified             | 0.62±0.20                 | ab             |
| AD    | AD2    | 10.67 Qualified                 | 3.38 Qualified             | 0.83±0.40                 | cde            |
| AD    | AD3    | 9.97 Qualified                  | 4.01 Qualified             | 1.05±0.39                 | a              |
| AD    | ADB    | 12.69 Unqualified               | 2.87 Qualified             | 0.60±0.28                 | a              |
| AT    | ATS    | 12.14 Unqualified               | 3.36 Qualified             | 0.75±0.34                 | abcd           |
| AT    | AT1    | 12.31 Unqualified               | 3.23 Qualified             | 0.63±0.22                 | ab             |
| AT    | AT2    | 12.00 Unqualified               | 2.63 Qualified             | 0.64±0.19                 | abc            |
| AT    | AT3    | 11.59 Qualified                 | 4.49 Qualified             | 0.74±0.41                 | abcd           |
| HS    | HS1    | 11.50 Qualified                 | 5.66 Unqualified           | 0.80±0.24                 | acde           |
| HS    | HS2    | 12.70 Unqualified               | 4.90 Qualified             | 0.88±0.30                 | def            |
| HS    | HS3    | 11.29 Qualified                 | 4.47 Qualified             | 0.94±0.41                 | ef             |

Figure 1 depicts the quality of 12 grades melinjo chips from 3 different stores, namely AD, AT, and HS. AD has four grades of chips, i.e. AD1, AD2, AD3, and ADB; AT has four grades, i.e. ATS, AT1, AT2, and AT3; and HS has three grades, i.e. HS1, HS2, and HS3. A smaller number (besides the code of the store) means a higher grade, for instance, AD1 has a higher grade than AD2. In addition, ATS chips are classified with super quality which have higher grade than AT1. In other hand, ADB chips are not sold to customers directly because they are considered as not having adequate dryness, that the store worker re-sundry them for about half a day before the sorting. In general, the chips are not properly sorted according to the quality they have. All grade 1 from the three stores do not have better qualities than the lower grade chips.
Based on SNI, which allows 12% moisture content (weight per weight) at maximum for melinjo chips, 6 of 11 samples were unqualified. The unqualified chips, sorted from the highest to the lowest moisture content, are HS2 (12.70%), ADB (12.69%), AT1 (12.31%), AD1 (12.20%), ATS (2.14%), and AT2 (12.00%). It was surprising because some of grade Super, 1, and 2 chips are unqualified. HS2 has more moisture than ADB, which was considered as not proper to sell. HS2 is supposed to have better quality than HS3 which actually has much less moisture at 11.29%. Furthermore, ATS has less moisture content than AT1 by 0.17% and almost has no difference with AT2. ATS is supposed to have less moisture than AT1 (12.31%), AT2 (12.00%), and AT3 (11.59%). The qualified chips, sorted from the least to the most content of moisture, were AD3 (9.97%), AD2 (10.67%), HS3 (11.29%), HS1 (11.50%), and AT3 (11.59%). Oddly, the measurement pointed out that AD3 has the least moisture among all samples.

In terms of broken chips percentage which SNI regulates 5% (weight per weight) at maximum, all products are classified as high-quality chips, except HS1. It exceeds the limit slightly, with 5.66% of broken chips. AT2 has the smallest percentages at only 2.63%. Surprisingly, ADB, the wet chip that is considered as not proper to sell, has much better quality than the remaining chips. It has the second lowest percentage at only 2.87% of broken chips. The remaining, from the lowest to the highest percentage, are AT1 (3.23%), ATS (3.36), AD2 (3.38%), AD1 (3.40%), AD3 (4.01%), HS3 (4.47%), AT3 (4.49%), and HS2 (4.90%).

The thickness of the chips, despite not being mentioned in the SNI, is measured to assess the homogeneity of the products. All the products do not have homogeneous thickness that could be seen both in Table 1 and Figure 2. Generally, the thickness ranges between 0.64 to 0.94 mm, while the standard of deviation ranges from 0.19 to 0.41 mm. Sorted from the thinnest to the thickest are ADB (0.60±0.28 mm), AD1 (0.62±0.20 mm), AT1 (0.63±0.22 mm), AT2 (0.64±0.19 mm), AT3 (0.74±0.41 mm), ATS (0.75±0.34 mm), HS1 (0.80±0.24 mm), AD2 (0.83±0.40 mm), HS3 (0.94±0.41 mm), HS2 (0.88±0.30 mm), and AD3 (1.05±0.39 mm).

3.3. Identification of problems and recommendation of technology innovation that might be accepted and adopted to address the problems

Melinjo chips SMEs in Aceh use basic technology and non-food-graded equipment for their production. They also do not follow GMP guidelines which GMP application itself is determined to produce good quality processed food, safe for consumption and meet the needs of consumers. All these aspects cause not only laborious production processes, but also heterogeneous products. Finished products quality is not consistent in terms of moisture content, percentage of broken chips, and thickness which is related to the production process, especially in the size and ripeness of raw materials (melinjo seeds), and pounding skills of the workers. In trading, melinjo chips are found graded wrongly. The workers of the stores sort the dry products according to the rough visual estimation, instead of using Indonesian National Standard or SNI 01-3712-1995. The regulation defines characteristics of melinjo chips, namely identical size and appearances as well as dryness and another attributes such as condition (smell, taste, colour, appearance), percentage of broken chips, moisture content, ash, protein, heavy metal contamination (Cu, Pb, Hg, Zn, As), and mold.

In order to cope with these technical problems, there are several solutions in the form of innovation and technology recommendations. The first recommendation is to change the traditional equipment to food-graded mechanical equipment with a roasting timer and a guideline for the size and thickness.
Nevertheless, in the process of transferring this technology requires capital and training which covers both SNI and GMP subjects. Once it is done, it is expected to decrease the intensity of labour and increase production while at the same time to ensure the homogeneity and safety of products. Moreover, the use of SNI will eliminate the loss that all stakeholders (pounders, sellers, and customers) might have. Some aspects to be examined in SNI demand laboratory experiments which is not easily applicable in SMEs that are mostly located in the rural area. Thus, a practical measurement should be applied. For instance, to measure the moisture content, it could be done by calculating the weight of the products before and after drying with a kitchen scale.

Furthermore, melinjo chips SMEs which manufacture their products individually have problems in distribution and marketing because they do not know how to market their product and reach a wider market. They only depend on their existing consumers and word-of-mouth marketing. Thus, the recommendation is to form a cluster. Najib and Kiminami [8] figure out that clustered SMEs have better performance than dispersed SMEs. Waits [9] utters that the concept of an industry cluster allows the enterprises to cooperate with other enterprises within the cluster, as well as with universities and governments. Hanna and Walsh [2] give an interesting example of small firms in Northern Italy that develop clusters with various members, from manufacturers to trade associations and membership service centres to strengthen their market positions in knitwear and ceramics industries. The expert external parties give support by providing training as well as research and development, and capital approach. Purnomo et al. [10] state that collaboration with Universitas Padjajaran has become a successful model for developing SMEs with the assistance of the university. The university has given continuing supports for Ibu Popon cluster to increase its process value that brings noticeable improvement, both in the business and nearby community. The improvements are in the life quality of the community, empowerment of the women, better use of technology, and elaboration of partnerships and networks. Najib and Kiminami [8] pursue that cooperation in clustered SMEs correlates positively with innovation which later brings benefit in better business performance (sales volume, profitability, and market share).

Forming a cluster allows knowledge sharing to materialise within the entrepreneurs. According to Silalahi and Sundiman [11], in Ariron Jaya Tehnik automotive workshop, knowledge sharing becomes a source of innovation for enhancing competitiveness which is used to solve technical problems and improve the services to consumers. Knowledge sharing works both as dissemination and accumulation parts of knowledge. The persistent knowledge sharing from individuals within an enterprise will give continuous improvement that shapes better ways and rise performance of the company. Furthermore, supports from the government are also essential for the development of the SMEs, particularly in clustered SMEs. Governments are recognised as key players that have the capability to link the clusters with banks or other financial firms to allow the capital more accessible by SMEs. Another significant benefit that can be acquired from the government is the development of production technology that can be adopted by SMEs to increase their competitiveness [8].

In term of regulation, governments, both local and national, are recommended to take some steps to encourage SMEs to follow the standardised production process (GMP), such as providing workshop for food producers on how to apply GMP, giving information about the potential for broader market, giving incentive, and exclusive access for GMP-applying SMEs to market their products. These steps can help SMEs because according to Tambunan [12], they depend on their own savings, money from relatives, and credit from informal lenders for financing their daily business operations. Most SMEs have the same reason for ignoring the regulations that are existed, such as GMP guidelines and PerKBPOM 2014 No. 11. While GMP regulates how food products must be manufactured, PerKBPOM 2014 No. 11 strengthen the application of GMP. It commands all food products must have been processed according to GMP guidelines before distributed to the market. The process to acquire the GMP license is actually not easy, because there are 16 aspects that have to be inspected that mostly hard to fill by SMEs. GMP regulation covers location, building, sanitary facilities, equipment and utensils, materials, process monitoring, final product, laboratory, personnel, packing, label and food description, warehousing, maintenance and sanitary program, transportation,
documentation and recording, training, product recall, and implementation of guidelines. From the view of the regulators, better monitoring and firmer implementation should be taken. Nevertheless, the SMEs ignorance is exacerbated by the bureaucratic procedures which are so cumbersome and costly that entrepreneurs have difficulties in acquiring the GMP license [13]. Therefore, related parties should give easier access for SMEs to acquire the licence.

In addition, increasing products awareness in customers and producers are also necessary. It could be done by spreading product awareness through social media. Social media is considered as a cheap, but powerful channel that has vast coverage. Both customers and producers should be informed about the quality and safety of products. Furthermore, as a key that determines the success of a product, customers can give feedback, thus, drag the producers to innovate and make better products.

4. Conclusion
Melinjo chips SMEs in Aceh use basic technology, non-food-grade utensils, unstandardised production process and grading system. They are not aware of the importance of innovation and do not know how to innovate and depend on other parties for their development and marketing. The recommendations that might be adopted are to alter the equipment, follow the GMP guidelines for the production, manufacture SNI-based chips, and form a cluster. In summary, to innovate and have higher competitiveness, melinjo chips SMEs in Aceh should be aware of their limitations and open for the innovation and technology recommendation, while all stakeholders should support with their own capabilities.

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