

## Chapter 2

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### PRODUCTION SYSTEM ORGANIZATION OF THE WOOD PRODUCT

**Abstract:** In the chapter the basic information about the company producing wooden product for home, garden, as well as windows, doors and floors, was presented. The object of the research is the sandbox with a fixed roof, which is produced by this company. Production process depicted technologically was presented. In the research the BOST survey – Toyota management principles in questions was used, E4 area, connected with the 3rd Toyota management principle and characteristics of respondents, e.g. E12 area, were analysed in details. The results were presented in the form of radar graphs, pie charts, Pareto-Lorenz diagrams and importance ranges.

**Key words:** wood industry, sandbox, production process depicted technologically, BOST survey, area E4

#### 2.1. Characteristics of subject and object of the research

The analysed company is located Silesian Voivodeship, was founded in 1986 as a small craft in the wood industry. The company has started its activity from the production of small wood products such crucifixes, cutlery, etc. With time, the company has been developing, increasing its assortment. In 1995 the company was transformed into a production-trading-service company. The sawmill was built, and the production line of wood windows and hardwood floors was launched.

The company provides services in the field of wood industry and specializes in the manufacture of furniture for the house, the garden, the

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children, as well as windows, doors and parquet floors. The company has a very wide assortment, so that it has reached a high position in the market among the manufacturers of the wood. It offers home products such as shelving, cabinets, desks, benches, flower pots, chairs, stands, chests of drawers. Products manufactured for the garden include garden furniture, planters, fences, windmills, tool sheds, kennels for dogs, tables for transplanting flowers. The company also offers products for children, such as children's houses, swings, sandboxes, children's furniture, cradles, rocking horses. The company also offers the highest quality windows, doors and parquet floors. Windows can be of different shapes and colours. The company offers rectangular, triangular, circular, trapezoidal or oval windows. They are simple and easy to use, as well as durable and resistant to adverse weather conditions.

The sandbox with a fixed roof is an object of the research. It is constructed from pieces of wood, such as: top strips, narrow side strips, wide roof connecting strips, roof strips – bevels, narrow roof connecting strips, wide side strips, legs, legs-connecting strips. The company itself produces all mentioned elements. But it is necessary to buy other non-wood elements such as: hex head wood screw 3x20, screw 4x50, screw 3.5x35, butterfly nut M6, washer M6, spring washer M6, carriage bolts M6x50, Wood screw eye hook, self-control nut M6, connecting screw M6x80, anchor plate 2+1, key 4, string in meters, butterfly nut M5. All these elements are connected in one final product.

The sandbox, which is shown in Figure 2.1, has dimensions of 120x120x20 cm.

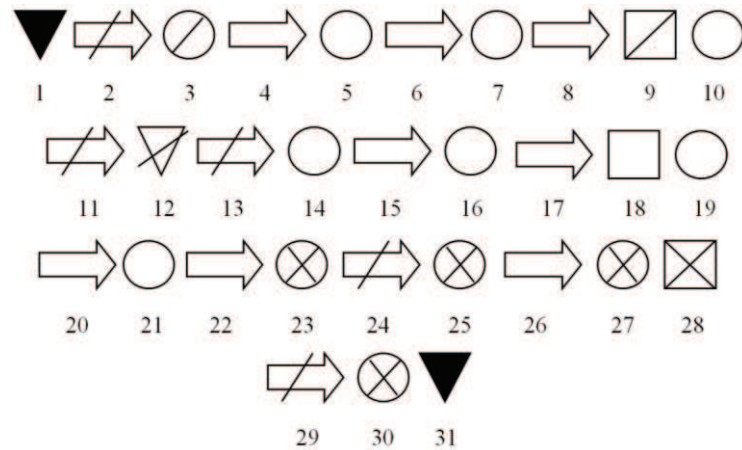


*Figs. 2.1. Sandbox with a fixed roof.*

*Source: materials from the research company*

## **2.2. Production process of the research object depicted technologically**

Production process of the sandbox with a fixed roof depicted technologically was presented in Figure 2.2.



**Fig. 2.2. Scheme of the production system of the sandbox with a fixed roof depicted technologically.**

Source: Own study

Characteristics of the route points (BORKOWSKI S., ULEWICZ R. 2008, DURLIK I.1998, BURCHART-KOROL D., FURMAN J. 2007, DZIUBA S.T., PIEKARA A., MAŁAS W., KOZIOŁ P. 2013.):

1. Wood storage. 2. Inter-department transport from the wood storage to the production hall. 3. Cutting with a vertical frame saw. 4. Inter-operational transport. 5. Cutting with a gang saw. 6. Inter-operational transport. 7. Cutting with an edge saw. 8. Inter-operational transport. 9. Control. 10. Sorting boards in stacks. 11. Transport outside 12. Seasoning (2-3 weeks). 13. Transportation to the drying store. 14. Cutting with milling machine. 15. Inter-operational transport. 16. Treatment with a woodworking machine. 17. Inter-operational transport. 18. Control. 19. Cutting with A Formatting circular saw. 20. Inter-operational transport. 21. Sorting the good and bad parts. 22. Inter-operational transport. 23. Cutting and drilling necessary holes with a multi-function machine. 24. Inter-department transport. 25. Varnishing. 26. Inter-operational transport. 27. Drying. 28. Final quality control. 29. Inter-department transport. 30. Packing. 31. Storage of the final product.

### 2.3. Results analysis

In the research company the BOST survey – Toyota management principles in questions (BORKOWSKI S. 2012a, BORKOWSKI S. 2012b, BORKOWSKI S. 2012c) was conducted among 31 employees. E4 area, connected with the 3<sup>rd</sup> Toyota management principle: “Use the pull systems to avoid overproduction”, was analysed in details. Respondents in this area answered the question: which factor provides the production system organization ? They had a choice between following factors:

- Production on a customer's request (DZ),
- Rational use of machines, people (MM),
- Creation of product supply (PZ),
- Quick order processing (BS).

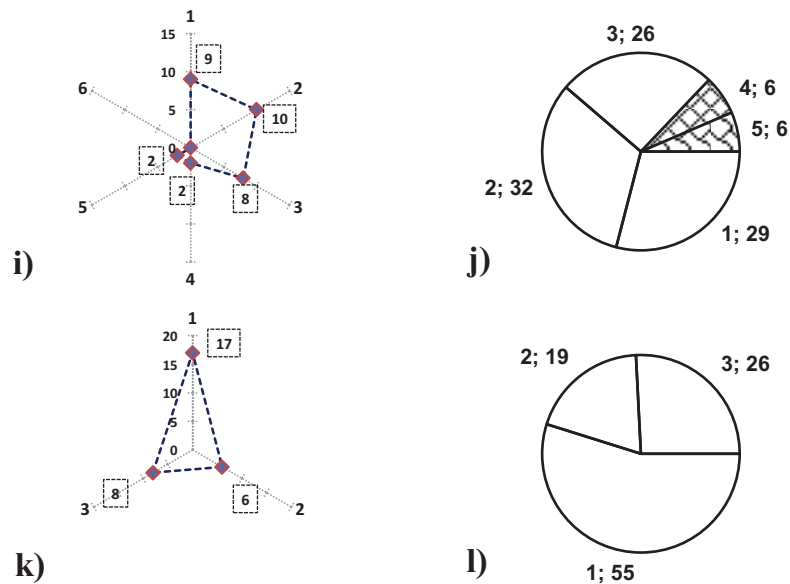
In addition to the E4 area, in the chapter also the characteristics of the respondents, e.g. the E12 area, was presented. In Table 2.1. characteristics of the respondents features was presented, and in Figure 2.3 in form of the radar graphs and pie charts numeric and percentage characteristic of the respondents from the research company was shown.

**Table 2.1. Features of respondents Characteristics.  
It concerns company producing wood products**

Sym- bol	Features' marking and their characteristic					
	MK	WE	WI	SC	MR	TR
1	Men	High school	< 30	< 5	1	Regular
2	Women	Professional	31 - 40	6 to 10	2	Transfer
3		Secondary	41 - 50	11 to 15	3	Finance
4		Higher	51 - 55	16 to 20	4	
5			56 - 60	21 to 25	5	
6			61 - 65	26 to 30	6	
7			> 66	31 to 35		
8				> 36		

Source: Own study





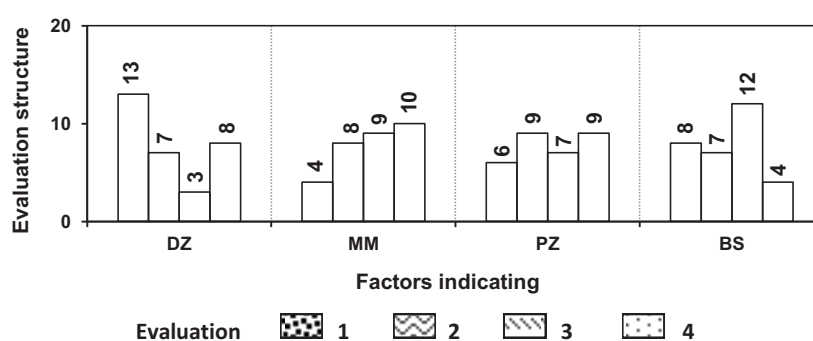
**Fig. 2.3. Numeric ( radar graph) and percentage (pie chart) respondents characteristic with consideration of: a), b) gender, c), d) education, e), f) age, g), h) job seniority, i), j) mobility, k), l) way of employment. It concerns company producing wood product.**

Source: Own study

Characteristics of surveyed respondents features was presented in numeric way, what can be seen in radar graphs presented in Figure 2.3. The same features were presented in percentage in form of pie charts. Figure 2.3a and 2.3b relate to gender of respondents. It results from them, that in the company 27 men (87% of respondents) and 4 women (13% of respondents) work. Next Figures (Figure 2.3c and 2.3d) present statement of education, which suggests that most of people have a secondary education - 15 people (e.g. 48% of the respondents), and the higher education only 3 people, which represents 10% of respondents. The rest of the employees has high school education (19% of respondents) and

professional (23% of respondents). Figure 2.3e and 2.3f relate to age of respondents. Most of employees (32%) is in the age group below 30 years, and the smallest number of employees is in the age group 61-65 years (3% of respondents). Figure 2.3g and 2.3h relate to job seniority. From these figures it can be concluded that most of respondents are employees with job experience less than 5 years (29%). There are no employees with seniority in the range of 21-25 years. In Figures 2.3i and 2.3j mobility is presented. For 10 respondents (32% of respondents), the research company is second place of employment, and for 9 people (29%) is the first job. There are no workers for whom it would be the sixth place of employment. After analysing Figures 2.3k and 2.3l connected with mode of employment it can be said that the majority of employees (55%) are employed in normal mode.

In Figure 2.4 the numerical distribution analysis of evaluations E4 area factors was presented.



**Fig. 2.4. 3<sup>rd</sup> principle. Distribution analysis of evaluations E4 area factors. It concerns company producing wood product.**

Source: Own study



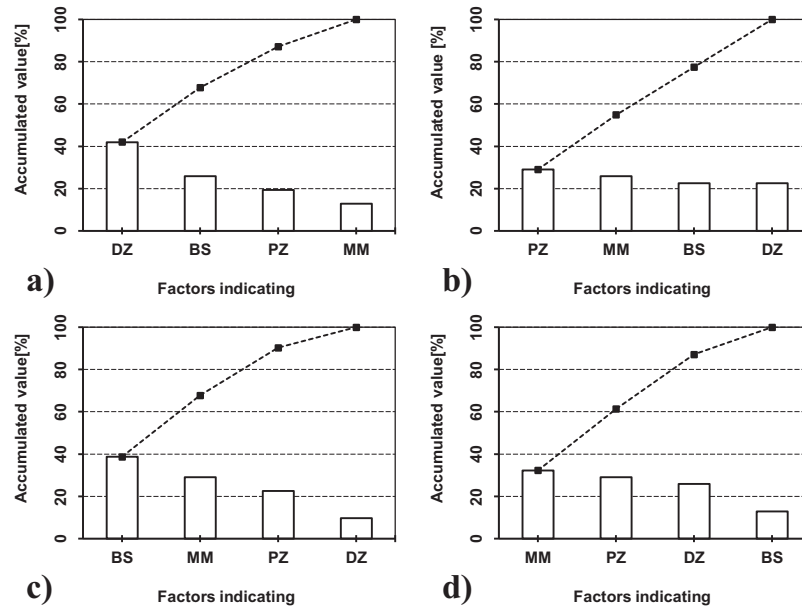
Analysing the data presented in Figure 2.4 it can be stated that the most important factor of the production system organization according to respondents is *rational use of machines, people* (MM), only four of them found it to be the least important factor, while 10 respondents rated this factor the highest evaluation “4”.

As a little less important factor respondents found *creation of product supply* (PZ), who received the evaluation “4” from 9 employees. The assessment of “3” by the most respondents was given to factor *quick order processing* (BS), while by the least to factor *production on a customer's request* (DZ).

According to respondents the factor, which at least ensuring the production system organization, is factor *production on a customer's request* (DZ), which received the lowest evaluation “1” from 13 respondents.

## **2.4. Summary**

For the evaluation of individual factors of the 3<sup>rd</sup> Toyota management principle the Pareto-Lorenz diagrams were constructed. The following diagram for each importance evaluations are shown in Figure 2.5.



**Fig. 2.5. Pareto-Lorenz diagrams of the factors' importance E4 area for evaluations: a) „1”, b) „2”, c) „3”, d) „4”. It concerns company producing wood product.**

Source: Own study

In order to present the factors that describe the 3<sup>rd</sup> Toyota management principle, the following importance ranges, which are show in form of formula (2.1, 2.2, 2.3, 2.4), were constructed:

- for evaluation „1” -  $DZ > BS > PZ > MM$  (2.1)

- for evaluation „2” -  $PZ > MM > BS > DZ$  (2.2)

- for evaluation „3” -  $BS > MM > PZ > DZ$  (2.3)

- for evaluation „4” -  $MM > PZ > DZ > BS$  (2.4)

The first graph shows the relationship of evaluation “1” (Figure 2.5a). Factor *production on a customer's request* (DZ) received the highest ratings at this level (41%). Respondents found it to be very important factor in the good production system organization. The smallest amount of evaluation “1” received the factor *rational use of machines, people* (MM) - 16%. Factor *creation of product supply* (PZ) received the most often evaluation “2” (Figure 2.5b) - 25%. In case of evaluation “3” (Figure 2.5c) factor *quick order processing* (BS) most often was evaluated at this level obtaining 40% of the votes. This evaluation was granted in 30% to the factor *rational use of machines, people* (MM). Factor *rational use of machines, people* (MM) got also the highest evaluation “4” (Figure 2.5d), receiving 32% of all votes. While factor *creation of product supply* (PZ), which received votes 29% of respondents, was ranked as the second one.

From the analysis of the graphic representation of the results it can be concluded that the most important factor in the opinion of a group of surveyed employees proved to be the factor *rational use of machines, people* (MM). While factor, which was the least important, was the factor *production on a customer's request* (DZ). The analysis will allow the company to take appropriate steps to improve the production system organization, using the reasonably available machinery and equipment, as well as people.

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