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Cuttle fish crackers product quality control to reduce total of product defects in trading company Ardial, Banyuwangi Regency

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Abstract

Quality control of the product cuttle fish crackers at trading company Ardial Banyuwangi regency is very important, because it will have an impact on improving the quality of production quantities primarily to a decrease in the number of defective products and customer satisfaction in Banyuwangi, East Java, Indonesia. The purpose of this research is to reduce the number of defective products cuttle fish crackers in the trading company Ardial. The research method used is six sigma and causal analysis using fishbone diagrams. The results showed that the calculation of the six sigma method generates the value of DPMO (Defects Per Million Opportunities) at 3.20 (color, flavor, and crispness), 3.15 (density shapes, broken, torn, and chipped), and 3.18 (delicious and savory) which means that these three variables is less than 6 sigma, it needs to be improved to reduce the number of defective products in the trading company Ardial Banyuwangi. The results of the causal analysis using fishbone diagrams to mismatches that occur in cuttle fish cracker products show needs improvement on the lighting in the production room, enhancing the employability of workers, broaden the place of production and the need for maintenance on crackers cutting machine tools, maximizing the use of raw materials and cuttle fish use of sunlight in the drying process, and precision measurement scales glittering in the main raw material ie cuttle fish.

Introduction

In the competitive world of industry is very high in providing the best service to consumers, the company must maintain the quality of the product because it has a very important role. The quality of a product has become a basic factor in the decision of consumers choosing a product, a result that product quality is the key factor that into the company's goals for the company to compete with other companies. The entrepreneurs who want to grow their business must work hard to seek new opportunities in terms of best quality where quality must be maintained or even developed into a better direction. In a production system, the quality of the resulting product plays a very important. The quality of a product has become the basis of consumer decision factors in choosing a product, consequently the quality of the products is a key factor that can bring success to the company's objectives and will be able to improve the competitiveness of the companies that make similar products.

Demand for seafood is increasing due to the increase in the level of consumption of the world's population and increased awareness of the nutritional quality of fishery resources (Emberg *et al.*, 2001). Fish is an excellent source of protein, minerals and vitamins but low in fat, cholesterol and sodium (Gamal and Shamery, 2010; Saritha and Patterson, 2012: Jianadasa *et al*., 2014). The quality of the freshness of the fish plays an important role in human health and consumer acceptance as well as in the international fisheries trade. More recently, with food security is an important issue which is of great concern in the world, the determination and evaluation of the freshness of the fish is much more significant in research and development (Cheng *et al*., 2013).

Development of new products from new sources becomes imperative to capture the flavor of different people with different food habits. Light and crunchy foods rich in nutrition and healthy for the body is desired by consumers (Rohani *et al.*, 2010). Crackers cuttle fish is one of the products processed snack crackers are crisp made from raw materials that are rich in protein (Borderias *et al*., 2005).

Ardial trading company in Banyuwangi is a home industry engaged in the manufacture and sale of food souvenirs typical of Banyuwangi, one of which manages the raw materials meat and cuttle fish ink to be used cuttle fish crackers. To meet the needs of consumers, trading companies Ardial in Banyuwangi hope to maximum satisfaction to the consumer in the

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form of taste and appearance. Production of cuttle fish crackers produced by the trading company Ardial of 150 packs or 150 kg per day, while the demand in the market at 250 kg per day. Unmet demand in the market and there are still many discrepancies or defects in the production process in the cuttle fish crackers trading company Ardial be a problem to be solved, so that the research must be done using the method of quality control by using six sigma which aims to provide solutions to improve and control cuttle fish cracker production process that is expected to reduce the number of defective products.

Materials and Methods

This research was conducted in a trading company Ardial in Banyuwangi and implemented in May to April 2014. The number of panelists as many as 155 respondents who represent the cuttle fish crackers fan Ardial trading company in Banyuwangi which mostly women by 89 people (57%) and men by 66 people (43%). The number of respondents whose age is less than 12 years at 0%, 13-23 years at much as 33%, 24-44 years at 50%, and more than 45 years at 17%. Profession of respondents who had a job as a civil servant by 7%, 28% self-employed, private employees at 17%, housewives at 22%, 18% students and students at 8%. The results of the primary data, and then used to analyze the variables that can affect the level of importance and satisfaction level of product quality with cuttle fish crackers in Ardial trading company. Data processing includes processing the level of importance and satisfaction levels are tested for validity and reliability, the data can be said to be valid if the large value of corrected item total correlation is positive and greater than the value of table-r pearson product moment at α 0.05, while reliably if the value of cronbach alpha greater than 0.5 (Santoso and Tjiptono, 2002). The next step is the analysis of data using the map control C. Map control C has the ability to detect or separate the unexpected causes of variability of quality, so it can be used to locate and fix a disorder that arises during the production process. The basic form chart consist of three horizontal bands, which contains a center line and two lines control. Line middle is the average value of the quality characteristic and two control lines serves as the upper control limit and lower control limit. Control line distance from the center line is calculated based on statistical theory, therefore, if the process under control then all sample points will fall between the two lines (Gaspersz, 2002). Data processing was followed by using six sigma to compute the value of DPMO (Defects Per Million Opportunities). Calculation of DPMO is obtained from the formula:

DPMO = [Many of the products are defective / (Many products are inspected x CTQ Potential)] x 1,000,000

After a calculated using the six sigma method, followed by a causal analysis using fishbone diagrams.

Result and Discussion

Color, flavor, and crispness

Trading company Ardial per day can produce 30 to 40 kg or about 140 to 150 packs of cuttle fish crackers. Because there are many products that defects in it then needs to be investigated further to reduce the number of defective products. In trading company Ardial there are already tools or machines used for production equipment such as printing equipment, oven, refrigerator, cutlery crackers, seller (press plastic tool). The results of the questionnaire showed that very low levels of consumer satisfaction with a percentage of 45% was not satisfied and 55% dissatisfied, while the high level of importance to the important percentage of 32% and 68% very important, so it should be looking for the cause and how to overcome them. Based on the questionnaires received many customer complaints that this cuttle fish crackers there are defective products, among others, as color is not attractive, not crunchy, and taste typical of cuttle fish is not felt. For that we need improvements in the production process with quality control methods using the map controls C.

The results of the analysis showed that the C control map data that is outside the control limits (out of control) which is above the upper control limit and under the lower control limit with the results of the upper control limit at 33.04, average at 19.72 and control limits below at 6.40, it is necessary to conduct the examination in the production process to find the cause of the data coming out of the control limits. The results of examination of the data out of control due to decreased human labor power. Table 1 is a table of the total number of defects including type of product is not attractive colors, not crisp, distinctive flavor cuttle fish is not felt during the production of 25 days at trading company Ardial with a total production of 3,750 packs of cuttle fish crackers.

Furthermore, through the conversion of DPMO to sigma value by looking at the table appendix 5 of the book Gaspersz (2002), note that for DPMO = 43,822.22 is closest to the DPMO = 44,565 on the value of sigma = 3.20. Because this number is less

Table 1. Data of all types of defects cuttle fish crackers for 25 days at trading company Ardial

No	Defect type	Total defects (packs)	Percentages (%)
1	Color is not attractive	196	39.8
2	Not crunchy	148	30.2
3	Typical cuttle fish flavor does not taste	149	30
	Total	493	100

than 6 sigma, it needs to be fixed. To repair the next step is to use a fishbone diagram.

Figure 1 shows the causal analysis of the output of defective products on cuttle fish crackers at trading company Ardial. Results of analysis of cause and effect that causes defects in cuttle fish crackers at trading company Ardial, among others;

a) The decline of human labor power causing the output work less well as the emergence of a defective product on cuttle fish crackers, as a further improvement in the process of trading company Ardial should make changes to the work performance of employees so that intonation is always stable and produce a good product.

b) Use of raw materials also need to be considered and must be adapted to other materials because it is the most significant cause of a defect in the manufacture or processing of cuttle fish crackers products. Temperature and heat of the sun also affects the level of crispness cuttle fish crackers.

c) The use of equipment sealer should be noted again because if the sealer is open, less heat or even too hot will cause product defects.

d) The working environment is narrow and in poor lighting can inhibit the action of the workers who can not move freely. In doing his job at the time of production processes running so that workers are less comfortable and less flexibility in work that resulted in a lot of time spent in vain, in addition to the lighting in the room was still not working provide illumination that can support the performance of the operator to operate the machine production so that the results less than the maximum.

Crispness is the main thing that should be considered in making fish crackers (Abimbola, 2002). Temperature and frying time affects the physical properties and texture of crackers produced (Saeleaw and Schleining, 2011) and protein levels (Neiva *et al*., 2011; Kamari and Shabanpour, 2013). Crackers crispy level occurs when the product was exposed to high temperatures (Cheow *et al.*, 2002). The results showed that treatment of the cooking cycle repeats four-chilling able to increase the resistant starch in fish crackers, so as to improve the quality of fish crackers kerenyahahn (Nor *et al*., 2014). Crackers crispy fish

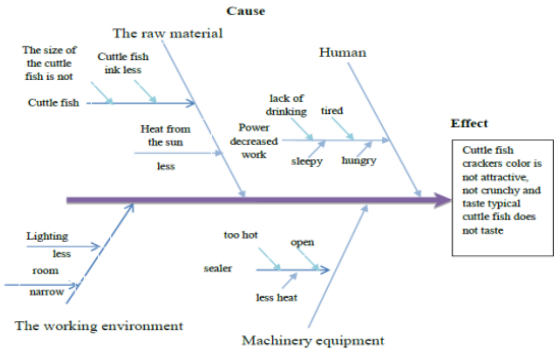

Figure 1. Analysis cause-effect from the output of a product defect case

is also a very important thing for consumers, it is evident the level of crispness fish crackers to get the highest score of the few trained panelists (Noorakmar *et al*., 2012) and more than 70% of the respondents chose to eat hollow lekor because of (Omar *et al.*, 2011).

Density shapes, broken, torn, and chipped

The results of the questionnaire showed a low level of satisfaction with percentage at 43% very satisfied and 57% dissatisfied with the high interest rate while the percentage of 35% critical and 65% very important, so it should be looking for the cause and how to overcome them. Based on the questionnaire were a lot of complaints that customers on that are defective products, among others, the form is not solid, broken, torn or chipped, it needs to be further investigated to reduce the number of defective products.

The results of data analysis indicate that the map control C upper control limit at 36.02, average at 21.96 and lower control limit at 7.90, it is necessary to conduct the examination in the production process to find the cause of the data coming out of the control limits. From the results of the data is out of control due to serve targeted human labor power decreases. Table 1 shows the total number of types of product defects such form is not solid, broken, torn and chipped during the production process of 25 days at trading company Ardial with a total production of 3,750 packs of cuttle fish crackers.

Furthermore, through the conversion of DPMO to sigma value by looking at the table appendix 5 of the book Gaspersz (2002), note that for DPMO = 48,800 is the closest to the DPMO = 49,471 on the value of sigma = 3.15. Because this number is less than 6 sigma, it needs to be fixed. To repair the next step is to use a fishbone diagram. Results of analysis of cause and effect that causes defects in cuttle fish crackers at trading company Ardial, among others:

a) The decline of human labor power causing the output work less well as the emergence of a

Table 2. Data of all types of defects cuttle fish crackers for 25 days at trading company Ardial

No	Defect type	Total defects (packs)	Percentages (%)
1	The shape is not solid	145	26.4
2	Broken	158	28.8
3	Torn	130	23.7
4	Chiped	116	21.1
	Total	549	100

defective product on cuttle fish crackers, as a further improvement in the process at trading company Ardial should make changes to the work performance of employees so that intonation is always stable and produce a good product.

b) Use of raw materials also need to be considered because if the process has not been smooth grinding cuttle fish or rough, this will cause the results of cuttle fish crackers form is not solid and disability.

c) Treatment cutting machine at trading company Ardial still needs to be improved because the crude product obtained was harsh, dense and defect after being cut by the cutter machine.

d) The condition of the equipment should also be considered because it also affects the quality of the resulting crackers cuttle fish. If using the manual way possible defects in the product will be greater and if the machine is damaged, the manufacture of cuttle fish crackers can not be done. Therefore, the condition of the equipment must be properly addressed.

e) The narrowness of the work environment, poor lighting, lack of ventilation, hot and room temperature can inhibit the work of the workers who can not move freely. In doing his job at the time of production processes running so that workers are less comfortable and less flexibility in work that resulted in a lot of time spent in vain, in addition to the lighting in the room was still not working provide illumination that can support the performance of the operator to operate the machine production so that the results less than the maximum.

Delicious and savory flavor compared to other cuttle fish crackers

The results of the questionnaire showed a low level of customer satisfaction by 47% is still not satisfied and 53% fairly satisfied, while the high interest rate with a percentage of 28% important and 72% very important, so it should be looking for the cause and how to overcome them. Based on many customer complaints questionnaire is contained defects such as bad taste and not tasty, it needs to be further investigated to reduce the number of defective products.

Table 3. Data of all types of defects cuttle fish crackers for 25 days at trading company Ardial

No	Defect type	Total defects (packs)	Percentages (%)
1	Not delicious	298	57.6
2	Not savory	218	42.4
	Total	514	100

The results of data analysis indicate that the map control C upper control limit at 34.16, average at 20.56 and lower control limit at 6.96, it is necessary to conduct the examination in the production process to find the cause of the data coming out of the control limits. From the results of the data is out of control due to serve targeted human labor power decreases. Table 3 is a table of the total number of defective product types including bad taste, and not savory production during 25 days at trading company Ardial with a total production of 3,750 packs of cuttle fish crackers.

Furthermore, through the conversion of DPMO to sigma value by looking at the table appendix 5 of the book Gaspersz (2002), note that for DPMO = 45,688.89 is closest to the DPMO = 46,479 on the value of sigma = 3.18. Because this number is less than 6 sigma, it needs to be fixed. To repair the next step is to use the fishbone diagram shown in Figure 2. Results of analysis of cause and effect that causes defects in cuttle fish crackers at trading company Ardial, among others:

a) The decline of human labor power causing the output work less well as the emergence of a defective product on cuttle fish crackers, as a further improvement in the process at trading company Ardial should make changes to the work performance of employees so that intonation is always stable and produce a good product.

b) The use of the materials of the maximum product will also cause defects. One of them if use less fresh cuttle fish could make bad cuttle fish crackers and savory. Effect of less than the maximum sunlight can also cause this defect cuttle fish crackers.

c) The use of the scales was also influential and need to be taken to ensure that the raw material size according to how many cuttle fish are needed. If the size of the weights is less, then it will cause bad cuttle fish crackers and savory.

d) The narrowness of the work environment, poor lighting, lack of ventilation, causing the room stuffy and hot air can inhibit the action of the workers who can not move freely. In doing his job at the time of production processes running so that workers are less comfortable and less flexibility in work that

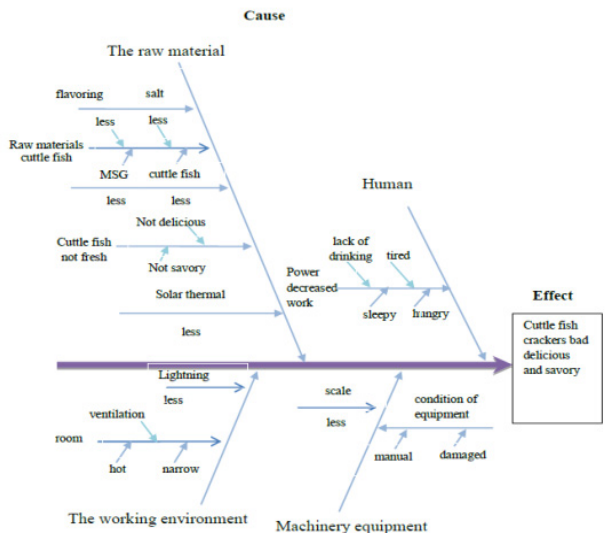

Figure 2. Cause Analysis due to defects in the product output cuttle fish crackers

resulted in a lot of time spent in vain, in addition to the lighting in the room was still not working provide illumination that can support the performance of the operator to operate the machine production so that the results less than the maximum.

Fish crackers product quality is largely determined by the raw materials of fish (Taewee, 2011), the thickness of the slices before frying, the percentage of linear expansion, and several other factors (Ibrahim and Dewi, 2013). The nature of both crispness and color texture of fish crackers is also influenced by the addition of cassava flour as a substitute material for the manufacture of crackers (Wang and Mujumdar, 2012). Taste delicious fish crackers is also determined by the quality of the frying oil. The quality of oil during frying fish crackers are also determined by many factors, such as the type of material and the type of frying oil used (Leskova *et al*., 2006; Choe and Min, 2007). Repeated use of cooking oil can cause changes in the physical appearance of oil, such as an increase in viscosity, color, and decrease smoke point oil (Rani *et al*., 2010). Repeatedly heated oil consumption has been shown to increase the risk of hypertension for consumers (Soriguer *et al*., 2003).

Conclusion

The cause of the discrepancy in the cuttle fish crackers at trading company Ardial on map contol C is the power of the employee at the time decreases so that the production process is less controlled. The results of calculations with the six sigma value DPMO at 3.20 (color, flavor, and crispness), 3.15 (density shapes, broken, torn, and chipped), and 3.18 (delicious and savory) which means that the third this variable is less than 6 sigma, it needs to be improved to reduce the number of defective products at trading company Ardial at Banyuwangi regency.

Causal analysis using fishbone diagrams to mismatches that occurred on product cuttle fish crackers, so it needs to be an improvement on the lighting in the production room, enhancing the employability of workers, broaden the place of production and the need for maintenance on crackers cutting machine tools, maximizing the use of raw materials and cuttle fish use of sunlight in the drying process, and precision measurement scales glittering in the main raw material ie cuttle fish. Suggestions from this study is trading company Ardial immediate repair of facilities and infrastructure where production processes, maintenance of the machine cut crackers, using raw materials that are still fresh cuttle fish, and a balance of higher quality.

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