

QUALITY EVALUATION OF SELECTED FOOD INDUSTRY PRODUCT USING CHOSEN TOOLS

Abstract: In the paper the quality evaluation of selected product produced by food industry company which operates in the Lodz region is presented in this paper. Chosen tools were used in the analysis: Pareto-Lorenz's diagram, Ishikawa's diagram and QFD method. The analysis includes data concerning the quality of product being evaluated. The analysis covers the period of six months (April – September) of 2012.

Key words: quality evaluation, quality tools, food industry

3.1. Introduction

Quality is the one of the key factors affecting the efficiency and productivity of companies. Companies that generally have to multiply profits, must ensure that the quality of products they offer is as high as possible. They realize that in order to be competitive on the market they must take care of their customers by meeting their requirements and expectations. In companies working in food industry systems such as HACCP, ISO and TQM can help them to achieve high level of quality. Having such systems makes company's image is stronger, so that the company can get more new customers (INGALDI M 2013, KNOP K, BORKOWSKI S 2011, ISO 22000:2005).

The continuous quality analysis is also very important. It can help to find any problems which appear in company, find their reasons and remove them. Many different quality tools and methods can be helpful.

In the paper the quality evaluation of selected product produced by food industry company which operates in the Lodz region is presented in

¹ Dr inż., Czestochowa University of Technology, Department of Production Management and Logistics, ekonstan@wip.pcz.pl

this paper. Chosen tools were used in the analysis: Pareto-Lorenz's diagram, Ishikawa's diagram and QFD method. The analysis includes data concerning the quality of product being evaluated. The analysis covers the period of six months (April – September) of 2012.

3.2. Activity of company X

Activities of company X include the production of processed fruit and vegetables products. Complete range of products consists of over 80 various products. Percentage of major groups of products was presented in Table 3.1.

Table 3.1. Production of major groups of products in the study period

Group of products	Percentage, %
Products with cucumbers	34.9
Grated horseradish	7.38
Products with beetroot	16.73
Sauerkraut	9.17
Sorrel	4.96
Compotes	9.69
Food additives - mustard - mayonnaise - tomato concentrate	7.47
Vegetable salads	9.69
Total	100.00

Source: Own study based on information materials form Company X 2013, ŚWIERCZ K. 2013

As it is presented in Table 3.1, products with cucumbers are the predominant group of products. These groups of products are about 35% of total production of the company. Products with beetroot are the second largest group. They are significant part of production. It is caused by entering into agreement with regular foreign customer.

Company X implemented HACCP system in 2008. This system is the management method and tool which aim is to ensure food safety. According to the definition given in the Act dated 11.05.2001: “HACCP is a system procedure to ensure food safety through identification and assessment of hazards of food safety in terms of the quality of healthcare and the risk of these hazards during all stages of food production and distribution” (ISO 22000:2005).

3.3. Characteristics of product

The analysis presented in the article concerns the production of tomato concentrate. Tomato concentrate is a partially dehydrated tomato puree. Through the process of pasteurization it is protected from bacteria and expiration date is extended. Tomatoes are the main ingredient. The finished product has the characteristic flavour of tomatoes. It has salty and sour odour and dark red colour. Additional components may be spice flavours, aromas, vegetable. Table 3.2 shows the basic nutritional value of tomato concentrate produced in the Company X.

Table 3.2. Nutritional value in 100 g of tomato concentrate 30%

Nutritional value	Value
Protein	5.4g
Carbohydrates	21.2g
Fat	1.6 g
Energy value	93 kcal

Source: Own study based on information materials form Company X 2013, ŚWIERCZ K. 2013

Company X produce two types of tomato concentrate:

- at 20% extract content,
- at 30% extract content.

Produced concentrate is poured into the jars with the capacity of 0.2 and 0.9 l.

3.4. Quality analysis of tomato concentrate using Pareto-Lorenz's diagram

Data collected during control process of tomato concentrate was used to the analysis. Data shows non-conformances occurring in production process of tomato concentrate. These non-conformances were presented in Table 3.3.

Table 3.3. Non-conformances occurring in production process of tomato concentrate

	Name of non-conformance
P1	No label
P2	Askew stuck label
P3	Heterogeneous structure of concentrate
P4	Liquid consistency
P5	Mould
P6	Too large dose
P7	Too small dose
P8	Poorly tightened caps
P9	Damaged packaging
P10	Dirty packaging

Source: Own study based on information materials form Company X 2013, ŚWIERCZ K. 2013

Information on the frequency of occurring non-conformances was collected. Data covers the study period of April – September, because it is a period of time, when most of tomato concentrate is produced. It is due to availability of materials (fresh tomatoes). Number of non-conformances in each month under study is presented in Fig. 3.1. It can be said that most of non-conforming products were revealed in months July and May. It is caused by increased production of tomato concentrate during the regular season of fresh tomatoes.

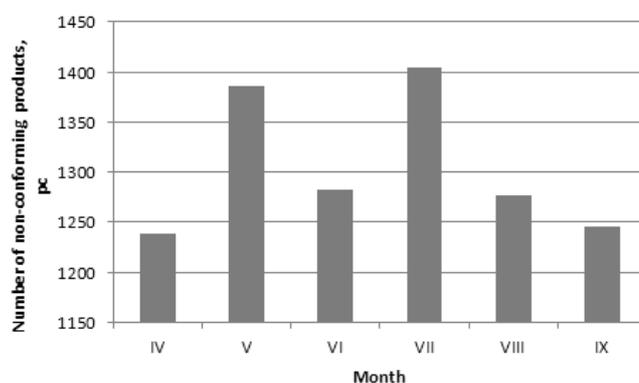


Fig. 3.1. Number of non-conforming products revealed in months IV-IX.

Source: Own study based on information materials from Company X 2013, ŚWIERCZ K. 2013

Based on collected information calculation, which enabled to create the Pareto-Lorenz's diagram of number of individual non-conformances, were made. Results of the analysis are presented in Fig. 3.2.

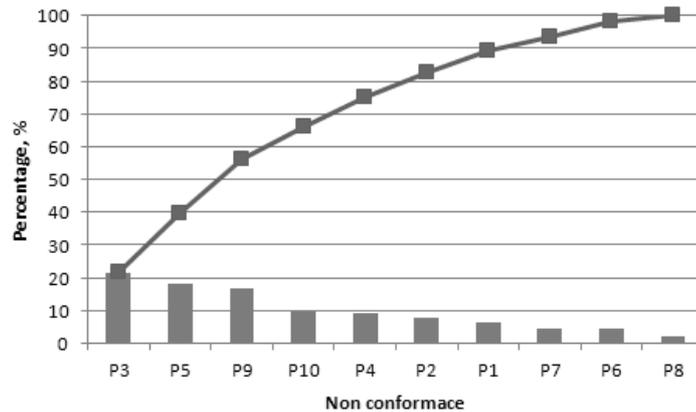


Fig. 3.2. Pareto-Lorenz's diagram for non-conformances P1-P10.

Source: Own study based on *INFORMATION MATERIALS FORM COMPANY X 2013*, ŚWIERCZ K. 2013

Based on results presented in Fig. 3.2 it can be said that over half of non-conforming products occurred after production process was connected with three non-conformances: P3 – heterogeneous structure of concentrate, P5 – mould, and P9 - damaged packaging.

It can be concluded that the elimination of non-conformance P3, which occurred in production process the most often, would reduce total number of non-conforming products by over 1/5. This problem was caused by incorrect setting of machine which rubs tomato pulp.

Non-conformance P5, mould, occurred in nearly 1/5 of non-conforming products. It is caused by lack of proper control of acceptance of raw materials, inaccuracy of workers sorting vegetables and problems during process of pasteurization.

Non-conformance P9, damaged packaging, occurred in 16.7% of non-conforming products. It is caused by poor quality of materials used as packaging which are delivered to the company. To reduce this non-conformance, company should increase process of control of supplies. or changes supplier.

The removal of reason of these non-conformances in production process can cause the overall 50% decrease in number of nonconforming products and in can cause the increase of company's efficiency and improving of its image.

Subsequently, non-conformances was divided into four following groups of related non-conformances:

- A – non-conformances connected with labelling of products (P1, P2),
- B – non-conformances connected with concentrate consistency (P3, P4, P5),
- C – non-conformances connected with weight of products (P6, P7),
- D – non-conformances connected with packaging of products (P8, P9, P10).

Based on collected information calculation, which enabled to create the Pareto-Lorenz's diagram of number of groups of non-conformances, were made. Results of the analysis are presented in Fig. 3.3.

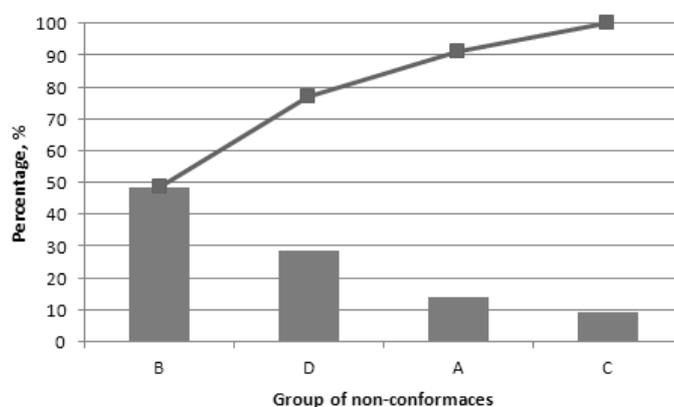


Fig. 3.3. Pareto-Lorenz's diagram for groups of non-conformances A – D.

Source: Own study based on INFORMATION MATERIALS FORM COMPANY X 2013, ŚWIERCZ K. 2013

According to the analysis presented in Fig. 3.3 it can be said that almost half of non-conforming products was connected with group B,

non-conformances connected with concentrate consistency. Three non-conformances are in this group: heterogeneous structure of concentrate, liquid consistency and mould. These non-conformances are caused by operations carried out at the beginning of the production process such as: sorting of tomatoes, rubbing of tomato pulp and improper pasteurization parameters. Proper training of employees and increased control process at the beginning of production process would allow to eliminate non-conforming products in about 50% and improve efficiency of production.

3.5. Quality analysis using Ishikawa's diagram

For the group of non-conformances, which caused the largest group of non-conforming products, Ishikawa's diagram was made. This diagram was made by 5M method: man, machine, method, material, management. This analysis was presented in Fig. 3.4.

After the analysis of Ishikawa's diagram, it can be said that:

- **Man:** additional trainings and adequate supervision of employees would lead to reduce mistakes made by staff. It should be also ensure that motivation system for employees such as bonuses and rewards for well-done job should be maintain.
- **Machine:** machines used in production process should be serviced and maintained regularly. Old machines should be replaced by new equipment, because the old are less productive and cause too many non-conforming products. Also, adequate supervision of employees, who serve machines, would reduce problems.
- **Material:** materials, used in the production process, should be high quality, so the best suppliers should be selected. Raw materials (tomatoes) should be controlled by acceptance during process of delivery and during process of sorting also enhanced control should be conducted. It should lead to the situation that tomatoes taken to the production process did not have any evidence of rot.

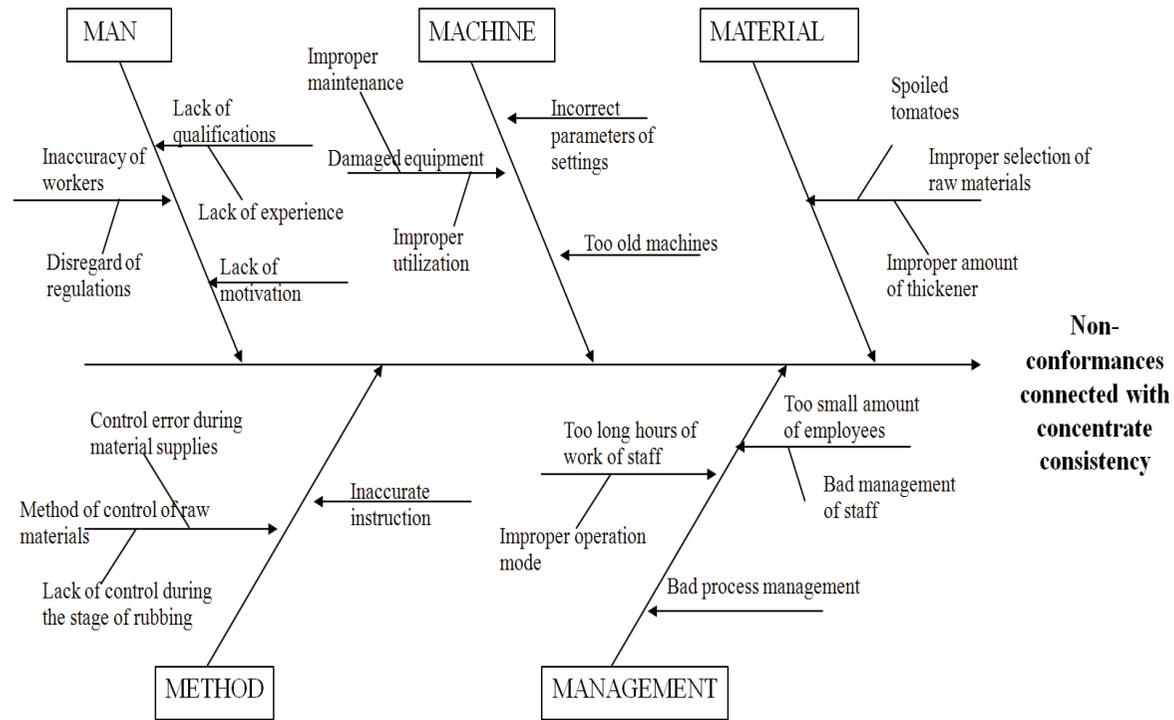


Fig. 3.4 Ishikawa's diagram for the reason of non-conformances connected with concentrate consistency.

Source: Own study based on INFORMATION MATERIALS FORM COMPANY X 2013, ŚWIERCZ K. 2013

- Method: appropriate use of methods, standards and implementation of control process is very important during production process. Processes should be carried out and supervised in proper way. It should be also ensured that the instruction are clear and understandable to employees.
- Management: management is a key factor, which helps to achieve high results of production. Qualified staff should deal with management in every company. Managers should be familiar with specific business processes and be able to organize work skilfully. Managers are also responsible for the quantitative and qualitative selection of the staff, because it often determines the performance of company.

3.6. The analysis of customer requirements using QFD method

In order to meet customers' requirements and products properties the analysis QFD was made. In this analysis the following steps have been taken:

1. Research carried out among customers about their requirements and preferences. Based on the results it was found that the most important requirements for customers are:
 - Good taste,
 - Aesthetic label,
 - Undamaged packaging,
 - Pleasant taste and smell,
 - Thick consistency,
 - Price,
 - Uniform consistency.

For every feature customers determined the rank in the scale of 1-5.

2. Assessment of the competitors. It helps to understand how customers perceive products of Company X to their competitors.
3. Determining technical parameters for tomato concentrate and setting target values for these parameters:

- Readability of label – clear label,
 - Content of tomatoes per 100g – the greatest content of tomatoes,
 - Right smell – sweet-sour smell of tomatoes,
 - Right colour – intensively red,
 - Right structure – no lumps and parts of tomatoes,
 - Thickener content – complies with the standard.
4. The matrix of relationships. Determining the relationship between customer requirements and technical parameters. These relationships can be:
 - ■ - strong – 9,
 - ▣ - medium -4,
 - □ - weak -1.
 5. The matrix of correlation. The analysis of technical parameters, which can interact, is made.
 6. Calculation of absolute values for each parameter, ie. numerical calculation of product of value of cells and value of assessment of the customer. The numbers are then summed in their columns to determine the value for each parameter.

All information were transferred to the “house of the quality”, what is presented in Fig. 3.5.

The QFD analysis presented in Fig. 3.5 shows that tomato concentrate produced by Company X can be evaluated well in comparison to the competitors. This comparison indicates which parameters should be improved in order to be much better than other producers. Four of parameters: aesthetic label, consistency, taste and smell of products are very important.

As the result of the QFD analysis three most important quality parameters of this product were determined: content of tomatoes per 100g, right colour and thickener content.

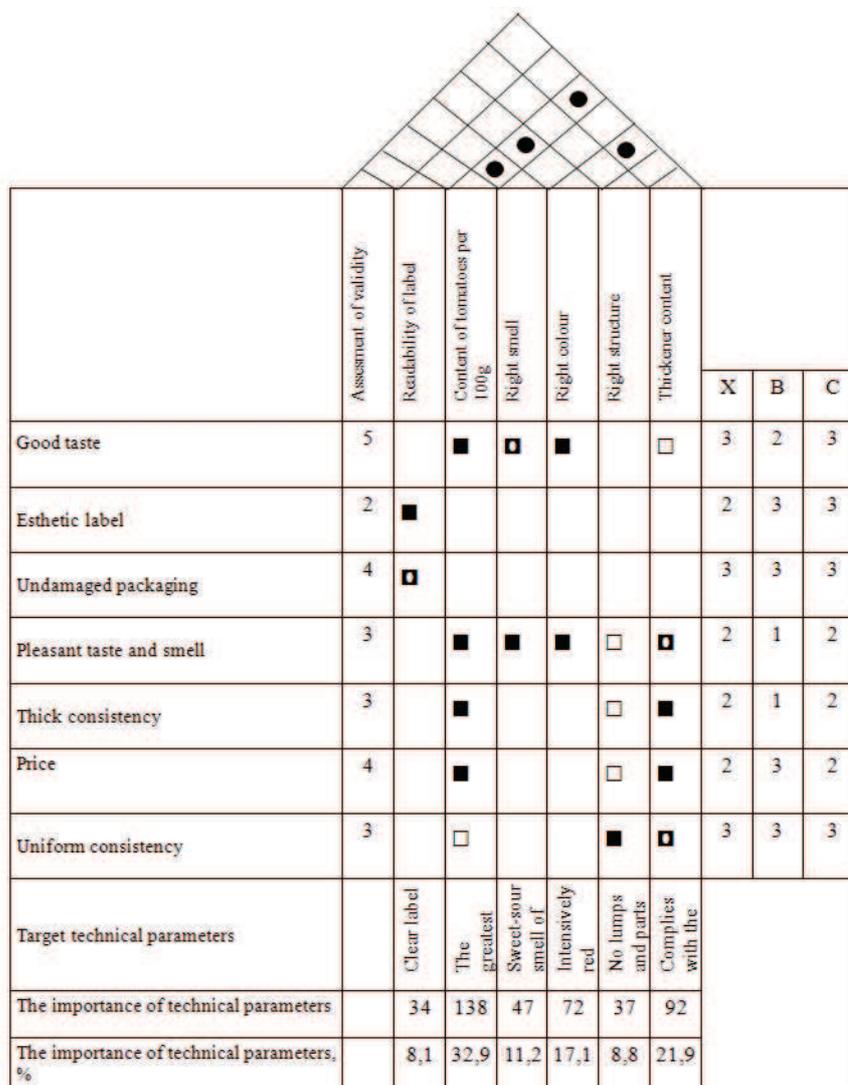


Fig. 3.5 The house of quality for parameters of tomato concentrate.

Source: Own study based on INFORMATION MATERIALS FORM COMPANY X 2013, ŚWIERCZ K. 2013

3.7. Summary

The functioning of the company on the market based on competitive advantage and maintaining good relationships with customers. To maintain good relationships with customers, their expectation should be examined and fulfilled. Therefore, companies are increasingly adopting systems which provide and support quality management. In food industry, these systems are HACCAP, ISO 22000, GMP, IFS, BRC. With these systems, quality tools using in various analysis companies can improve their products.

The paper presents the analysis of non-conformances occurring in production process of tomato concentrate using quality tools such as Pareto-Lorenz's diagram and Ishikawa's diagram. Customer expectations, the level of competitiveness of the company and the main technical parameters of products were also examined with the QFD method.

Based on the analysis presented in the paper it can be concluded that:

1. Pareto-Lorenz's analysis revealed that non-conformances, which occurred the most often, are: P3 - heterogeneous structure of concentrate, P5 – mould, P9 - damaged packaging. To reduce this non-conformance, company should increase process of control of supplies. or changes supplier.
2. Pareto-Lorenz's analysis of group of non-conformances showed that group B of non-conformances connected with concentrate consistency generated the largest number of non-conforming products. Proper training of employees and increased control in the early stages of the production process would allow the elimination of defects in about 50% and improve production efficiency.
3. Ishikawa's diagram defined all factors caused problems connected with concentrate consistency. Factors were divided into 5 groups according to the principle 5M. Diagram showed that two groups: man and management have a great importance. Improving of management style would affect the work of staff.

4. Research on customers allowed to emerge with their essential requirements for parameters of products. Based on the matrix of QFD method it can be said that four of parameters: aesthetic label, consistency, taste and smell of products are very important, they are critical parameters of products.
5. Analysis of the causes and effects of non-conformances by selected tools and methods can serve to improve the quality of process and product quality. Elimination of their causes can improve productivity.

Bibliography

1. INGALDI M. 2013, *Problems of management in food industry company*, in: Contemporary problems of managing small and medium-sized enterprise, Monography, red.: Oksana Seroka-Stolka. Sekcja Printing House of Faculty of Management. Czestochowa University of Technology, Czestochowa, pp.198-210.
2. INFORMATION MATERIALS FORM COMPANY X 2013.
3. ISO 22000:2005: *Food safety management systems – Requirements for any organization in the food chain*.
4. Knop K., Borkowski S. 2011, *Analysis of Quality Problems in Food Industry on Example of the Tomato Concentrate*, in: Determinants of Product Quality. Monography. Editing and Scientific Elaboration Stanisław Borkowski, Manuela Konstanciak. Liga-Press. Lviv , pp. 66-81.
5. ŚWIERCZ K. 2013, *Quality analysis of products as a tool for the evaluation the efficiency of production system in the selected company*, Master work under the direction of Edyta Kardas, Czestochowa University of Technology, Czestochowa.