

# Development of Sheet Jam from Various Local Materials and Ecopreneurship for Application in the Early Revolution of Industry 4.0

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**Abstract**—This research is a research and development based on technopreneurship in the form of experiment with new innovation which has found sheet jam from various local material and ecopreneurship. It aims to develop the product sheet jam of various local materials based on ecopreneurship that is watermelon, yellow pumpkin, black plum, and lontar palm. So far there has been no sheet jam available in the market. Therefore, to support the industrial revolution 4.0 with an emphasis on food processing technology in the food and beverage industry, the researcher has made new innovations by utilizing local materials and ecopreneurship based on new products. This product was provided by factory-based technopreneurship touches so that the results can be developed into local-based entrepreneurship by taking into account the ecosystem. This research involved five students of Home industry department. From the experimental results, it has been found four products of sheet jam made from different materials. For hedonic test and quality, data were collected using questionnaires. Similarly, Organoleptic tests were also conducted by using color, taste, texture, aroma, quality indicators. There were 25 panelists involved in the test, namely trained (10 peoples), untrained (10 peoples) and consumer panelists (5 peoples). All products are innovated by doing three experiments until the result is favored and fulfill the factory standard. Data were analyzed with SPSS program for percentage and mean test. The results of the third experimental test that became the final product and prototype model to be developed further. The results have found sheet jam of watermelon, yellow pumpkin, black plum fruit, lontar palm fruit.

**Keywords**—*innovation, sheet jam, local materials, industrial revolution 4.0, ecopreneurship*

## I. INTRODUCTION

Sheet Jam is a jam made from various ingredients and printed in sheet form and can be served together with fresh bread or other cakes. Development innovation is a new process or idea that is carried out to produce something new that is different from the previous one so that it is more useful and efficient. Various Local Materials and Ecopreneurship used in this research are watermelon fruit, yellow pumpkin, black plum fruit, and lontar palm fruit. Ecopreneurship concept is often equated with green entrepreneurship, environmental entrepreneurship, and technopreneurship with technological ecopreneurship [1]. In food technology, Industrial 4.0 Revolution focused more on food innovation and security. Definition of diverse Industry 4.0 varied. The German Chancellor, Angela Merkel [2]

argues that Industry 4.0 is a comprehensive transformation of all aspects of production in the industry through the incorporation of digital technology and the internet with conventional industries [2]. Schlechtendahl et al. [3] emphasize the definition of the element of speed from the availability of information, namely an industrial environment where all entities are always connected and able to share information with one another. A more technical understanding, by Kagermann et al. [4] that Industry 4.0 is the integration of Cyber-Physical System (CPS) and the Internet of Things and Services (IoT and IoS) into industrial processes including manufacturing and logistics and other processes[4]. Hermann et al. added that Industry 4.0 is a term to refer to a set of technologies and value chain organizations in the form of smart factories [5]. From the above explanations, Industry 4.0 can be interpreted as an industrial era where all entities in it can communicate with each other in real time at any time based on the use of internet technology and CPS to achieve the goal of achieving new value creation or optimization of existing values from every process in the industry.

The relationship of Revolution Industrial 4.0 with food technology as the key in the industry is food innovation and security. Industry 4.0 is predicted to have great potential benefits regarding improving the speed of production flexibility, improving services to customers and increasing revenue. Drath and Horch stated that the challenge faced by a country when implementing Industry 4.0 is the emergence of resistance to changes in demography and social aspects, instability of political conditions, limited resources, the risk of natural disasters and the demand for the application of environmentally friendly technologies [6]. Its relationship with food technology according to Akita and Hermawan that the strategy and innovation of the food sector answer the challenges of the industrial era 4.0 and the food and beverage home industry sector is an example of the implementation of industry 4.0 [7]. The food and beverage industry is determined as one of the national manufacturing sectors that have been ready to be a pilot for the application of Industry 4.0 technology in the country. They further explained that the food and beverage industry in Indonesia has the potential to become a champion because the supply and the user are numerous. Therefore, the key to the food industry is food innovation and security.

The Indonesian Food Innovation of the fourth industrial revolution era has prepared its strategic steps by creating product innovations in the food and beverage industry, and

business innovation [8]. These made authors interested to develop an innovation of sheet jam from various material based ecopreneurship because the product has not been found yet in the market, but it has potential and innovation to increase economy and open the new jobs. The support of the establishment of the Indonesian Food Innovation and Business Innovation is urgent to develop to increase the income of society.

Hawken et al. [9] believe that the fourth industrial revolution becomes a big leap for every national industrial sector, where information and communication technology will be fully utilized, not only in the production process but also throughout the industrial value chain. This can give birth to new business models with a digital basis to achieve high efficiency and better product quality. The initial application in the Industrial Revolution 4.0 required to make product innovation. Product Innovation is an activity to make changes in production in order to reduce production and operational costs, increase the amount of production and improve product quality. It strives for production to run as efficiently and effectively as possible. The basic concept of innovation has five aspects, namely Simplify, Combine, Integrate, Re-arrange, and Eliminate [10].

This article tries to discuss the development of sheet jam which has made from various local and ecopreneurship materials. The sheet jam has not available yet on the market and is completely new and innovative, so it needs to be developed. The aim of the research is to utilize existing local materials in an environment that is easily available, available everywhere, makes it easy to get raw materials in Makassar. This can increase added and selling valued raw materials of the products. Its manufacturing process can also be easily done.

All of the fruits used in the product such as watermelon, yellow pumpkin, java plum, and lontar palm grow a lot in Makassar, easy to be found but the utilization is not known yet by Makassar people. The fruit is delicious, but the price is low, often wasted and became garbage so that it damages the environment. The benefits are very much, and the nutritional content variously and is very much needed. Therefore, it needs to be socialized to the community by innovating product development to be a popular product with the community. The price is can be increased and can be made as an entrepreneurial with local raw materials that are useful to improve people's life. All of them are very delicious and suitable to make a sheet jam.



Fig. 1. Watermelon, yellow pumpkin, Java plum, Palmyra

## II. RESEARCH METHODS

This research uses Research and Development (R & D) that aims to develop sheets of locally based environmental ingredients. This research is a type of quasi-experimental research by choosing one shot case (XO) [11].

The research was conducted at the laboratory of home industry department in Universitas Negeri Makassar by using four different fruits namely watermelon, yellow pumpkin, java plum, and lontar palm. The experimental trials have been conducted three times involving five students and have produced a prototype of the jam product model in accordance with factory standards that are marketable and favored by panelists and consumers.

The research procedure started from the pre-survey for preliminary findings on materials, theoretical and prescription studies, model development designs, realization, and model building /of prototypes product which carried out three times in the laboratory. Data collection techniques used organoleptic tests by 25 panelists and used data source triangulation techniques, with the instrument checklist, observation, interviews, document analysis, Forum Group Discussion (FGD), review the development of the sheet jam model. Organoleptic tests are used for hedonic and hedonic quality tests. Organoleptic tests have collected data on laboratory results by panelists with observation, interviews, FGD, and questionnaires [12].

Data are processed and analyzed using descriptive analysis with the help of the SPSS program. Qualitative data is analyzed qualitatively. Performance Indicator is a prototype model of sheet products. A prototype model of the product is watermelon, yellow pumpkin, java plum, lontar palm sheet jam that have a savory and sweet taste, according to the quality of industrial production.

After the sheets jam were examined in the laboratory, the data was collected by conducting organoleptic tests with 25 trained panelists to obtain the best production model that was most preferred and feasible to be developed according to industry needs. This method has been done using triangulation data collection techniques and works well. Organoleptic testing is a test by using the human senses as the main tool for measuring the acceptance of the product and its quality. Sense-organ is used to assess a food and beverage product that relates to four main criteria, namely taste, color, texture, and aroma. The four are assessed for hedonic and hedonic quality tests. Stone explained that organoleptic testing is the testing of food products based on the level of preference and willingness to use a product. In organoleptic testing, panelists are needed to make an assessment [13]. There are 7 kinds of panels that are usually chosen to be used, namely (1) Individual experts, (2) Small expert panels, (3) trained panels, (4) Untrained panels, (5) Panels rather trained, (6) Consumer panel, (7) Children's panel [13]. This study uses 25 trained panelists.

## III. RESULT AND DISCUSSION

The final results were tested through experimental three times from the last recipe.

### A. Watermelon Sheet Jam

Watermelon is cooked 200 grams, added with 100 grams of sugar, and puree with a blender until smooth. Then, the

result was poured into a pan and add with jelly powder that has been made with 200 ml of water, 2 grams of salt, 5 grams of butter, enough vanilla. Then it should be mixed and cook until thickened and pour the crack that has been moistened with water. Let the new cold cut into pieces according to the size of the sliced bread. The final product then is packaged and labeled. The product has to be stored in the refrigerator and ready to be served with bread or cake.

**B. Yellow Pumpkin Sheet Jam**

The jam was made from An old, cooked pumpkin 250 grams, 150 grams of granulated sugar, 16 grams of flavorless jelly powder, 5 grams of margarine, 750 ml of water, (with or without milk and eggs), and 1 tablespoon of cinnamon. All ingredients are mixed and stirred until smooth and cook until boiled and thick. The mixed ingredients were poured into a rectangular mold that has been wet with water until it is 3-5 mm thick. The results were chilled and cut into pieces. The final product then is packaged and labeled. The product has to be stored in the refrigerator and ready to be served with bread or cake.

**C. Java Plum Sheet Jam**

The jam was made from 300 grams of seedless java plum, 500 grams of granulated sugar, 15 grams of jelly powder, 3 grams of citrus, 3 grams of salt, 15 grams of butter, 400 ml of water, 1 teaspoon of vanilla. Java plum, sugar, and 200 ml of water. All were blended until smooth. It was then added with the dissolved jelly powder with 200 ml of water, salt, butter, vanilla and stirred until blended. The mixed ingredients were cooked until boiled and thick. It was then poured into molds that have been moistened with a thickness of 2-3 mm and cooled. After the cold, it was cut into pieces according to the size of the bread. The final product then is packaged and labeled. The product has to be stored in the refrigerator and ready to be served with bread or cake.

**D. Palmyra Sheet Jam**

The jam was made from 250 grams lontar palm, 150 grams of granulated sugar, 15 grams of flavorless jelly powder, 300 cc of water, 1/2 cup of milk, 1 teaspoon of

vanilla, 5 grams of butter, no preservatives and coloring. Lontar palm was peeled clean, washed, cut into pieces and mashed with a blender. It was then mixed with sugar, vanilla, jelly powder mixed with water, mix well and cook until boiled and mature taro. Then add milk, mix well and cook until thick. Prepare a rectangular mold, wet and print it with certain specificities according to taste. Let the new cold slice as much as white bread. Give plastic packaging with labels and store them in the refrigerator or ready to be marketed or ready to be served with fresh bread or cake. The result is as follows:



Fig. 2. Watermelon, Pumpkin, Java Plum, Lontar palm Sheet jam

All of these products are tested by organoleptic for hedonic testing and hedonic quality.

Description: Organoleptic test for hedonic assessment and hedonic quality: with scale 1-5. Hedonic Assessment: 1 = Very Unlike, 2 = Don't Likes, 3=Somewhat Likes, 4 = Likes, 5 = Very Likes. Hedonic Quality Assessment: 1 = Not Very Good, 2 = Not Good, 3 = Somewhat Good, 4 = Good, 5 = Very Good.

Summary of the last organoleptic test results by panelists for the hedonic and hedonic quality test can be seen in tables 1, 2 and 3.

TABLE I. SUMMARY OF HEDONIC ASSESSMENT RESULT OF THE LAST EXPERIMENTAL RESEARCH

Model Product	Aroma					Color					Texture					Flavor				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1. Watermelon Sheet Selay /f	0	0	5	10	10	0	0	0	8	17	0	0	0	12	13	0	0	0	11	14
%	0	0	20	40	40	0	0	8	32	68	0	0	0	48	52	0	0	0	44	56
2. Yellow pumkin Sheet Selay/f	0	0	4	11	10	0	0	4	10	11	0	0	0	10	15	0	0	0	14	11
%	0	0	16	44	40	0	0	16	40	44	0	0	0	40	60	0	0	0	56	44
3. Sheet Selay Java Plum /f	0	0	0	7	18	0	0	0	0	25	0	0	0	8	17	0	0	0	7	18
%	0	0	0	28	72	0	0	0	0	100	0	0	0	32	68	0	0	0	28	72
4. Sheet Selay Palmyra Fruit/f	0	0	5	14	6	0	0	6	12	7	0	0	0	9	16	0	0	2	10	13
%			10	56	24	0	0	24	48	28	0	0	0	36	64	0	0	8	40	52

**TABLE II. SUMMARY OF HEDONIC QUALITY ASSESSMENT RESULT OF THE LAST EXPERIMENTAL RESEARCH**

Model Product	Aroma					Color					Texture					Flavor				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1. Watermelon Sheet Selay /f	0	0	4	10	11	0	0	0	10	15	0	0	0	12	13	0	0	0	10	15
%	0	0	16	40	44	0	0	8	40	60	0	0	0	48	52	0	0	0	40	60
2. Yellow pumkin Sheet Selay/f	0	0	4	14	7	0	0	4	16	5	0	0	0	12	13	0	0	0	12	13
%	0	0	16	44	40	0	0	16	40	4	0	0	0	40	60	0	0	0	56	44
3. Sheet Selay Java Plum /f	0	0	0	5	20	0	0	0	0	25	0	0	0	5	20	0	0	0	4	21
%	0	0	0	28	72	0	0	0	0	100	0	0	0	32	68	0	0	0	28	72
4. Sheet Selay Palmyra Fruit/f	0	0	8	10	7	0	0	0	2	23	0	0	0	7	18	0	0	0	11	14
%	0	0	32	40	28	0	0	0	8	92	0	0	0	28	72	0	0	0	44	56

### E. Discussion

The results of experimental research can be explained that the acceptance of panelists and consumers on the aroma, color, texture, flavor are as follows:

1) *Aroma*. In terms of the aroma of the sheet jam that uses java plum which is most preferred because of its quality is the best among others. The mean value is far above the average value (4.72). High frequency and percentage and very liked.

2) *Colour*. When viewed in terms of color, the quality of the experimental results that are the best in term of color and the preferred quality is sheet jam from java plum fruit (5). Others are also very popular because they are considered to be in very good quality. The most preferred color is java plum, then watermelon, yellow pumpkin, and the last is lontar palm. Some of the panelists preferred to have white coloring, which means it is still original. However some of them also those recommend adding coloring agents.

3) *Texture*. In terms of texture, most of the panelist like the texture very much because the quality is also very good. The most preferred texture is the jam from java plum (4.68) because of its freshness, just as watermelon and yellow pumpkin.

4) *Flavor*. The taste determines the quality of a product. From all the results of the experimental product, the most favorite sheet is java plum jam (4.72) because it is considered to be the best quality (4.84). The next is a fresh watermelon sheet jam, followed by lontar palm and yellow pumpkin sheet jam.

### IV. CONCLUSION

From the results of the study, it can be concluded that various local environmentally-based ingredients can be made into sheets by providing the right technology touch and can be tested repeatedly through organoleptic tests from experimental research. The innovation of the development of sheet jam was produced from local ecopreneurship-based ingredients such as watermelon, yellow pumpkin, java palm, and lontar palm fruit. It has been tested by experiment three

times with an organoleptic test for hedonic test and hedonic quality test. Through this research of four local materials which have been tested and there are many other local materials that can be developed through research innovation. This research can be developed into an entrepreneurial to create new jobs and to improve people's living standards.

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