

An analysis of work of maintenance department employees

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Abstract

The article presents the results of research into the time of work of maintenance department employees in a selected production plant. The measurements have been taken for three selected employees during 9 working days. Major activities performed by the employees have been identified and classified in three basic groups: the effective time devoted to daily duties connected with technical means maintenance, the auxiliary time which involves preparatory and administrative works as well as the ineffective time during which the employees undertook activities not related to the performed work. Among the ineffective and auxiliary activities the longest lasting ones have been specified. By means of the 5Why Method the causes responsible for the occurrence of major ineffective and auxiliary activities have been identified. As a result of the conducted analysis, corrective measures aimed at shortening the time of these activities have been identified, which should contribute to the improvement of maintenance department employees' work effectiveness.

Introduction

Striving for perfection leads to the improvement of enterprises' competitiveness – the production process is more effective, the quality of goods is higher and manufacturing costs are lower. Effective economy and management allow goods to be manufactured and services to be provided in a cheaper, better and faster way than before. To achieve success, contemporary enterprises must be more efficient. In such a case rational management of employees' time may help. The effective management of work time in an enterprise is one of main factors influencing the competitiveness and dynamics of development. Satisfaction with performed work, as well as the effectiveness of undertaken activities is highly influenced by organisation and work time management [1]. A higher degree of organisational involvement of employees in the work process is a higher form of work organisation [2].

To achieve success, an industrial enterprise must guarantee among others the stable work of machines and devices applied in the production process. The main duties of maintenance teams include organisation, planning, supervision and coordination [3]. Skilful control of auxiliary processes is also important. They are necessary to guarantee full production capacities of a company and the simul-

taneous effective use of working time, materials and equipment [4]. Maintenance teams' work frequently lacks a precisely specified plan of action and priorities are established on an ad hoc basis, usually with insufficient personal and technical resources, so the skill of work time management and its effective use play a particularly important role [5, 6].

An analysis of the working time of maintenance department employees in order to propose improvement actions has been conducted by means of the 5Why Method. Its author is Sakichi Toyoda. The 5Why Method was quickly implemented and improved in Toyota corporation. It is described as Toyota's scientific approach method, which consists in repeated asking of the question „Why”. Owing to it, both a given problem and its solution become simpler and more evident. The 5Why Method is very popular all over the world and until present is used as a main element of Kaizen [7]. In general, 5Why can be described as a cause-and-effect analysis, because an answer to one question automatically leads to another one, creating a logical whole until the real cause of a defect or irregularity is found. The 5Why analysis is not limited to 5 questions, but may equally well finish after 3 or 7 questions [8, 9].

Research method

In the investigations, each working day was divided into 4 elements. The first of them is the time of effective work, the second – auxiliary time, the third – break time, and the fourth – ineffective time. The effective work time includes: consultations with employees, pondering over a problem, repair, check of machines and devices after repairs, inspections, maintenance etc. The auxiliary time has been divided into: the moving of employees, filling in the documents related to repair activities, searching for employees or relevant parts, preparing and tidying up the workstations. Apart from that, the break time and ineffective time have been distinguished [10].

The research method was based on open, uncontrolled, standardized observation of employees [11]. It was aimed at measuring the time devoted by employees to a particular activity, and the received data was recorded in chronological order. Each employee was first informed of investigations to be carried out. The research was conducted at the turn of two months: August and September 2011, i.e. in the period of enhanced production in the plant. It was done during 9 working days and each employee was subjected to observation three times. Three employees were examined during morning shifts, from 6 a.m. to 2 p.m.

Research analysis

Working time measurement

Table 1 presents average results for all the examined employees.

The above table shows that the longest average time of effective work for all employees is devoted to: repair, consultations with employees, as well as check of the machines so as to discover any irregularities. In the case of auxiliary time the highest values were noted for: administrative activities, tidying up and preparation of a workstation, while the lowest measured values were recorded for the employees' moving and search for employees or necessary parts. The average ineffective time amounted to approximately 25 minutes.

For each employee the average time of activity duration was calculated, which resulted in the obtaining of data given below in a form of a pie graph (Fig. 1).

The above graph shows that on average each of the three employees works effectively during 50% of the whole working day time. The auxiliary time also accounts for a large part, which amounts to 28% (ca 2 hours). On the other hand, the ineffective time accounts for 18% (ca 1.5 hours). The break time is invariably 6%, i.e. 0.5 hours.

Table 1. Average duration of the examined employees' work

| Activity | Average duration | | |
|-------------------------------------------------|------------------|------------|------------|
| | Employee 1 | Employee 2 | Employee 3 |
| Effective time: | | | |
| Consultations with employees | 14.00 | 18.85 | 14.77 |
| Pondering over a problem | 15.18 | 11.00 | 8.33 |
| Repair | 24.00 | 30.75 | 33.67 |
| Check of the machines' functioning after repair | 10.50 | 11.00 | 5.67 |
| Check of machines' malfunctioning | 18.60 | 14.50 | 15.43 |
| Auxiliary time: | | | |
| Employees' moving | 4.02 | 4.00 | 3.85 |
| Preparation and tidying of a workstation | 10.83 | 8.50 | 14.00 |
| Bureaucracy | 32.00 | 39.13 | 22.00 |
| Searching for employees or relevant parts | 7.50 | 5.75 | 5.75 |
| Break time: | | | |
| Break | 30.00 | 30.00 | 30.00 |
| Ineffective time: | | | |
| Talks (not related to work) | 21.55 | 27.25 | 25.92 |

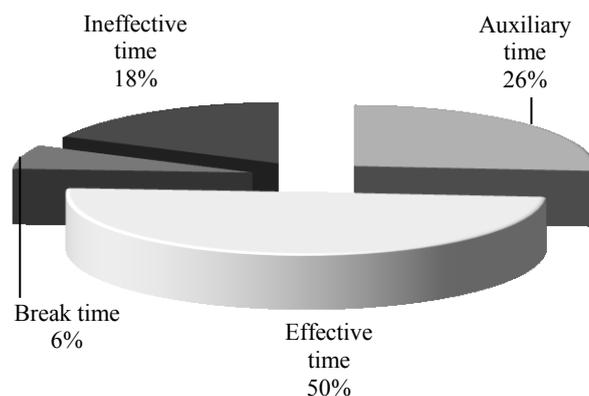


Fig. 1. Average values of the examined employees' working time

Working time during the day

In the next part of research the effective time, the auxiliary time, the break time and the ineffective time in particular hours of the employees' work were subjected to analysis. Relevant values were assigned to each of the eight hours of work. The results have been given in a bar chart (Fig. 2).

From the above graph it can be concluded that the working time is fully used in the second and third hour of a working day. Then the employees work the most effectively – the auxiliary time is short, whereas the ineffective time is scarce. The least effective work is observed at the beginning

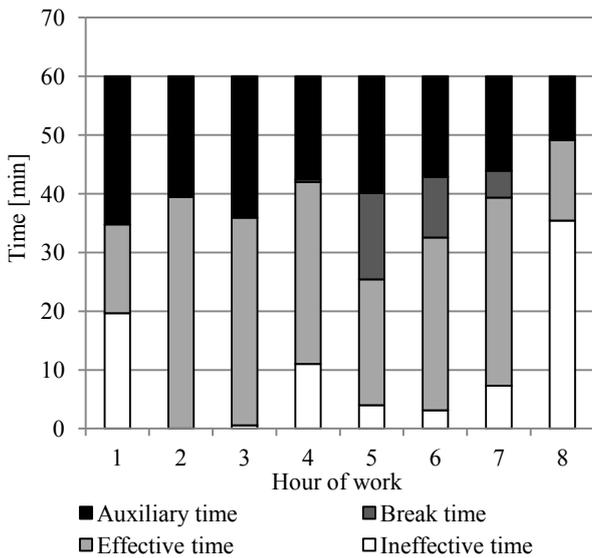


Fig. 2. Average values of working time during the day

and at the end of the day (the first and the eighth hour) – the effective time is short, as opposed to the auxiliary and ineffective time.

The 5WHY Method

The last stage of research is aimed at identifying the causes of the auxiliary and ineffective time length. This problem was analysed using the 5Why Method. An analysis carried out by means of this method has been presented in figures 3 and 4. The 5Why Method allowed analysing the reasons for the occurrence of ineffective and auxiliary time, which consists of:

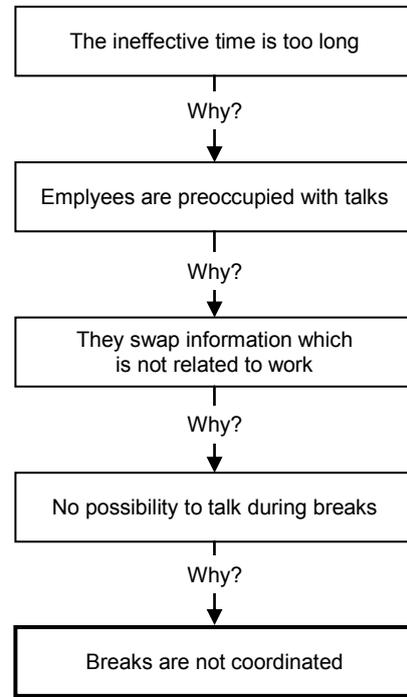


Fig. 3. The 5Why Method – ineffective time

- activities which involve filling in the documentation, as well as other administrative activities;
- tidying up the workstation;
- employees’ moving;
- searching for parts.

The ineffective time is chiefly devoted to employees’ talks which are not related to the job.

An analysis carried out by means of the 5Why Method allows stating that the reason for such

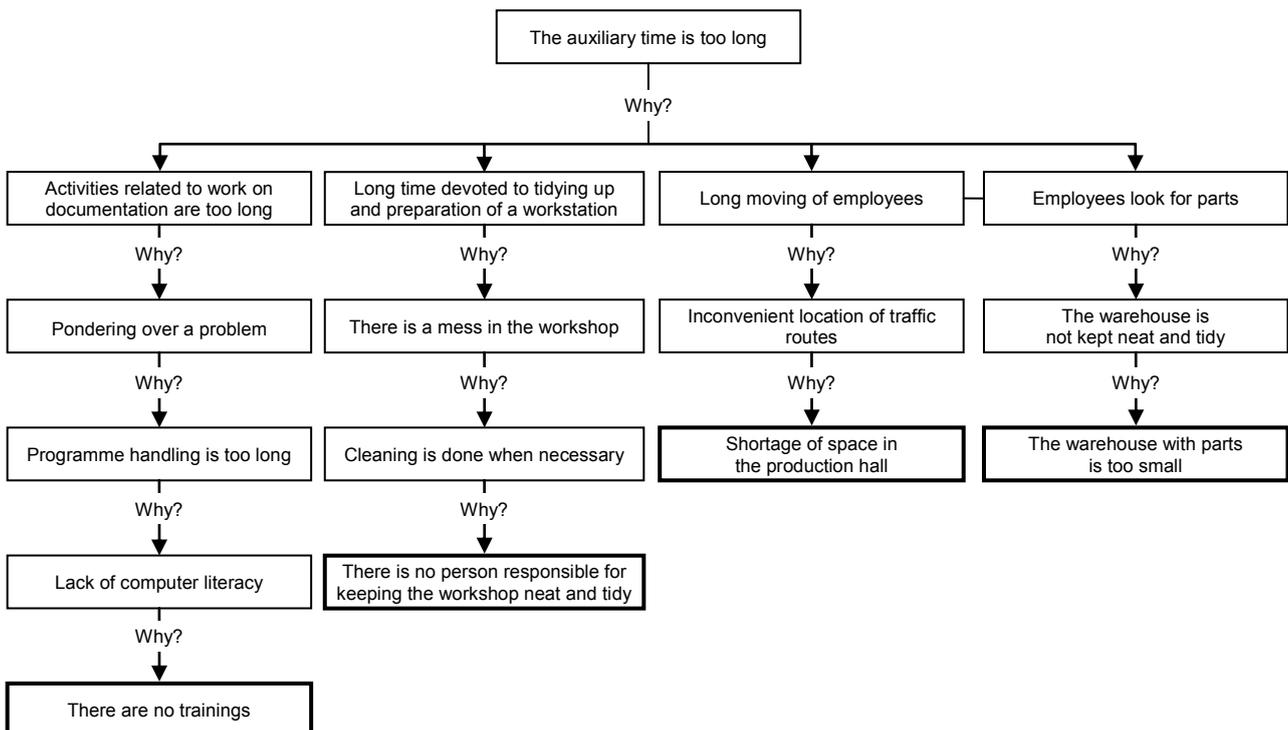


Fig. 4. The 5Why Method – auxiliary time

behaviour of employees might be the fact that the breaks are not coordinated and employees have no contact with each other during a break. Unfortunately, in the case of maintenance employees the coordination of breaks with production department workers is not possible due to the specificity of their work. In order to prevent this problem, we can divide breaks into shorter periods.

In the case of the auxiliary time, the major problem is time-consuming bureaucracy. The employees devote a lot of their time to pondering about how to use the computer and the installed programme for maintenance department work support. In order to shorten the duration of these activities, the simplest way would be to introduce training courses in computer literacy for the employees and to recruit new employees in a more careful way.

Another problem resulting from the auxiliary time measurement is connected with long-lasting preparation and tidying of a workstation. This is due to the fact that employees clean up the workshop only when it becomes evidently necessary. There is no duty to tidy up one's workstation on a regular basis; also, there is no person responsible for this activity. As a result, not only are the workshops dirty, which does not favour a good atmosphere at work, but also the omnipresent mess makes it difficult to find necessary parts and tools. This problem can among others be solved by:

- trainings on how to keep a workshop tidy;
- personal responsibility for keeping a workshop clean;
- introduction of the 5S rules.

Another problem resulting from the auxiliary time is too long time spent by employees moving from a workshop or warehouse to machines under repair along the traffic routes established in the production house. In order to shorten this time, small, temporary workstations with necessary, the most typical spare parts and tools could be organised (so-called service outlets).

The last problem is too long time devoted by employees to the search for parts. A spare parts warehouse is too small and at the same time is contained in a too small workshop. The small space, with scarce lighting favours a mess and practically makes it difficult to locate spare parts and tools. This problem can be minimized by introducing:

- another system of storing or warehouse rooms;
- 5S rules, including visual management;
- changes in the lighting of warehouses and workshops;
- a person responsible for storage;
- training courses on storage rules.

Conclusions

The conducted analysis allows the following to be stated:

1. The average ineffective time for all employees accounts for 18% (ca 1.5 hours)
2. The average auxiliary time is 26% (more than two hours).
3. The largest portion of auxiliary time is devoted by employees to the completion of formal documentation, involving the use of computers and maintenance support systems, as well as to the tidying of their workstations. An important role is also played by employees' moving and their search for parts.
4. Employees work the most effectively in the 5th, 6th and 7th hour.
5. In the 1st and 8th hour employees work ineffectively.
6. The most important activity contributing to the ineffective time is talking to other employees about things unrelated to work.

On the basis of the analysis conducted by means of the 5Why Method the following recommendations improving the effectiveness of maintenance employees' work can be formulated:

1. An attempt to coordinate or organise breaks for employees in a different way.
2. Introduction of trainings in computer literacy and the use of software.
3. Better selection of new employees in terms of their computer skills and the command of their work organisation principles.
4. Introduction of personal responsibility for keeping a workstation clean.
5. Introduction of 5S rules.
6. Introduction of a person responsible for keeping a workshop clean and a person in charge of storage.
7. Introduction of service outlets.
8. Changing the system and place of spare parts storage.

References

1. ŻURAKOWSKI F.: Funkcjonowanie przedsiębiorstwa. Zarządzanie. Wydawnictwa Szkolne i Pedagogiczne, Warszawa 2004.
2. JASIŃSKI Z.: Zarządzanie pracą. Agencja wydawnicza Placet, Warszawa 1999.
3. LEGUTKO S.: Trendy rozwoju utrzymania ruchu urządzeń i maszyn. Eksploatacja i Niezawodność (Maintenance and Reliability), no. 2, 2009.
4. MIKLER J.: Znaczenie utrzymania ruchu w nowoczesnym przedsiębiorstwie. <http://www.eison.pl/zasoby/8-utrzymanie-ruchu/23-aretics>.
5. MIDOR K., SZCZEŚNIAK B., ZASADZIEŃ M.: The identification and analysis of problems within a scope of cooperation

- between traffic maintenance department and production department. Scientific Journals Maritime University of Szczecin, no. 24, 2010.
6. MĄCZYŃSKI W., NAHIRNY T.: Efektywność służb utrzymania ruchu jako składowa efektywności przedsiębiorstwa. [w:] Knosa R. (red.): Innowacyjność procesów i produktów. Oficyna wydawnicza PTZP, Opole 2012.
 7. TAGUE R.N.: The Quality Toolbox. ASQ Quality Press, Milwaukee, Wisconsin 2005.
 8. HUBER Z.: Metodologia 5-Why. <http://www.strefa-iso.pl/5-why.html>.
 9. STANEK K., CZECH P., BARCIK J.: Metodologia World Class Manufacturing (WCM) w fabryce Fiat Auto Poland SA. Zeszyty Naukowe Politechniki Śląskiej, Transport, z. 71, 2011.
 10. DRZYMAŁSKI A.: Podstawy organizacji pracy działu UR. Utrzymanie ruchu, nr 2, 2012.
 11. KACZMARCZYK S.: Badania marketingowe. Metody i techniki. PWE, Warszawa 2003.