

INCREASING THE PRODUCTION CAPACITY OF THE COMPANY THROUGH THE IMPLEMENTATION OF COMPUTERISED MAINTENANCE MANAGEMENT SYSTEMS

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Abstract: Efficient machine and equipment service management as well as maintenance of operational readiness of the machine park significantly contributes to the obtained product quality. Implementation of computer systems maintenance is today the basis for the proper company functioning. The article presents the use of Computerised Maintenance Management Systems (CMMS), which contributes to the increase in production capacity of the company. It also presents significant benefits achieved due to implementation of CMMS system in the organization.

Keywords: company, production capacity of enterprises, CMMS, machine operation, maintenance

1. Introduction

Powerful technological progress, optimization of business processes and new solution possibilities contribute to the use of more and more modern tools supporting company management.

The basis for the effective functioning of enterprises is efficient exchange of information within the organization. Nowadays, in order to obtain fast and accurate processing of information companies can use computer systems that support the process of production data collection from machines performing various stages of production. Real-time access to complete information on the production processes, product quality and efficient use of resources enable companies to acquire and process production data directly from the production line in a manner independent of the process itself.

A very important aspect is to maintain operational readiness of machinery available in the company, because it determines the gain of the planned production capacity [7]. Technical condition of the existing infrastructure contributes significantly to the quality of products and the competitive advantage of enterprises [1]. In order to ensure full production capacity of the company it is required to obtain a well-organized and well-functioning computer system, responsible for the maintenance management of machines, equipment and technical condition of the company at a certain level.

The aim of the study is to present the use of CMMS system, which can contribute to an increase in the production capacity of the company. Moreover, it highlights significant benefits achieved due to the implementation of a CMMS system in the company.

2. Production capacity of an enterprise

In general, production capacity of a company is defined as the maximum amount of production that a company can achieve in the given technological and organizational

conditions. For various reasons, the level of production capacity fluctuates even on a daily basis. It can be due to random employee absences, unexpected breakdown of machinery and equipment or problems that may arise with the supply of materials, media and components [3].

Dynamics of the company's production capacity reflects not only the usage and replacement of the production means, but also improvement of technology and production organization. Therefore, production capacity depends not only on specific factors used in the production process, such as operating resources, objects of labour and manpower, but also on technical and organizational progress [4].

Ensuring continuity of all machinery and equipment work is not a simple task. The real challenge is not to efficiently eliminate breakdown of machinery and equipment in the production process, but not allow it to occur. Those responsible for the condition of the machinery, maintenance engineers, make a significant contribution to the decision-making process related to production control.

Currently computer systems play a very important role in raising production capacity of a company, because they are responsible for maintenance management of machinery and equipment. Thanks to the usage of such specialized and efficient computer systems maintenance engineers are able to analyse production capacity and worktime of machines. Moreover, they can identify the workload of individual processes and, indirectly, determine the production capacity of enterprises.

3. Problems connected with the operation of the company

The analysed manufacturing company was established in 2001. Currently it employs 186 people. The company operates in the automotive industry and specializes in the production of parts for trucks and cars. The main strategy of the company is to uphold the high quality of products. The company continues to expand its range of produced parts for the new vehicle models. Due to the modern machinery park the company willingly cooperates in the production of metal parts. The high quality of their products is confirmed by the quality certificate ISO 9001: 2015.

Despite many years of activity in the market, the huge problem for the analysed company was to introduce correct, accurate and rapid flow of information. Company's main problem was the lack of appropriate software responsible for the records of failures and defects, and maintenance management of machines and equipment that would support the work of maintenance engineers.

When the fault was found, the operator of a machine or device reported it to the foreman. Then, the foreman informed about the failure his shift manager. After that the shift manager transmitted the information to the maintenance engineer by phone. Finally, the maintenance employees could undertake corrective actions by restoring the technical efficiency of a machine or device.

After removing the fault maintenance workers registered it manually in the so-called failure card, in which they had to describe symptoms of each particular failure. After removal of the failure maintenance employee was also obliged to describe duration time of the breakdown repair, completion of the repair work, number of people involved as well as suggestions for preventive measures in the future.

At the end of the work, maintenance employee was required to enter all the information about the existing failures and faults in a simple computer database called Access. In such a database it was possible to create simple reports based on the data prescribed from the

failure cards. Failure cards were archived in binders. Access to data stored on the cards had only maintenance employees. The company formally had the data registry system, but the information gathered in it was used on a very low and inefficient level. Furthermore, inputting all the necessary data manually on the failure cards was rather laborious.

Another organizational problem, which appeared in the company, was the lack of machinery and equipment inspection schedule as well as the lack of reliable information about inspections that were already performed. The absence of such important information limited to a large extent possibility to plan and adapt maintenance to real needs of machines and devices operating in the enterprise, which resulted in more frequent occurrence of failures and unplanned downtime. Consequently, the production capacity of the company decreased with the occurrence of each failure, and these were more and more frequent.

When the analysis of the company's functional problems was completed it was suggested to implement CMMS software in order to streamline maintenance works in the audited company. The company analysed the proposal and decided to implement a computer system that would be appropriate for the needs of the company.

5. Computerised Maintenance Management Systems

CMMS computer systems are employed as a part of manufacturing maintenance subsystem in production and service companies, which use technical facilities. They allow gathering information about failures of facilities and implemented operation processes including their meticulous descriptions for specific equipment and machinery. They also allow scheduling periodic and preventive inspections, taking into account their appropriate queuing [5].

Implementation of Computerised Maintenance Management Systems is essential in companies that possess advanced production processes based on expensive investment in machines. CMMS systems control the process, value it and at the same time give the basis for the design of maintenance and repairs system [6].

CMMS systems usually cooperate with ERP systems and external devices, which allows for smooth, rapid and effective management of the company's technical infrastructure. The process of data exchange is based on numerous interfaces, which are enriched by XML files [8]. This significantly improves company's production capacity, increases the comfort of management, and rationalizes planning of periodical inspections as well as repairs of machinery and equipment.

6. Implementation of CMMS in the company

The main challenge of the company was smooth the efficient implementation of the system class CMMS compatible with existing software ERP (Enterprise Resource Planning). After a thorough analysis of potential CMMS software vendors, the company decided to implement CMMS system produced by Queris Company. Software selection was determined by the fact that Queris stands out from the competition in a wide range of application possibilities. Moreover, it offers individual approach to the customer, can be flexibly configured and offers carefully chosen solutions for manufacturing companies.

The beginning of Queris CMMS software implementation in the analysed company took place in November 2014. It included, among others:

- a) installation of CMMS software,

- b) introduction of the identification data for individual machines and equipment (names of machinery and equipment, codes, numbers, date of production, etc.)
- c) division of the plant into functional areas,
- d) assignment of individual machines and devices for specific functional areas,
- e) establishment of machinery and equipment inspection plan,
- f) establishment of the users' list together with division of their roles:
 - foreman – can report new failures;
 - maintenance engineer – can report new failures, take appropriate actions and fulfil preventive machinery maintenance;
 - team leader – can report new failures, take appropriate actions and fulfil machinery preventive maintenance as well as create new preventive machinery maintenance and generate reports.
- g) integration of CMMS system with ERP system and other industrial control systems (i.e. WinCC or PCS 7) already existing in the production company,
- h) execution of technical tests checking the CMMS operation,
- i) training of maintenance engineers,
- j) training of production staff,
- k) functional testing of the system.

The implementation process of Queris CMMS software in a manufacturing company lasted 15 months and was completed successfully in February 2016. It was time-consuming and complex, since it had to ensure the accuracy of data entry and required a large commitment in identifying any possible mistakes and eliminating them.

Integration of CMMS system with ERP system was very time-consuming and complicated, because it had to provide connection to the existing information system in the company in order to transfer the collected data in real time. It should be noted that the existing in the manufacturing company ERP system did not response to all the need of maintenance management (i.e. it did not have such functions as detailed register of assets, emergency repairs or scheduling maintenance). Implementation of CMMS resolved many common functional problems in the enterprise. First of all, immediate flow of information was not any more a problem. Secondly, it introduced ongoing monitoring of the technical condition of machinery and equipment. Moreover, the usage of the new software reduced unplanned downtime and automated records concerning the work of maintenance engineers. Furthermore, CMMS system largely contributed to the growth of company's production capacity. Implementation of the CMMS system in the production company increased efficiency of machines and equipment, because it eliminated losses associated with their use. Automatic flow of information opened new possibilities for the company due to access to real-time data. All the data obtained from the manufacturing process enabled the company to analyse key performance indicators, obtain a true picture of the company's potential and production capacity.

7. Measurable benefits of CMMS system in the studied company

Analysing significant benefits which were obtained from the implementation of the CMMS system in the studied company during the time of 9 months (from March 2016 to November 2016), it was easily noted that maintenance engineers streamlined their work. Another huge change was seen in the flow and collection of information on the current and projected state of individual objects, automatic registration and notification of events (failures, downtime, and exchanges). In addition, there was an increase of control over the

technical condition of machinery and equipment, which prolonged their trouble-free operation – increase in Mean Time Between Failures (MTBF).

MTBF shows how often a static point of view, followed by damage to the technical object (machine or equipment). In enterprises index is used to determine the schedule of preventive maintenance [2].

Implementation of CMMS system had a huge impact on the growth of the Overall Equipment Effectiveness (OEE) of 9,87% (in the analyzed period) and thereby increased the production capacity of the company by achieving high performance and efficiency of technological systems (including machinery and equipment) and the minimization of failures and other unplanned events. Another advantage was an improved control over maintenance costs of machinery (in motion) and technical infrastructure associated with it, the possibility to plan and schedule maintenance of machinery and equipment and access to the full history of failure and downtime. Next benefits that were achieved include elimination of manual data records related to failure and/or downtime on paper, automation and simplification of the process connected with creating, controlling and monitoring maintenance work orders and inventory control improvement of spare parts and consumables.

Thanks to the integration of CMMS system with the ERP system, the company improved its work processes, flow of data, insight into production schedules and ability to identify optimal timing of preventive machinery and equipment maintenance. In addition, integration of CMMS system with ERP system enabled the company to make analyses related to the costs of repairs and production. Moreover, it allowed for analyses of machines and equipment downtime in correlation with supply chain efficiency.

Integration of CMMS systems with industrial control SCADA systems (based on WinCC or PCS 7) allowed the company to create an interface to the supervision and visualization system, which the company had not had before.

8. Conclusions

The aim of the study was to show the application of the CMMS system, present its contribution to the increase in production capacity of the company and demonstrate significant benefits from the implementation of the CMMS system in the organization. The implementation of the CMMS system allowed the company to introduce a number of significant changes and improvements.

The CMMS system allowed the company to improve and increase the functionality of the maintenance work. The implementation streamlined notification of failures and improved efficiency of electronic record concerning occurred failures and downtime. Moreover, it improved the flow and collection of information, increased control over the technical condition of machinery and equipment. Furthermore, implementation of CMMS system largely contributed to the increase in production capacity by ensuring operation continuity of all machinery and equipment. Finally, it improved management of machines and equipment maintenance, which eliminated unplanned downtime.

Integration of CMMS system with ERP system helped to improve the exchange of information, which consequently increased flexibility and efficiency of data flow. Integration of CMMS system with industrial control systems introduced rapid insight into the actual state of machinery and equipment, which optimized monitoring and control of the production process.

In conclusion, the nine-month analysis of the CMMS system in the studied company proved that implementation of the new system was a very good solution. It contributed to the increase in production potential of the machine park and improved maintenance. Due to the CMMS system it was possible to eliminate activities that did not give added value and achieve significant savings.

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