MEASUREMENT AND ANALYSIS OF INTERNAL CUSTOMER SATISFACTION ON THE EXAMPLE OF PRODUCTION DEPARTMENT AND MAINTENANCE UNIT

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Summary: The article presents the concept of the relationship between the maintenance department and the production departments, consistent with the internal customer – internal supplier model. A tool was developed to measure the perceived quality of services of the maintenance department employees, who provide their services to the production departments. Based on the analysis of results, it became possible to identify weaknesses and critical points of that cooperation and to formulate recommendations for improvement of mutual cooperation.

Keywords: maintenance, internal customer, work quality, TPM.

1. Introduction

The maintenance is a series of actions organizational and technical, as well as, economic and legal, which aim is to show the real state of affairs and the preserve and restore of that state of affairs, which is desirable in a given moment. [1]. It is a whole complex of factors from which correct operation depends on effective implementation of production in a factory. Undeniably, the effectiveness of a company will increase significantly when the maintenance works efficiently. The basic, yet most important task of the maintenance department is to perform work consisting in a constant control of the equipment technical condition, which aims to maintain and preserve the desired state of technical measures. Moreover, the tasks of that department's staff include also carrying out of any actions preventive and protecting the devices against the side effects, such as damage or contamination. Effective maintenance of technical suitability depends on many factors, and to be able to perform this process properly it must involve all participants of the production process [2, 3], as schematically presented in Figure 1.

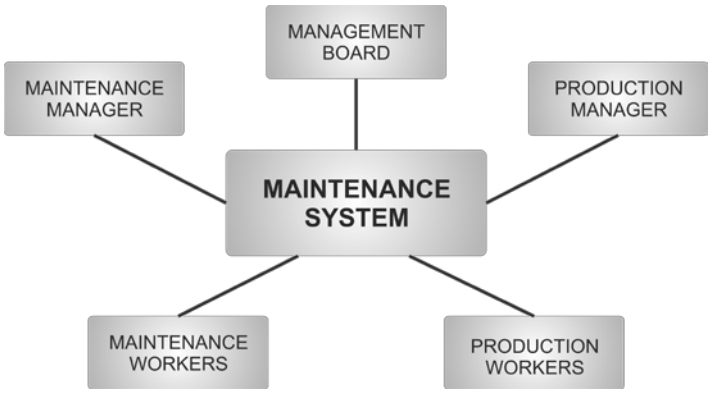

Fig. 1. The components involved in the maintenance process

The various processes in the organization are performed by its personnel, who take various actions and activities that are required for a given workstation. All of these processes are interrelated and constitute a kind of chain of internal customers, in which each member of the organization uses the services or goods provided by other employees. This approach is called a process approach, in which each employee must fulfill three roles: supplier, customer and contractor. This phenomenon is illustrated in Figure 2, where the value chain is presented.

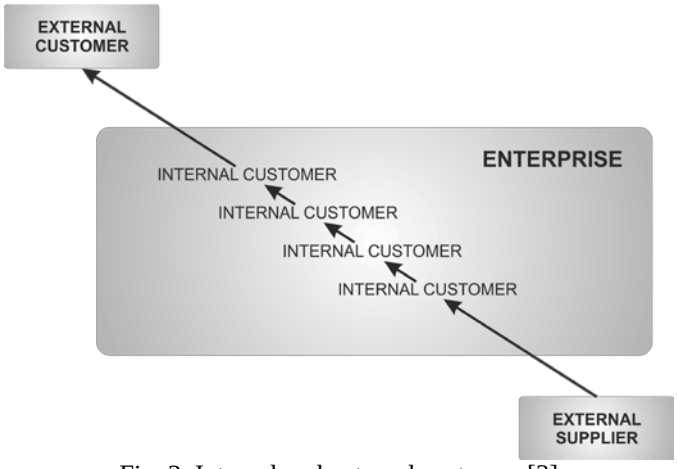

Fig. 2. Internal and external customer [3]

The value chain starts with an external supplier passing through internal clients and ends with an external client. In this approach, the internal customer satisfaction translates directly into the internal customer satisfaction with the goods or services [3].

A practical reflection of such the relationship is cooperation between the maintenance and the production departments. According to the assumptions of continuous improvement contained in the ISO 9000 series and the modern concepts of maintenance management, every employee of an organization should be involved in the maintenance process and strive to continually improve it. Therefore, it appears advisable to measure the perceived quality of services provided by the maintenance department to the production departments. So that the picture resulting from that could be fuller the method presented below also involves measuring of the perceived assessment of the possibility of performing work by maintenance employees.

The maintenance department work quality testing was performed in a company being a leading company in the steel market. The products supplied by that organization are made mostly of alloy, stainless steel, galvanized and copper coated steel and aluminum. The production consists in the fact that the finished materials are cut and shaped into the appropriate elements. For example, flat and long products are manufactured of aluminum, while pipes and hollow profiles, rods and other equipment are manufactured of stainless steel. The products made of steel include plates, beams and construction products. The stock of machines of the organization in question includes, among others, prefeeders, feeding and receiving rolls, guillotine shears, knife cages, tapes feeding and receiving trolleys, S-blocks, finished tapes winders, trestles, orgapacks (binding of the finished products with a steel tape), carousels, turntables and cranes, forklifts and balances. The company employs 68 employees of the production line and 56 "other" employees (among

other: administrative staff, quality and control department, sales and human resources). While the maintenance department employees are employed by an external company, and their number in the examined organization is dependent on current needs [5].

2. Research methodology

The presented method, in its part research, involves measurement of the internal customer satisfaction, which is the production department, and the maintenance department capabilities measurement. Summary and confronting of the two results, explained the perception of work of the maintenance services in relation to the tasks performed by them, which helped to determine the quality and efficiency of the work [6]. The researches were carried out using two survey forms: one for employees of the production departments, and one for the maintenance department employees. Topics of questions of both surveys focused in the following areas: timeliness of repairs, information flow and work culture. Table 1 shows all topics included in the survey forms.

Tab. 1. Topics raised in the research

Production	Maintenance
1. Are repairs/overhauls conducted in due time?	1. Does a condition of work place hinder carrying out machines overhaul?
2. Is repair/overhaul time satisfactory?	2. Does the position of a machine in production hall allow for easy access to them during the machine repairs or overhauls?
3. Are maintenance workers always available?	3. Are there any mechanical failures which are a consequence of bad use of machines by workers of production department?
4. Is the time of waiting for maintenance worker satisfactory?	4. Is the description of mechanical failure prepared properly by a worker ?
5. Do machines after repairs work satisfactorily?	5. Does it happen that a mechanical failure is reported in other way than according to the procedures?
6. Are corrections necessary after the repairs?	6. Are there problems reported which should not be solved by traffic maintenance department?
7. Is a place of work after the conducted repair left clean?	7. Is there a correct and precise report of all failures?
8. Are all reported defects diagnosed fast by maintenance workers?	8. Is it obvious who to contact with in production department in case of occurrence of problems when removing the failure or in case of repair?
9. Do maintenance staff inform about delays of deadlines in repairs?	9. Are there situations in which due to a superior's decisions, the date of planned repair/overhauls is postponed?
10. Are the causes of defects described correctly by maintenance workers?	10. Are TM workers asked for advice in terms of the order of removing failures in case of occurrence of many failures simultaneously?

cont. of tab. 1. Topics raised in the research

11. Is information about delays in repairs provided?	11. Do production department workers require too precise information about the course of repair/overhaul?
12. Is the date of removing a defect provided?	12. Do conditions in the production hall (noise, temperature, humidity) hinder the work during repair/overhauls?
13. Is information about planned overhauls provided?	13. Is there pressure on the performance of repairs/overhauls in a short time at quality of repair's expenses?
14. Do maintenance workers look after order turning work?	14. Do the personal aversions between workers of production and traffic maintenance departments influence on affectivity of preformed repairs and overhauls?
15. Do traffic maintenance workers disturb other workers' work?	15. Are there enough TM workers to fulfil their duties?
16. Do traffic maintenance workers dress neatly?	16. Do production department workers disturb work during performed repairs/overhauls?
17. Is there a possibility to choose a scope of repair e.g. between fast repair (makeshift) and solid repair (long term)?	17. Do TM workers have good and efficient tools?
18. Do maintenance workers have proper and efficient tools?	18. Are documents connected with preformed repairs/overhauls legible and easy to fill them in?
19. Are documents connected with the performance of repairs/overhauls legible and easy to fill them in?	19. Is the improvement of TM workers' qualifications adequate to accomplishment of tasks prepared for them?
20. Are document for reporting repairs available?	20. Are production workers well mannered in contacts with TM workers?
21. Are workers familiar with a procedure of reporting and acceptance of repair?	21. Is the time of implementation of the procedure related to the ordering of spare parts satisfactory?
22. Are documents concerning repairs subjected to be lost?	22. Are procedures connected with ordering parts easy to do?
23. Are maintenance workers competent?	23. Are a number of available spare parts sufficient?
24. Do maintenance workers draw attention to actions they take?	24. Is there a good relationship with spare parts providers?
25. Are maintenance workers well-mannered?	25. Do TM department have an ability of priority treatment of strategic machines?
26. Do maintenance workers understand production workers' needs?	26. Are there long term contracts with spare parts deliverers?
27. Do maintenance workers help willingly with solving problems concerning machine failures?	27. Does it happen that during the failure removal the UR staff are called for other failures?

cont. of tab. 1. Topics raised in the research

28. Are maintenance workers willing to stay longer at work to solve the matter?	28. Does it happen that repair/overhaul is not done due to political decisions(finance, maintenance, of client, organization-like)
29. Is the maintenance workers' time which they spend removing used efficiently?	
30. Are devices after repair meeting safety standards	

In both surveys, the questions were formulated in a transparent and simple way, so there was no doubt in their interpretation by respondents working in various positions and with different education. The answer to every question, is given based on a three-positional scale that allows the respondents to choose an appropriate category according to their opinion, namely: rarely, sometimes or often. Next to the answer a check box of significance of a given issue for the respondent, also using a three-positional scale: insignificant, significant or very significant. The next step of the method is to convert the various categories into the estimation by point. For the scale concerning the significance of a given issue category "insignificant" equals to 1 point, "significant" – equals to 2 points, a "very significant" – 3 points. The procedure for evaluation is analogous, except that the points assigned to particular categories vary depending on the form of questions, i.e., in one question a statement "rarely" may amount to 1 point, and in another one - 3 points. Such an alternate formulation of the questions will be an indicator to assess the reliability of the survey in terms of thoroughness in responding to individual questions, and will show whether the respondent understood the ideas of questions.

The questions were directed to the staff involved in the process of implementation of the service. The survey was directed to the production line employees (48 people) and maintenance department employees (16 persons).

3. Result analysis

3.1. General results

The assessment was calculated from the obtained results, using the weighted average for each type of survey, according to the above presented formula:

$$RW_{śr} = \frac{\sum_{i=1}^{n}(R_i \times W_i)}{\sum_{i=1}^{n} Wi} \quad (1)$$

where:

n – number of responses (number of questions × number of surveys),
R – value of the assessment,
W – value of the significance.

So obtained values are eligible for three levels of assessment:

- high (score from 2.34 to 3.00),
- average (score 1.67 to 2.33),
- low (score 1.00 to 1.66).

From the results obtained the weighted average was calculated separately for each type of the survey. The results are as follows: assessment of the maintenance services work quality 2.81, assessment of the ability to work by the maintenance staff amounts to 2.57 (Fig 3).

Fig. 3. The general result matrix

The classification of results to a high level assessment indicates a very high level of effectiveness of cooperation between maintenance and production line departments,. That cooperation is very good. The high work opportunities of the maintenance services translate into a high appreciation of their work. The focus should be on maintaining the current status of cooperation in the future.

3.2. Detailed results

Both in the area of the work quality and job opportunities of the maintenance department to identify the most important problems also can be performed based on the arrangement of scores in a modified quality map (Fig. 4 and 5).

That the results may be placed on, firstly the arithmetic mean must be calculated for the scores of individual issues raised in the surveys, then we calculate the arithmetic mean for the scores of significance of the particular issues. Thus the calculated values were put on the earlier prepared two maps of processes for different groups of the employees: production line and maintenance department employees.

The scores of the assessments and significance of the individual issues raised in the surveys are presented in table 2.

Tab. 2. The survey results

Issue	Work quality		Job opportunities	
	Assessment	**Significance**	**Assessment**	**Significance**
1	2,958	3,000	3,000	3,000
2	3,000	3,000	1,000	3,000
3	2,979	3,000	2,625	2,438
4	3,000	2,813	2,563	2,875
5	2,938	2,688	2,375	2,063
6	2,646	2,396	2,813	2,000
7	2,667	2,354	2,438	2,000
8	2,604	2,188	2,875	2,063
9	2,958	2,021	2,938	2,000
10	3,000	2,563	1,750	1,375
11	2,938	2,875	2,625	1,625
12	2,438	2,146	2,688	2,813
13	3,000	2,458	2,750	2,375
14	3,000	2,708	3,000	1,188
15	3,000	3,000	3,000	2,938
16	2,813	2,125	2,875	2,875
17	2,333	2,333	3,000	2,875
18	2,938	1,688	2,313	2,000
19	2,917	2,250	2,188	2,000
20	2,979	2,333	2,438	2,000
21	2,167	2,271	2,250	2,813
22	2,563	2,167	2,813	2,063
23	2,896	2,063	2,438	2,063
24	2,813	1,979	2,313	2,063
25	2,813	2,792	3,000	3,000
26	2,792	2,563	3,000	2,438
27	2,854	2,271	1,750	2,438
28	2,729	2,854	3,000	2,750
29	2,708	2,688		
30	3,000	2,750		

From data contained in table 2 a matrix for the scores of the assessment of the maintenance services work, was drawn up, which is included in Figure 4.

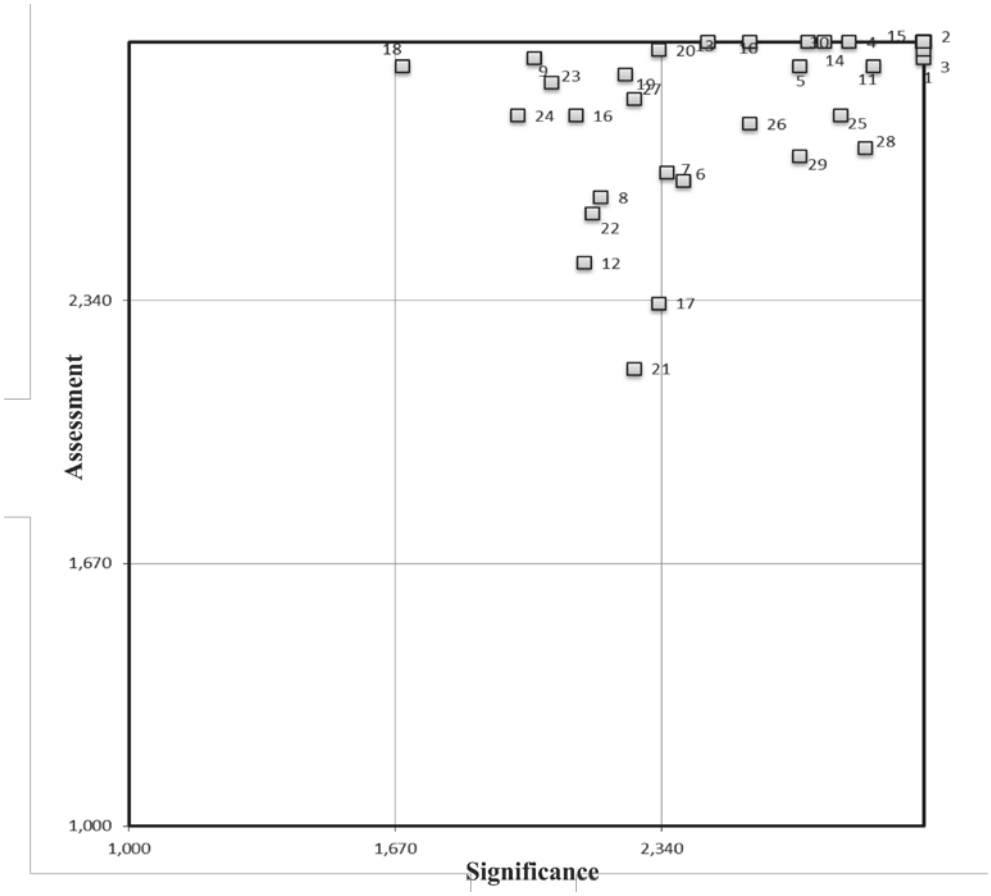

Fig. 4. Matrix of the assessment of the maintenance department work

The conducted analysis shows that most of the problems raised in the survey questions do not need to be improved and the level of cooperation with the maintenance department is high. This is a very satisfactory level - all the examined issues, included in the middle significance area obtained medium or high score, and the issues located within a high significance area were rated high. In this case there are no refresher actions needed, one should just take care to maintain that level.

Figure 5 shows a matrix of scores for assessment of the potential to perform the work by the maintenance employees.

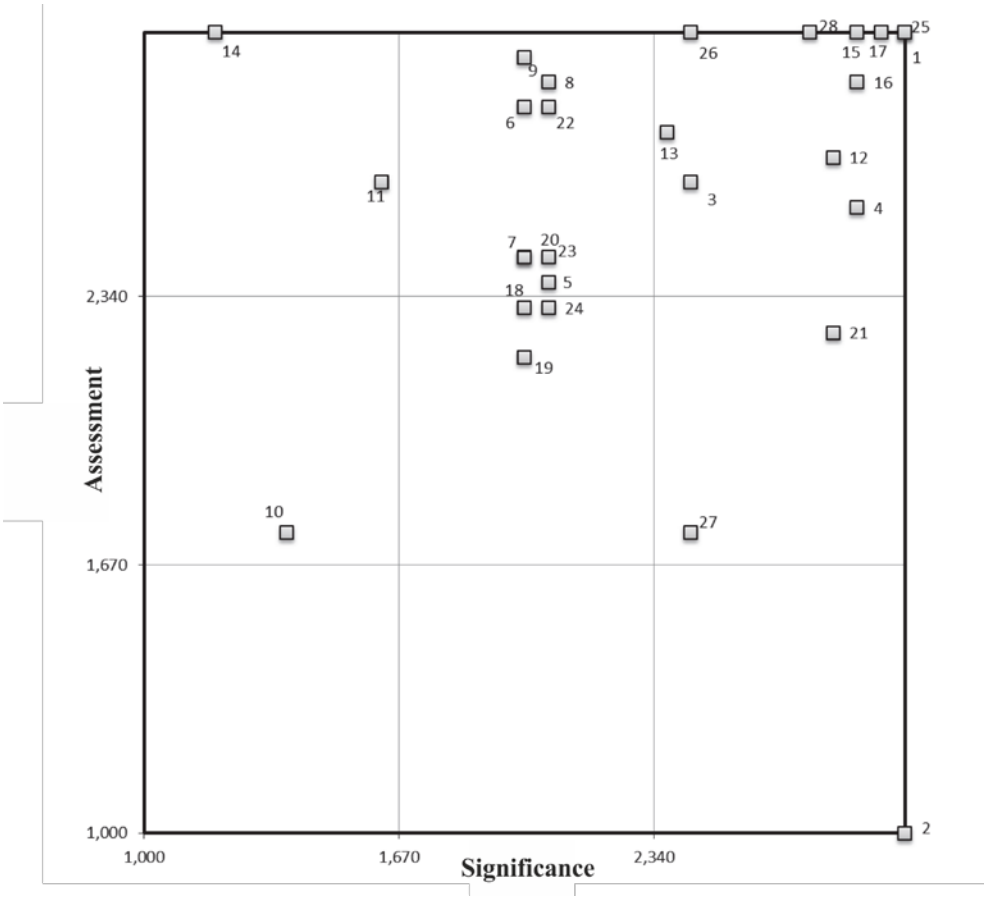

Fig. 5. Macierz oceny możliwości pracy

Ability to work of the maintenance employees is evaluated on a good level. Most issues are assessed adequately to their significance or higher. Here, the exception is the following question 2 - Does the arrangement of machines on the production floor allow an easy access to them during the machine renovation/ review?, Which has a high significance, and was evaluated at a low level. Similarly, the following issues 21 - Is the time of implementation of the procedure related to the ordering of spare parts satisfactory? and 27 – Does it happen that during the failure removal the UR staff are called for other failures? have a high significance, and only average scores. The aforementioned issues need to be improved as the first ones.

The further analysis scores classified according to the position held in the production department. Figure 6 shows the assessment of the maintenance work carried out by the employees employed as the blue-collar workers, Figure 7 illustrates the assessment of managers.

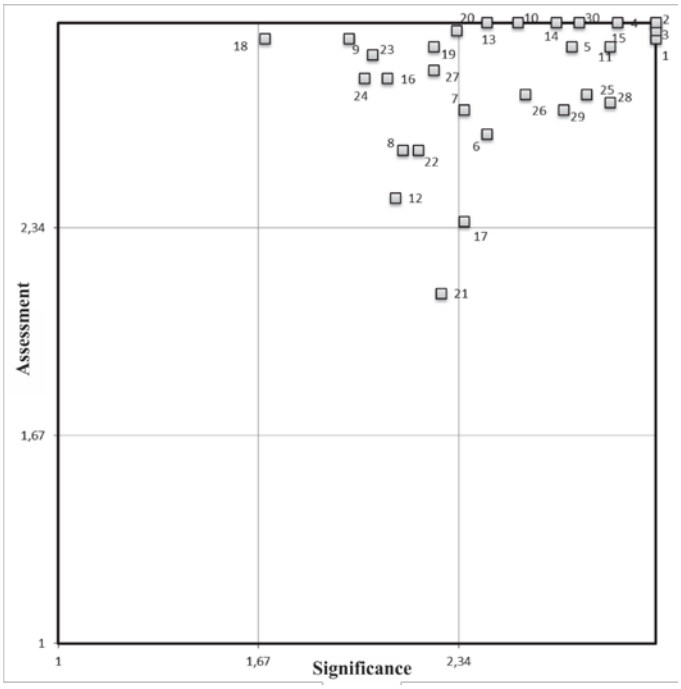

Fig. 6. Matrix of the assessment of the maintenance department work performed by line employees

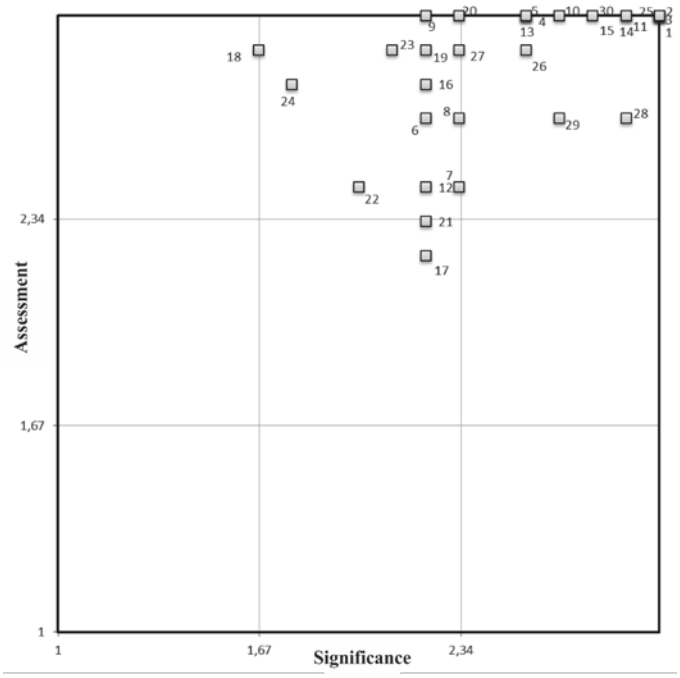

Fig. 7. Matrix of assessment of the maintenance department work performed by managers

The obtained results do not differ from each other, both in the amount of scores, and in terms of assigning of significance to the individual issues. The Managers and the workers very similarly perceive the quality of services provided by the maintenance staff, and similar issues are important to them.

4. Summary

The analysis of the scores shows that the level of effectiveness of cooperation between the maintenance and the production line departments is correct. Satisfactory job opportunities of the maintenance services translate into a high assessment of their work and their large opportunities. The focus should be put on the elimination of negative factors, what in future will benefit for the entire company and the general internal customer satisfaction. Also extremely important may be the constant improvement attitude of the company. Its essence is the constant improvement of processes in a company through small improvements made by all the employees. The pro-quality action in the company are designed to involve all staff in the improvement process, as all the employees task is a continuing analysis of the processes, policies, methods and standards of work. This allows finding and eliminating errors and imperfections in the company operation.

The above method of the internal customer satisfaction level measuring in the area of cooperation of the production and maintenance departments, should help managers to make an analysis of the functioning of the maintenance department in terms of the work performed, and the possibility of its implementation with the resources existing within the organization. The developed method allows a rapid diagnose of the current problems which sources underlie the managerial and organizational decisions of the examined enterprise. It also allows determining the level of the internal customer satisfaction with the services provided by the maintenance services.

With the results obtained in the described method steps can be taken to improve the quality of those aspects of work, which are seen as worse by the internal customer, i.e., the production department, but also may draw attention to the difficulties encountered by the maintenance staff. Also relevant is the fact that the simultaneous analysis of these two areas of the company, helps to improve the atmosphere of the organization, shared dialogue, and the maintenance department - production department relationships.

5. Conclusion

While summarizing the results of researches and analysis the following detailed conclusions have been defined:

1. The used method of survey satisfaction of the production department of the maintenance department work, showed that the level of effective cooperation between these departments is correct.
2. The aspects identified by the analysis undertaken, that require a necessary improvement include:

– when placing the new machines in the hall or changes to existing arrangement are made, the maintenance staff should also be consulted,
– use of assessment of the key components suppliers and finding the reserve suppliers, and if necessary replace them,
– the department staff work organization in a way impacting the effectiveness of their ongoing tasks.

3. The conducted survey has identified the following weaknesses in the organization, the improvement of which will undoubtedly improve functioning of the company:
- trainings in handling and filling documentation or a possible change of the documentation system,
- monitoring of the information flow channels,
- normalization of the time needed to review a given machinery,
- drawing attention to the importance and value of each unit of time, which affects the effective functioning of the company,
- bilateral control of the working time (the head of production line and the maintenance department employees),
- implementation of the scores system regarding cooperation with suppliers and efforts to build normal common relationship.

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