

DETERMINING A QUALITY PLACE IN THE PROCESS OF CONTINUOUS IMPROVEMENT BASED ON THE PRINCIPLE OF TOYOTA MANAGEMENT IN QUESTIONS - A CASE STUDY

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Abstract: The paper presents an analysis of an innovative method based on the principles of the Toyota Production System - BOST survey, which was carried out in 8 selected production companies from the plastics processing industry operating in the Silesian Voivodeship. Each question in the BOST survey relates to a given Toyota Rule and the Toyota House Roof. Thanks to this survey, you can learn the opinion of the surveyed employees on many areas of the functioning of a given enterprise, which may be an important hint to the operational and strategic activities of the enterprise. In the study, 1 question was selected for analysis, containing a set of factors (areas) closely related to process improvement and personal characteristics of the respondents was analyzed. The result of the work is to determine the position of quality in the continuous improvement process according to the surveyed employees and to propose improvement activities for selected companies.

Keywords: improvement, quality, Toyota management principles, BOST survey

1. INTRODUCTION

In everyday life, improvement can be defined as actions aimed at achieving a perfect state, both for products (which are used) and processes (as a result of which a product is obtained), and people (so that the use of these products is more complete), if it is described by target function. Improvement can also be treated as a natural human reflex to facilitate one's work. This simplification is related to the benefits for the internal customer.

According to S. Borkowski (Jeziorski and Borkowski, 2008), improvement can be called action, the results of which today are better than yesterday's, and tomorrow's better than today. Improvement is a dynamic activity. The basic condition for improvement is the identification of a specific area for which customers have specific requirements, or an area that generates losses.

In every organization, improvement is inextricably connected with the quality (Nováková et al., 2019, Anttila and Jussila, 2018) of products and services as well as the operation of machines and devices. For example, M. Imai (Imai, 2007) defines quality as

everything that can be improved, and according to W. Prussak, improvement is a quality management function focused on increasing effectiveness and efficiency (Prussak, 2006).

Quality improvement is part of quality management, aimed at increasing the ability to meet quality requirements. Requirements can relate to any issue such as effectiveness, efficiency or traceability (ISO 9000: 2015).

Continuous improvement is a set of repetitive activities aimed at increasing the ability to meet the requirements. It is one of the eight principles of quality management (Luburić, 2015).

The application of the principle of continuous improvement (Butler et al., 2018, Blaga, P. 2020) is associated with the use of a consistent, broad organizational approach to the improvement of the organization's achievements, ensuring the participation of experts in the use of methods and tools for continuous improvement, continuous improvement of products, processes and systems, understood as the goal of each person in the organization, setting goals and states a reference to driving continual improvement as well as recognizing and accepting improvements.

2. METHODOLOGY OF RESEARCH

BOST survey - Toyota management principles in questions, is a method developed by prof Stanisław Borkowski. The name "BOST" comes from the first two letters of the author's surname and first name and is legally protected (Borkowski, 2012a, Borkowski, 2012b, Borkowski, 2012c, Borkowski and Chuan, 2009, Borkowski and Shevtsova, 2009). Each of Toyota's principles is described in this survey by a set of factors called areas. The BOST survey consists of a survey for supervisors and a survey for staff. The BOST survey is successfully used in manufacturing companies and service institutions (including banks, hospitals, schools, shops). The version of the BOST survey used in manufacturing companies (version for personnel and version for superiors) consists of 12 sets of factors (areas). The survey has a ranking scale and respondents rate the importance of the factor on a specific scale.

The BOST survey - Toyota management principles in questions (Borkowski, 2012a, Borkowski, 2012b, Borkowski, 2012c, Borkowski and Chuan, 2009, Borkowski and Shevtsova, 2009, Liker, 2005, Liker and Hoseus, 2009) was conducted in 8 companies located in of the Silesian Voivodeship, from the plastics processing industry. These are companies that are diverse in terms of the products they produce. There are products manufactured for the construction industry, the automotive industry, the hydraulic industry, home products, textile industry products, as well as products for the medical industry. The subject of research is also a company producing sports goods and a company dealing in the production of foil packaging.

273 production workers were tested. In the case of all analyzed enterprises, the surveyed employees accounted for over 80% of the staff, which allowed for a holistic view of the analyzed enterprises and the researched issues related to process improvement.

From all the questions (sets of factors) of the BOST survey, 1 element (set of factors) related to Toyota's management principle 14 (area E8) was selected for more detailed analysis. Toyota's Management Principle 14 is: "To become a learning organization through tireless reflection (hansei) and continuous improvement (Kaizen). It is important to understand not to focus on immediate measures to improve individual elements of the enterprise or processes, but to focus on long-term improvement. A learning

organization is defined as an organization in which people constantly expand their possibilities of achieving truly desired results, in which new patterns of bold thinking arise, team aspirations develop freely, and where people constantly learn how to learn together (Liker, 2005).

In area E8 respondents answer the question: "What factor can have the greatest effect after improving it? Rate on a scale of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 (the 10th most important factor)". Respondents can choose from the following factors: hiring employees (ZT), motivating system (SM), technology portfolio (PT), quality (JK), maintenance of machines (UM), relation - employee - supervisor (RE), documentation (DA), information flow (PN), cooperation with clients (WS), cooperation with suppliers and cooperators (WD).

Moreover, the area E12 concerning the personal characteristics of the respondents was analyzed. In the area of E12, i.e. the respondent's characteristics, 6 personal characteristics are distinguished:

- gender (MK) - 1 - male, 2 - female,
- education (WE) - 1 - primary, 2 - vocational, 3 - secondary, 4 - higher,
- age (WI) - 1 - up to 25 years, 2 - 26 ÷ 35 years, 3 - 36 ÷ 45 years, 4 - 46 ÷ 50 years, 5 - 51 ÷ 55 years old, 6 - 56 ÷ 60 years old, 7 - 61 ÷ 65 years old, 8 - over 66 years old,
- work experience (SC) - 1 - up to 5 years, 2 - 6 ÷ 15 years, 3 - 16 ÷ 20 years, 4 - 21 ÷ 25 years, 5 - 26 ÷ 30 years, 6 - 31 ÷ 35 years, 7 - 36 ÷ 40 years, 8 - over 41 years,
- mobility (MZ) - current employment is a workplace: 1 - first, 2 - second, 3 - third, 4 - fourth, 5 - fifth, 6 - more,
- admission to work (TR) - 1 - normal, 2 - transferable, 3 - due to better financial conditions and the surveyed employee answers by marking the appropriate number.

For substantive and purely practical reasons, the detailed analysis at work is limited to 1 enterprise, while the analysis of the responses of the respondents of all 8 enterprises is presented in the collective statement of results.

The results of the analyzes of the selected set of factors for the studied enterprise will be presented in the form of histogram of the distribution of ratings for individual factors. The form of pie charts was chosen to present the analysis of the E12 area, i.e. the respondent's characteristics.

3. ANALYSIS OF THE OBJECTED RESULTS

A BOST survey in a selected company from the plastics industry that produces foil packaging was conducted among 33 production employees. The company produces food pouches, clothes bags, plastic garbage bags, soil bags, carrier bags and printed bags from the film. The first part of the analysis was the characteristics of the respondents, which is presented in Figure 1.

Figure 1a shows that men constitute a larger group of respondents in the enterprise (73%). With regard to the next characteristic of the respondents - education (Fig. 1b), more than half of the respondents have secondary education (55%), 27% of the surveyed employees have a vocational education, and only 15% are respondents with higher education. In the age groups (Fig. 1c) there are 46% of the surveyed employees under 25, 18% are 26 to 35 years old, and 15% of the respondents are 56 to 60 years old. When it comes to work experience (Fig. 1d), 30% of the respondents have up to 5 years of work experience, the second largest group are those with 6 to 15 years of work experience (27%).

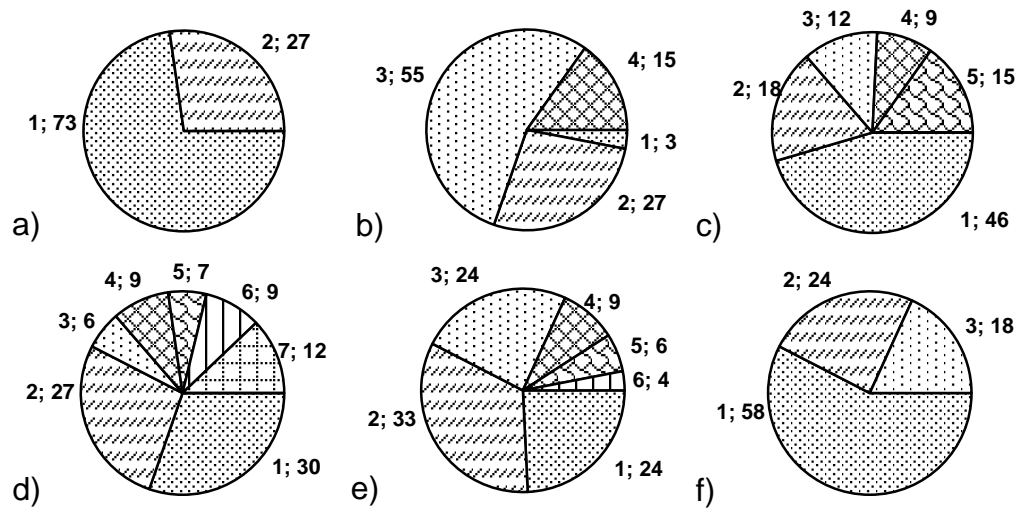


Fig. 1. Pie charts. Characteristics of the respondents (%) taking into account: a) gender, b) education, c) age, d) work experience, e) mobility, f) admission to work. It concerns a company producing foil packages.

Another feature of the respondents - mobility, is presented in Fig. 1e. It shows that for the vast majority of respondents (81%) the analyzed enterprise is the first (for 24%), second (for 33%) and third (for 24%) jobs. Due to the mode of admission to work (Fig. 1f), most of the surveyed employees (58%) were hired on a regular basis. The analysis of the distribution of ratings for the factors describing Toyota Rule 14 (area E8) is presented in Figure 2.

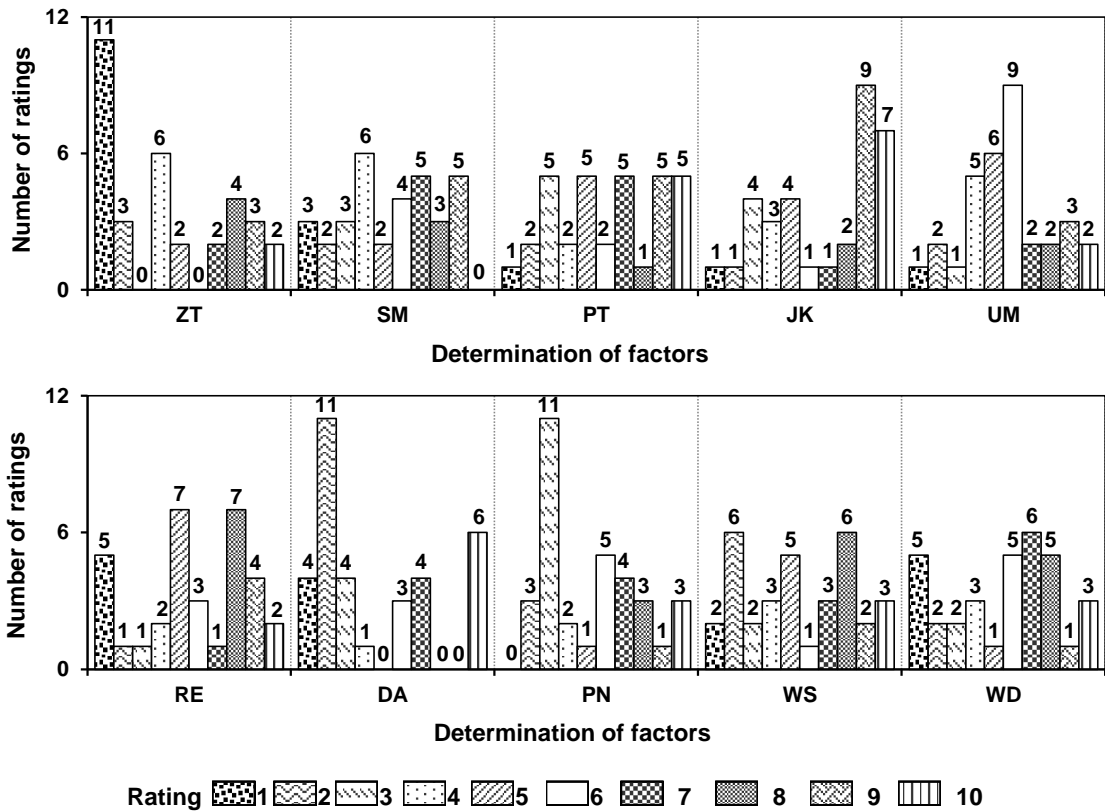


Fig. 2. Rule 14. Analysis of the distribution of grades for factors of the E8 area. It concerns the production of foil packaging.

For the surveyed employees of this company, the factor that can bring the greatest results after its improvement is quality (JK), as 16 respondents (48.48%) gave this factor a rating of "9" and "10". Moreover, only 2 respondents gave this factor the lowest ratings "1" and "2".

When analyzing the remaining factors describing the Toyota Rule 14, it can be seen that none of them received a large number of "9" and "10" ratings. The technology portfolio (PT) factor was rated "9" and "10" by 10 respondents, and in the case of the documentation factor (DA), 6 votes are rated "10", however, a large part of the votes are also low, e.g. the documentation factor (DA) received from 19 respondents (57.58%) ratings "1", "2" and "3".

In the group of factors that, according to the respondents, may bring the smallest effects after improving them, there is the factor of employment of employees (ZT) - here the ratings of "1" and "2" were given by 14 respondents (42.42%) and the factor of information flow (PN) - ratings "2" and "3" are also awarded by 14 respondents.

4. SUMMARY OF RESULTS

In summary, out of 273 respondents from all enterprises in the plastics processing industry:

- almost 70% of the respondents are men, and just over 30% are women,
- the smallest number of respondents has primary education (slightly over 2.5% of respondents), the next largest group are respondents with vocational education (around 28%), over 30% of the surveyed employees have higher education, while the largest group are respondents with secondary education - almost 40%,
- in terms of age, the largest group, more than 30%, are respondents aged 26 to 35, the next group of approximately 24% are young respondents up to 25 years old, the next largest group are respondents aged 36 to 45 (almost 20%), almost 12% are employees aged 46 to 50, respondents aged 56 to 60 constitute approximately 8%, while the smallest group are those aged 61 to 65 - less than 3%,
- taking into account the length of service, enterprises are dominated by respondents with 6 to 15 years of experience (about 1/4 of the respondents), the next group are respondents with up to 5 years of experience, similar in terms of the size of the group (about 12%) are employees with work experience in the range from 16 to 30 years, while the smallest group are respondents with long work experience over 41 years,
- the largest group are the surveyed employees, for whom the enterprise they work for is the second place of work - they account for almost 40% of all respondents, over 20% of the respondents indicated the surveyed enterprises as the first or third place of work, while for about 10% of the respondents the surveyed enterprise is the fourth place to work. Small groups of respondents (about 3, 5 and 4% of all respondents) indicated their workplace as the fifth and sixth,
- taking into account the admission procedure, it can be stated that almost 60% of the respondents were admitted to work in the normal mode, more than 20% due to finances, while the smallest group of respondents works on the basis of transfer.

A collective analysis of the results concerning one element related to Toyota management principle 14 (area E8) - quality (JK) for all companies from plastic industry is presented in Figure 3. These companies are marked for the purposes of the study from TS1 to TS8. In order to facilitate the collective analysis of the obtained results,

specific ratings zones were introduced: low ratings zone - ratings "1", "2" and "3", the zone of average ratings - ratings "4", "5" and "6" and high ratings zone - ratings "7", "8", "9" and "10".

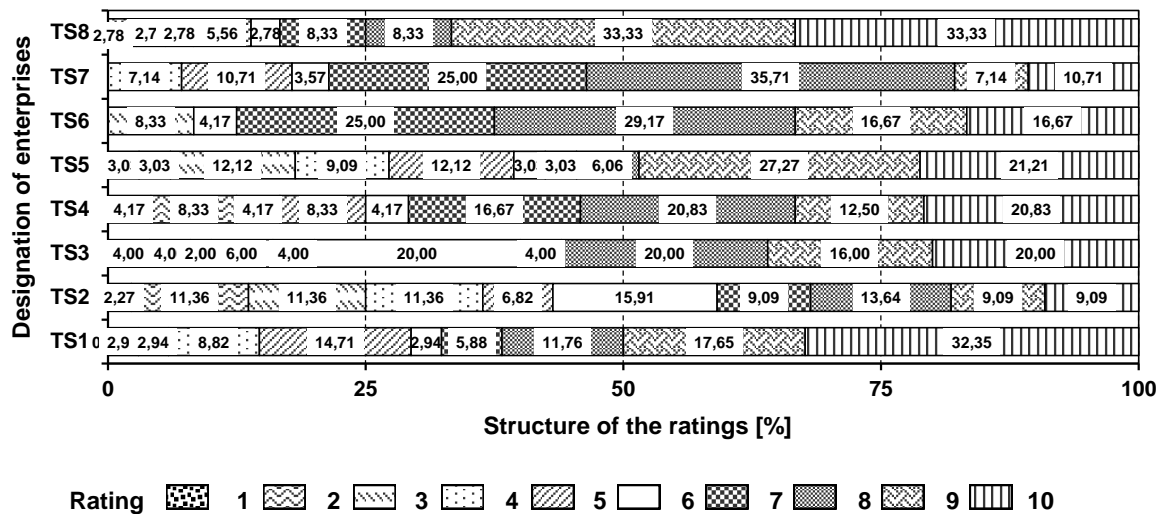


Fig. 3. A collective analysis of the results concerning one element related to Toyota management principle 14 (area E8) - quality (JK) for all companies from plastic industry.

Quality (JK) is perceived by the surveyed employees of enterprises from the plastics processing sector as likely to bring significant effects after its improvement. In 7 out of 8 analyzed enterprises, this factor received more than 50% "7", "8", "9" and "10" ratings from the respondents, with the most of these ratings given by the respondents of a company producing polypropylene fabrics (TS6) - 87.5%. Moreover, in this company, no interviewee rated this factor as "1", "2" or "3". Also in other enterprises, a small number of low ratings can be noticed. Compared to other companies with a lower number of ratings "7", "8", "9" and "10", the company producing rubber compounds for the automotive market (TS2) stands out. The quality factor (JK) received over 40% of these ratings from the respondents of this company,

5. CONCLUSION

Out of 8 analyzed enterprises from plastic industry, in 6 of them quality it ranks first in the rankings of importance, which means that the respondents perceive this factor as the one that can bring the greatest effects after its improvement.

If, according to the respondents, this factor may bring effects after its improvement, some quality improvement activities should be considered. This analyzed industry is very demanding in terms of quality requirements. The variety of products manufactured in this industry forces the company's management to focus on improvement activities in every area of the company's activity.

Considering the improvement of quality in a typical production enterprise, many techniques, methods and tools are taken into account to support this process. At the beginning, it is worth mentioning the 5S Practices. It is a very simple, inexpensive technique that can bring tangible results in the form of a clean, organized, effective and safe workplace, which is the basis for efficient production. Another technique that allows you to avoid errors in the production process is Poka-Yoke. A simple set of techniques

prevents a human being from making a mistake, who, according to Poka-Yoke, is not an infallible being. The two techniques outlined above have one thing in common. Employees of companies certainly adhere to the principles of both Poka-Yoke and 5S Practitioner, often not knowing what the "professional" name is. It is certainly important to constantly clean your workplace, as well as to use methods to minimize or eliminate errors at the workplace. However, the very application, even of the 5S Practice, will not be effective if no maintenance measures are introduced and perfecting this technique. According to Kaizen, all employees, both regular employees and top management, should be involved in these activities. The improvement activities also include comprehensive maintenance of TPM machines, the main goal of which is the cooperation of operators and employees of the maintenance department and the elimination of losses related to the operation of the machine park, and the SMED method, which allows to reduce the changeover time. It is also worth remembering about the traditional ones and modern quality management tools and quality management methods, which also, to some extent, contribute to quality improvement. Most of the techniques, tools and methods mentioned have one thing in common: teamwork. Continuous improvement is an endless process, but it will not bring the desired results if not all employees are involved in it.

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