THE IDENTIFICATION OF FACTORS DESCRIBING THE CONCEPT OF COMPANY DEVELOPMENT – CASE STUDY

Krzysztof Mielczarek – *orcid id: 0000-0003-3701-0192*
Czestochowa University of Technology, **Poland**

Abstract: The paper presents research results in a scope of evaluation importance of factors in enterprise from automotive industry. These paper presents a case study of the practical use of BOST surveys (first Toyota's management principle). Analysis of the research results was presented in the form of tables, histograms, radar chart and some statistical tools. Some production workers of the company with the help of BOST questionnaire survey showed, which factors are the most important. The aim of the analysis is to present which factors are the most important by building the significance sequences of obtained results. The results obtained for the type of small and medium-sized enterprises overlap with the results of tests verified in other enterprises.
Keywords: BOST method, Toyota management principle, importance hierarchy, statistical analysis

1. INTRODUCTION

Toyota Production System (TPS) is based on scientific principles and assumes that all separate elements work well for the benefit of the entirety (Borkowski and Ulewicz, 2009). Toyotarity is a scientific discipline examining human - machine and human - human relationships with the inclusion of a process-based approach, Japanese culture, especially of Toyota (Borkowski, 2012). The BOST method describes Toyota's management principles with its characteristic factors. Each of these principles described with an appropriate set of factors. Toyota's management principles are divided into sections that contains a set of factors describing principles: 1; 2; 3; 4; 6; 7; 14 and elements of the roof of Toyota's house. BOST studies are aimed to prove that in enterprises operating in Poland, irrespective of conducted activity, the employees unconsciously use management principles, about which perhaps they never heard. Respondents may assess the significance of a given factor by placing one of the numbers within the range of scale in an appropriate box (Borkowski et al., 2013). A preliminary condition for classification of the companies to BOST study was confirmed information about implementation of Toyota management

principles in the workstations in analyzed company. The researched company is a producer of car parts manufacturer. All products have safety certificates confirming the compliance of the products with the applicable standards and the high quality of the manufactured products.

2. METHODOLOGY OF RESEARCH

First Toyota management principle is based on the conviction that appropriate process leads to appropriate results (Gao and Low, 2015). If the process is designed properly, then good results will come automatically (Liker and Franz, 2011). Constant improvement of organization is possible through application of small steps approach (Selejdak, 2015). In the study the BOST method was used during tests. The BOST questionnaire form was filled out, by 40 respondents i.e. nearly half of workers of the company. In the purpose to form an opinion it is essential to know the opinion of workers from different ranks in enterprise. It lets on better look on the enterprise by eyes of workers (Borkowski, 2016). Tests were carried out basing on conducted BOST surveys. Respondents were asked to answer the following question:

What factors decide on the development concept of your company? Fill the blanks with 1; 2; 3; 4; 5; 6; 7 (7 the most important factor).

DK		Customer's interest
IP		Product innovation
WK		Cooperation with partners
ZP		Confidence in relations with employees
SP		Independence and responsibility of employees
RT		Development of technology
PR		Company culture care

This set of factors describing the first Toyota's management principle is called E2 area. Table 1 present a percentage list of significance rates of factors in the enterprise producing car parts articles.

Table 1.
Structure [%] of importance ratings for factors of E2 area

Evaluation	Indicating the factors						
	DK	IP	WK	ZP	SP	RT	PR
1	0.0	0.0	5.0	20.0	25.0	0.0	50.0
2	0.0	0.0	30.0	25.0	25.0	5.0	15.0
3	0.0	0.0	30.0	25.0	20.0	15.0	10.0
4	15.0	5.0	20.0	10.0	15.0	15.0	20.0
5	25.0	25.0	0.0	20.0	5.0	25.0	0.0
6	25.0	30.0	10.0	0.0	5.0	25.0	5.0
7	35.0	40.0	5.0	0.0	5.0	15.0	0.0

The results contained in Table 1 were graphically presented with the use of circular charts. It shows the structure of average rates for factors describing the first Toyota's management principle.

On the basis of the prepared structure of ratings for separate factors it was found that *Customer's interest* (DK) was the most important factor for 35% of respondents.

Product innovation (IP) has been assessed by respondents as very significant factor deciding about the enterprise's concept (40% for rate "7"). The next factor was *Cooperation with partners* (WK) and only 5% of respondents have given this factor rate "7". In the case of *Confidence in relations with employees* (ZP) 20% of respondents have given this factor rate "1" and 25% rate "2" and "3". The importance of the *Independence and responsibility of employees* (SP) is on very similar level. *Development of technology* (RT) has been assessed in very different ways by respondents. The assessment of the factor: *Company culture care* (PR) has been as follows: 50% of respondents have evaluated this factor very low deciding about the enterprise's development concept by granting it rate "1". In this enterprise the factors *Customer's interest* (DK) and *Product innovation* (IP) are the most important.
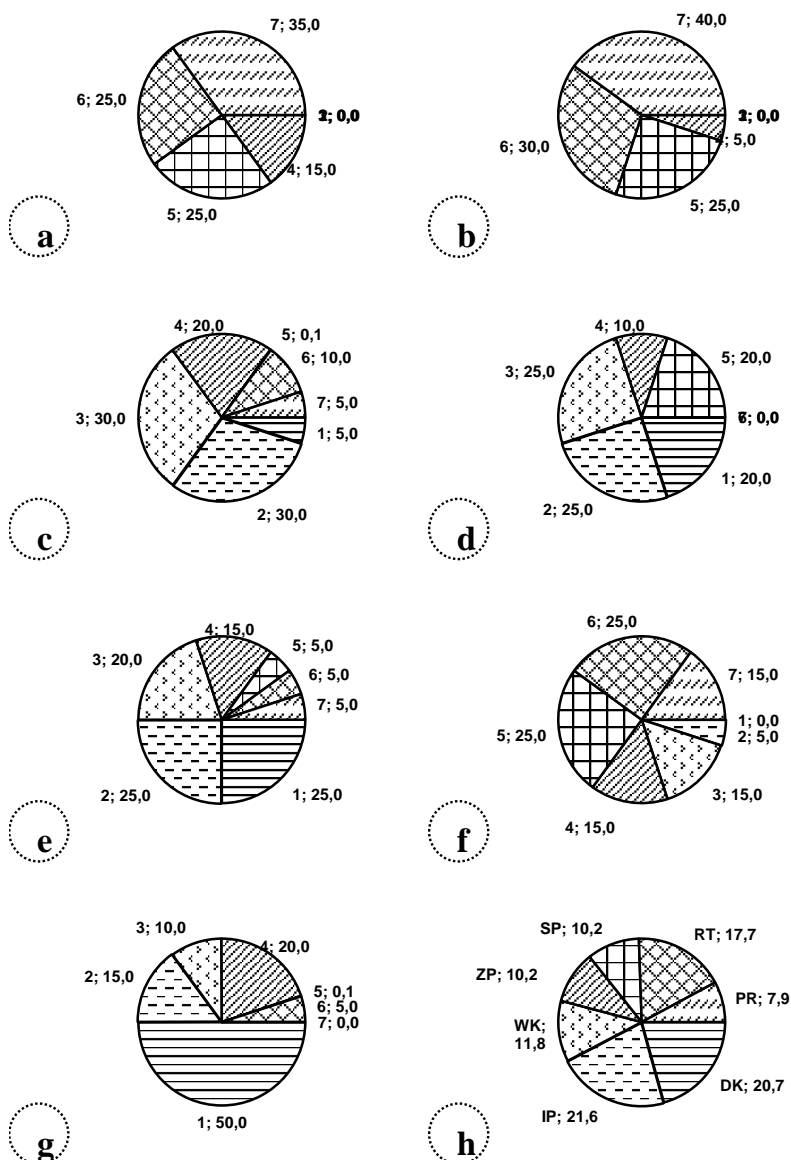

Fig. 1. Circular charts – rating structure of importance E2 area factors: a) DK, b) IP, c) WK, d) ZP, e) SP, f) RT, g) PR, h) average

According to the data in Fig. 2, the factor *Customer good* (DK) received 7 highest answers, which proves the high awareness of the respondents about the high importance of this factor. The lowest scoring answers are not marked in this area. *Product innovation* (IP) received 8 answers with the highest scores 7. Nobody marked the answer for weights "1", "2" and "3".

In order to determine the importance of individual factors from the researched area E2 in the presented company, whose employees expressed their opinions in the survey, radar charts were created for individual assessments (Fig. 3).
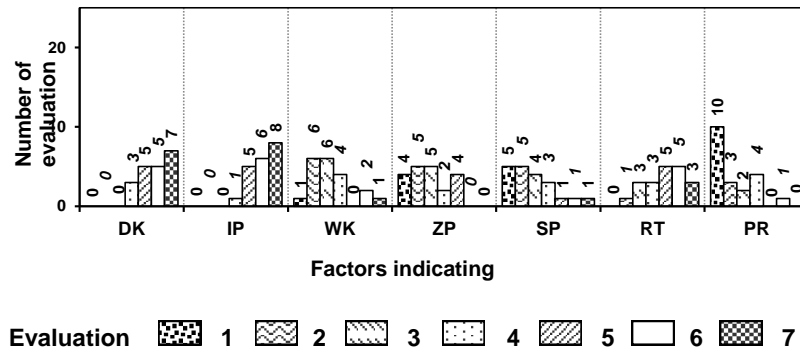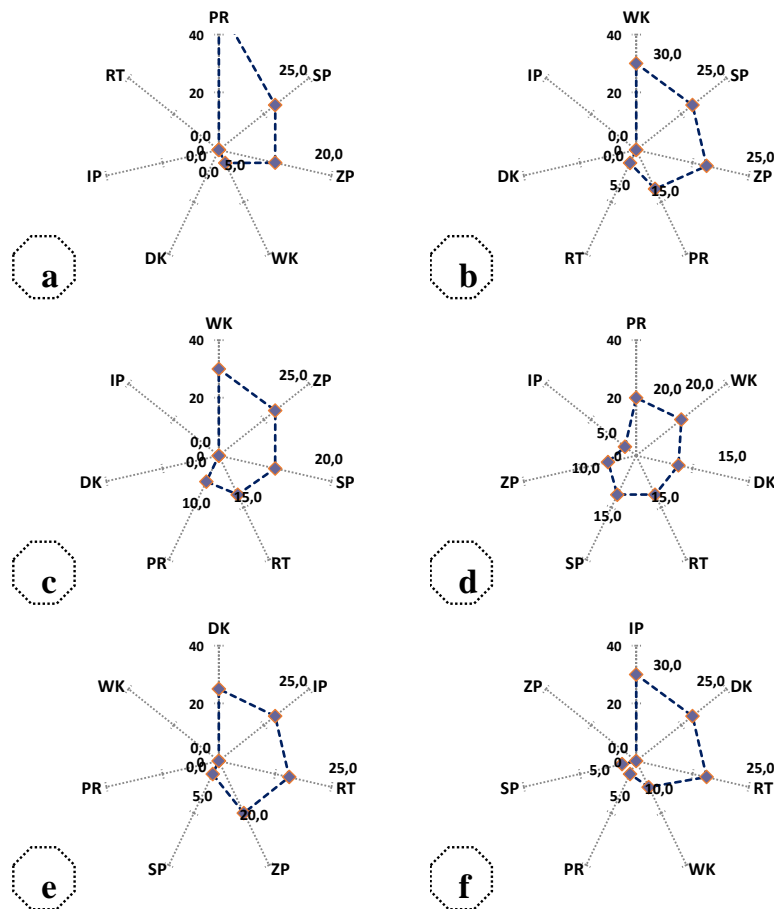

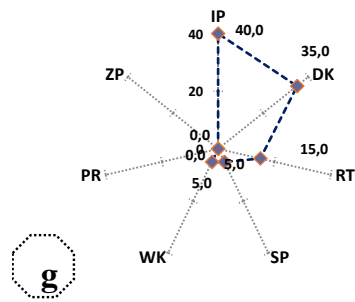Fig. 2. Analysis of the distribution of ratings for factors in E2 area

Fig. 3. Radar charts for E2 area importance factor for ratings: a) „1", b) „2", c) „3", d) „4, e) „5", f) „6", g) „7"

The purpose of the survey was to obtain clear and reliable information on the importance of selected factors in the development of a company in a automotive industry. Information on this subject was to be provided by the respondents - both the managerial staff and the blue-collar staff who completed the questionnaires. The numerical averages of the importance of the area factors are presented in Fig. 4.
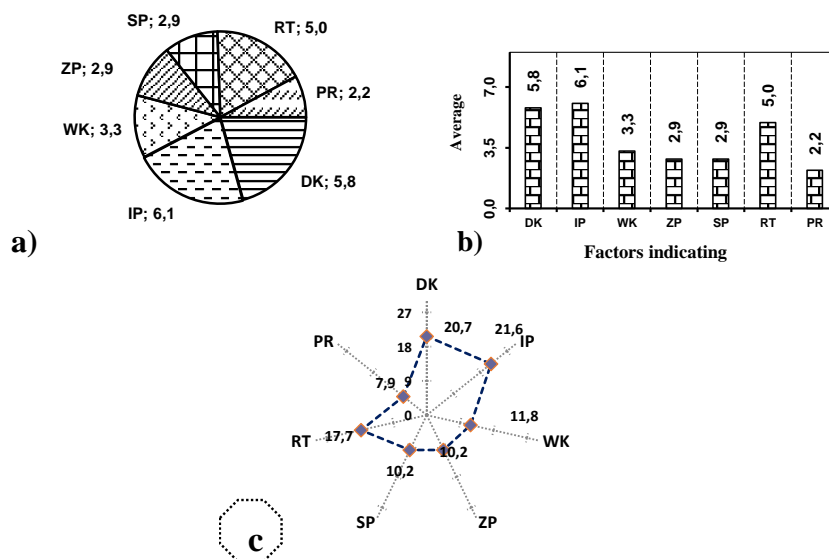

Fig. 4. Average ratings of importance E2 area factors: a) circular chart, b) histogram, c) radar chart

On the basis of the figure, it is possible to build a series of importance factors describing the studied E2 area. It is as follows:

$$IP > DK > RT > WK > (SP; ZP) > PR$$

In the conditions of the surveyed enterprise, in the opinion of the respondents, it is clear that the most important factor determining the company's development is the factor *Product innovation* (IP), which received 21.6% of votes. The second most important factor is *Customer's interest* (DK). In this way, the organization received information that it can be a starting point for making decisions in the field of improving

the company's management strategy. Acquired results and their multidimensional analysis confirm the accuracy of factors choice describing the first Toyota management principle.

The main task of summing histograms is to check the correctness of the performed calculations. They concern the average assessment of the importance of a given factor and the correctness of the calculation of its percentage share. The summing histograms for the obtained results are presented in Fig. 5.
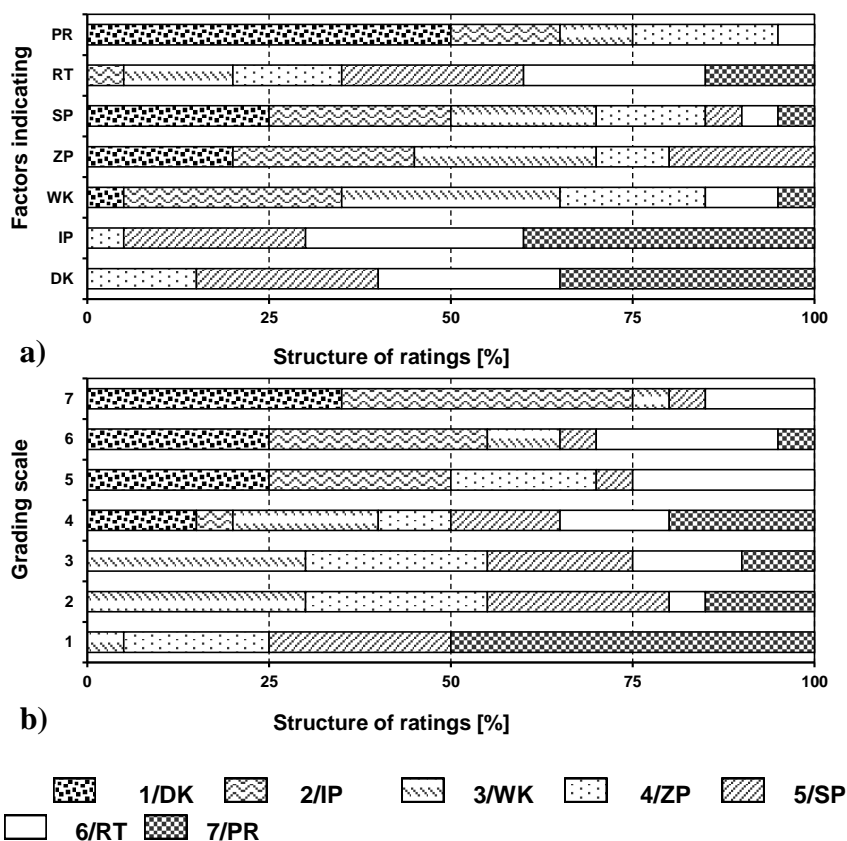

Fig. 5. Summing histograms. Comparison: a) structure of ratings, b) importance of factors in rating in grading scale

Assessments will be presented, which the percentage is on the line of 25% (Q1), 50% (median), and 75% (Q3) of the cumulative value. Summarizing the information obtained from the histogram of factors importance in the rating scale, we state:
- The first quartile is achieved for factors: 1 - PR, SP, 2 - ZP, WK, IP, DK, 3 – RT.
- The median is reached for the factors: 1 – PR, 2 – SP, 3 - ZP, WK, IP, DK, 4 – RT.
- The third quartile is achieved for factors: 3 – PR, 4 - ZP, WK, IP, DK, 5 – RT.
In both analyzed cases, it can be stated that the first quartile is achieved for higher rating scales.

3. THE RESULTS CONCERNING THE STRUCTURE

Calculation results of such positional statistical prameters as median, quartiles and range were presented using box-and-whisker plot with reference to all factors of the first Toyota management principle (Knop, 2018). Fig. 4 is presenting box-and-whisker

plot and its elements: basic graphs, quartiles Q1, Q3, M – Q1, Q3 – M, length of the upper and bottom plot (Uçurum et al., 2016). Box-and-whisker plot provided a lot of valuable information about rating distribution to the examined factor (Knop and Mielczarek, 2018).
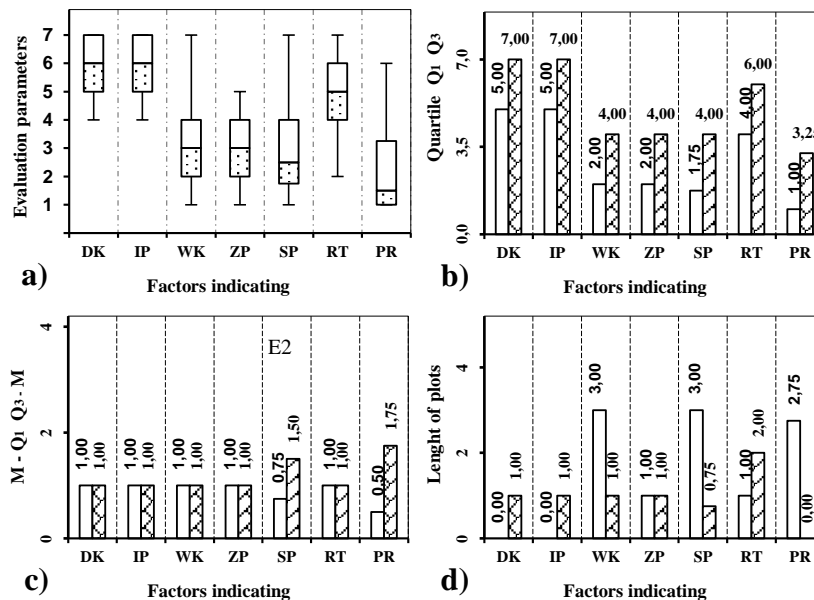

Fig. 6. Box-and-whisker plots and its elements: a) basic graphs, b) quartiles Q1 Q3, c) M - Q1, Q3 - M appropriately, d) length of the plot: upper (without filling), bottom (filled) for factors in E2 area

Accordingly, for factors with the symbols (DK), (IP), (WK), (ZP), (RT), the median lies ideally in the middle between the quartiles, which suggests that the distribution in the central part is symmetrical. For factors with the symbols (SP), (PR) it was observed that the median is located closer to the first quartile, which results in a right-skewed distribution. The graph is complemented by the whiskers on the outside of the box. When the whiskers are equal they testify about the symmetry of the entire distribution - (ZP). The longer upper tendril compared to the lower one confirms right-sided asymmetry. Such a case was noted for factors with the symbols (WK), (SP), (PR).

4. SUMMARY

The subject of the research was a company that manufactures car parts products. The key to success is the production of high-quality and safe products. The starting point for improvement is recording the existing condition. Employees were asked to produce their opinions on the present condition and as respondents they expressed their opinions concerning strategic development factors contained in the description of the first Toyota's management principle. The BOST method was used to achieve this goal. For the respondents, it is the good of the customer and product innovation that are the most important factor in the development of the organization. The above fragment of the analysis showed differences in the importance of factors describing first Toyota's Toyota management principle and it has revealed diversity in the significance of factors. In this way, the usefulness of the presented BOST method for

the assessment of the functioning of the production process was demonstrated. The correctness of factors selection which describe the first Toyota's management principle has been proved and confirmed by rates, which have demonstrated diversity in terms of statistical features and significance sequences. Therefore, they are "sensitive" to conditions existing in this particular enterprise. The acquired significance sequence of factors describing the first management principle is logical, thus confirming the correctness of their selection and the research results can be used in another small and medium-sized enterprises. The practical use of BOST surveys gives the opportunity to benefit from the practical knowledge of employees at the company's production level. This may contribute to the identification of key areas for the functioning of the enterprise.

References
Borkowski, S., 2012. *BOST Method as the Instrument of Assessment Process Functioning according to Toyota Principles,* University of Maribor, Maribor.
Borkowski, S., 2016. *Scientific Potential of Toyotarity and BOST Method*, Polish Quality Institute, Warsaw.
Borkowski, S., Rosak-Szyrocka, J., Klimecka-Tatar, D., Jagusiak-Kocik, M., Sygut, P., 2013. *Determination of the technology place in the metal company on the basis of the Toyota's management principles*, METAL 2013 - 22nd International Conference on Metallurgy and Materials, Conference Proceedings, 1691-1696.
Borkowski, S., Ulewicz, R., 2009. *Instruments of Production Processes Improvement,* PTM, Warsaw.
Gao, S., Low, S.P., 2015. *Toyota way style human resource management in large Chinese construction firms. A qualitative study,* International Journal of Construction Management, 15(1), 17-32.
Knop, K., 2018. *Statistical Control of the Production Process of Rolled Products*, Production Engineering Archives, 20, 26-31, DOI: 10.30657/pea.2018.20.06
Knop, K., Mielczarek, K., 2018. *Assessment of Production Processes Functioning in the Case of Air Bag Production*, MATEC Web Conf., 183, 04009, DOI: 10.1051/matecconf/201818304009
Liker, J.K., Franz, J., 2011. *The Toyota Way to continuous improvement*, McGraw Hill.
Selejdak, J., 2015. *Use of the Toyota Management Principles for Evaluation of the Company's Mission,* Production Engineering Archives, 1(1), 13-15, DOI: 10.30657/pea.2013.01.04
Uçurum, M., Çolak, M., Çınar, M., Dışpınar, D., 2016. *Implementation of Statistical Process Control (SPC) Techniques as Quality Control in Cast Iron Part Production,* Journal of Engineering Precious Research and Application, 1(3), 14-24.