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Increasing the competitiveness of local soybean-based tempeh SMI through disruptive innovation

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Abstract

Tempeh industry is included in the category of small and medium food industry (food SMI) which involves relatively a good number of business actors from the lower class economic community. Unfortunately, in many cases there are various problems related to the tempeh industry. The chief problem encountered in tempeh production is that the raw material—the soybeans—are dominated by overseas supplies, particularly from the USA. On the other hand, public perceptions, especially those of the majority of tempeh producers, opine that imported soybeans are superior to local beans viewed from physical and economic aspects. This is naturally very unfortunate since research findings have shown that tempeh made of local soybeans in some varieties has more superior qualities in their physicochemical and organoleptic properties, as well as being healthier due to being free of genetic engineering (GMO).

The physicochemical data of soybeans and *tempeh* were obtained through laboratory tests, whereas the socio-economic factors were obtained through surveys completed with in-depth interviews and focus-group discussions. The research site was deliberately determined to be the Sanan Center for Tempeh Industry and Tempeh Crackers in Malang. The choice of the location was based on the consideration that Sanan tempeh industry was one of the largest tempeh and tempeh crackers processing industries in Malang City. Primary data of the socio-economic aspects was collected via interviews with six tempeh producers and was based on the following prerequisites: 1) tempeh producers with more than 20 years' experience in running tempeh industry; 2) tempeh producers who used two varieties of soybeans, namely local and imported soybeans; 3) age range between 30-70 years old. The laboratory data used to confront the perception results consists of: water content, ash content, protein content, carbohydrate content, yield, texture, color, taste, odor, preference, density, weight/seed size, seed skin color, antioxidant and phenolic levels.

The research results for tempeh-producers preference toward local and imported soybeans as raw materials are: 1) imported soybeans excel in several aspects, i.e. larger size, better rising tempeh, better color, more identical in shape and cleaner, lower price, and more widely available; 2) local soybeans are perceived by tempeh producers as superior only in its more savory taste. However, laboratory test results gave some different results, such as: 1) the sizes of local soybeans (grobogan, argomulyo, panderman) are larger than imported beans; 2) local soybeans (bromo) have higher rising power than imported beans (local density < imported density); 4) local yield (anjasmoro, argomulyo, grobogan) are higher than imported ones; 5) the protein content in local soybeans are higher than imported beans; 6) the antioxidant and phenolic levels of local soybeans (grobogan) are higher than imported ones; the organoleptic properties (taste, color, odor, preference) of local tempeh (wilis, bromo, baluran, anjasmoro) have higher values than that of imported beans. Conclusions to improve the competitiveness of tempeh made from local soybeans, the disruptive innovation is to expose the benefits of tempeh products from the aspects of nutrition (protein and yield), organoleptic (taste), health (antioxidants, dietary fiber and GMO-free).

Keywords: Disruptive innovation, Tempeh SMI, Local and imported soybeans, Competitiveness

1. Introduction

Soybeans is the key raw material for tempeh, one of Indonesia's traditional foods which have the potential as a community source of nutrition. The portion of soybeans as material for tempeh is the largest (reaching 57%), the other 30% is for tofu and the rest for other related processed products. Unfortunately, to this date the national soybean demand still relies on imports (reaching 68%), equivalent to 2.26 million tons [1] dominated by imported products from the USA. This is very unfortunate because research findings have shown that tempeh made of local soybeans are more superior seen from the physicochemical and organoleptic properties, as well as healthier being free from genetic engineering. From the socioeconomic aspects, especially from tempeh producers' public preferences, opposing findings have been found except for taste, resulting in local soybeans look inferior compared to imported soybeans as tempeh raw material. This would exacerbate our country's dependence as soybean importer, since local soybeans are hard to sell in domestic markets and farmers are consequently have less interest in growing soybeans. It is very possible that local soybeans which actually have better taste and are healthier may become extinct in the future. This is evidenced by the increasingly complicated problems when soybean demands continue to increase in line with the increase in population growth and awareness of health quality. On the other hand, this demand has not been offset with an increase in domestic soybean production; since 1975 Indonesia has shifted its position from exporter to importer.

Interestingly, some important findings suggest that the quality of local soybeans actually is more superior to imported soybeans. One indicator is its more savory flavor [2]. In addition, local-national soybeans are viewed as healthier as they are free from the potential danger of genetic engineering

(Genetic Modified Organism) which has become a current global health issue. At present, the hegemony of capital-intensive industries has led to a structural dependence of the tempeh SMI to imported soybeans, which in turn has led to the elimination of local-national soybeans the material for tempeh industry and has weakened the national tempeh food security. In fact, a study [3] and a preliminary study conducted by a researcher team at a tempeh industry center in Malang showed that various local soybean varieties have a variety of potentials that not only meet the nutrition and health demands, but also market tastes. Therefore, innovative steps are needed to encourage the utilization of local-national sources as well as an effort towards food independence and sovereignty.

Associated with the latest innovations to generate techno-social changes, there is a concept known as 'disruptive innovation' [3]. Disruptive innovation refers to a renewal of institutional/organizational models to overcome conventional business domination. Some exemplar private and public companies have applied this type of innovation, including non-food industries, such as automotive industry in Sweden [4]; telecommunication industry, computer pharmacy, and e-commerce in China [5]; and multimedia industry in Malaysia [6]. Hence this study uses the concept of disruptive innovation as an entry point for developing tempeh industry which has the specific local-national characteristics that are independent of the dominance of capital-intensive industries, in relation to its raw material supply, production process, and marketing.

Perception is a process by which an individual chooses, organizes, and interprets an information input to create a meaningful picture of the world [7]. Perception may involve an individual's understanding of an event based on past experiences [8]. This makes Kotler [9] argue that individuals may possess different perceptions of the same object due to the three processes of perception: 1) selective attention; 2) selective distortion; and 3) selective

retention. Perception is shaped by a number of indicators which comprise knowledge, experience, and needs [10].

According to [11], tempeh is a processed soy product whose nutritional value has been increased, in particular components such as protein, fat, carbohydrates, and vitamins. Furthermore, the nutritional content of tempeh also dissolves easily in water and thus is easier to digest compared to soybeans. Moreover, soybeans are susceptible to damage by anti-nutrition substances, which can be avoided if the material is processed into tempeh. Fermentation causes degradation of soybean components which in fact produces a distinctive taste and aroma in tempeh. While the nutritional value of tempeh is slightly lower than that of soybeans, qualitatively it has higher nutritional value due to having better digestibility value: the level of protein soluble in water increases due to the presence of proteolytic enzyme activity [12].

2. Methods

To find out the perception of tempeh producers on raw soybean materials, the method used is case study to answer fundamental questions “why” and “how” a phenomenon studied occurs. The research location was deliberately determined to be Sanan Center for Tempeh Industry and Tempeh Crackers in Malang City. The location was chosen with the consideration that Sanan tempeh industry is one of the largest tempeh processing and tempeh crackers industry in Malang and has been well-known for many years. Primary data was collected by interviewing six tempeh producers who had been chosen with these prerequisites: 1) tempeh producers with more than 20 years of experience; 2) used two types of soybeans—local and imported; and 3) age range between 30-70 years old. The number is deemed sufficient to provide a detailed description regarding the purpose of this research. The researchers also conducted a non-participant observation, in which the researchers observed the participants’ behavior without actively participating themselves in their activities. In this case, the researchers used field notes and took some relevant photographs, which can help interpreting the data obtained from the interviews.

Whereas the laboratory physicochemical test data was based on reviews on previous research results so that the data can be used to compare the tempeh producers’ perception results and to find out whether the two data groups are in line or even contradict each other. The data obtained comprises water content, ash content, protein content, carbohydrate content, yield, texture, taste, odor, preference, density, weight/seed size, seed skin color, and antioxidant and phenolic levels.

3. Result and discussion

Tempeh producers’ perception on local and imported soybeans as raw material for tempeh production is presented in Table 1.

Table 1. Tempeh producers’ perception on local and imported soybeans

Criteria	Local Soybeans	Imported Soybeans
Size	Seeds are small and dissimilar in bulk	Seeds are large and uniform in bulk
Color	White and a little dull	Bright white
Cleanliness	Mixed with small stones, wood, corn, and soybeans	Mixed with corn
Taste	Savory	Non savory
Price	± IDR 8.000	±IDR 7.000-7.500
Availability	Not available in stores in Sanan Village	Available in large amount in stores in Sanan Village
Color	Dull	Brighter yellow
Cleanliness	Dirty	Not too dirty
	Mixed with gravel, clay, and wood	Mixed with corn
Seed size	Small	Large

Source: [13]

Table 1 suggests that tempeh producers’ perception on soybeans as raw material is, for local soybeans: 1) has more savory taste as tempeh; 2) the dull color of

the beans is caused by a mixture of dirt, gravel, wood, and soybean skin; 3) due to the small and dissimilar size of the seeds, the beans could easily slide through the slipping process (the process of removing soybean skin via a machine); 4) during the fermentation process, local soybeans do not rise. For imported soybeans: 1) the color of the beans is brighter and a little whiter; 2) there is no muck contaminant except corn; 3) the larger and uniform size of the seeds facilitates the slipping process; 4) during the fermentation process, imported soybeans do rise.

Next, the results of the reviewed laboratory physicochemical tests for local and imported soybeans are presented in Tables 2, 3, and 4.

Table 2. Antioxidant Activity, Phenolic Levels, and Food Fiber in Local Soybeans vs. Imported Soybeans

Soybean Variety	Antioxidant Activity (mg/g)	Phenolic Level (mg/g)	Food Fiber (%)*
Grobogan	0.1197±0.053	4.9835±0.22	6.53±0.06
Imported	0.1043±0.004	4.3247±0.25	6.21±0.09

Source: [14], *[15]

Table 3. The Physicochemical of Local Soybeans vs. Imported Soybeans

Soybean Variety	Grobogan	Imported
Water content (%)	13.27 ± 1.0516	11.42 ± 0.4278
Ash content (%)	4.47 ± 1.2015	5.1 ± 0.4310
Protein content (%)	32.58 ± 6.1497	31.47 ± 2.3452
Carbohydrate content (%)	4.33 ± 1.7164	4.09 ± 2.5181
Density (g/ml) *	0.65 (Bromo)	0.68
Yield (%)**	152.50 (Burangrang)	138.40

Source: [16], *[17], **[2]

Table 4. Seed Size (weight of 100 seeds) and Seed Color of Local Soybeans vs. Imported Soybeans

Soybean Variety	Weight of 100 seeds (g)	Color of Seed
Argomulyo	18 - 19	yellow
Grobogan	18	yellow
Panderman	15 - 17	yellow
Imported	14.80-15.80	yellow

Source: [2]

In tables (2, 3, 4) the results of physicochemical and organoleptic tests show that: 1) the sizes of local soybeans [grobogan (18), argomulyo (18-19), panderman (15-17)] are larger than that of imported soybeans (14.8-15.8); 2) local soybeans (bromo) have higher rising power compared to imported soybeans [local density (0.65) < imported density (0.68)]; 3) the color of local soybeans [grobogan (yellow), argomulyo (yellow), panderman (yellow)] is the same as that of imported soybeans (yellow); 4) local yield [burangrang (152.5)] is higher than imported yield (138.4); 5) the protein content of local soybeans [grobogan (32.58 + 6.1497)] is higher than that of imported soybeans (31.47 + 2.3452); 6) the antioxidant and phenolic levels of local soybeans [grobogan (0.1197 + 0.053 and 4.9835 + 0.2206, respectively)] are higher than those of imported soybeans (0.1043 + 0.0047 and 4.3247 + 0.2546, respectively); 7) the organoleptic values (taste, color, odor, preference) of tempeh made of local soybeans (wilis, bromo, baluran, anjasmoro) are higher than those of tempeh made of imported soybeans.

4. Conclusion

The conclusion derived from the results of this study is that the perception of tempeh producers on the physical and chemical of local soybeans as raw material for tempeh production, in which they judge local soybeans as inferior to imported soybeans, is very subjective since it is not in accordance with the results of laboratory tests. Nevertheless, their perception on availability and prices of the material is in accordance with field facts. In order to improve the competitiveness of tempeh made of local soybeans the disruptive innovation conducted is to expose the superiority of tempeh products from aspects of nutrition (protein and rendemen), organoleptic (taste), health (antioxidants, dietary fiber, and GMO-free).

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