Post-implementation benefits of a computerized maintenance management system – a case study on the industry

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1. INTRODUCTION

There is a general consensus that the role of maintenance is often overlooked when compared to other aspects of an organization. The following opinion is often shared among many organizations: «When everything is running smoothly, nobody notices or remembers maintenance, however when it isn't present at all, everyone is unanimous in agreeing that it should exist».

Let's start by discussing this article's premise which the reader may concur with, especially if they're associated with this field of industry. Though presented in a caricatural way, the premise, in any case, is a close portrayal of the situation for many companies. Even so, the paradigm is gradually appearing to change due to the increasing recognition of the importance of maintenance in the overall performance of organizations.

Henceforth, it's within this perspective that the decision to implement a computerized maintenance management system (CMMS) arises. This decision is often taken to increase the performance levels of the department and the quality of maintenance management, enabling the organization to evolve. Tom Peters' and Robert Waterman's critically acclaimed book, "In Search of Excellence", pinpoints the common elements found in organizations with the best management practices. We will focus on one of these elements, the *'priority to action'*, due to its presence in our case study.

Introducing changes and accelerating processes catalyzed the improvement of conditions for the company mentioned in this article, particularly in terms of decision-making.

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July 2020

The implementation was decided upon when the company realized their internal limitations and inefficiencies due to managing their maintenance by recording information on paper and spreadsheets, whilst also finding that some management parameters and processes could be optimized through the adoption of a CMMS.

In this article, the authors will present and detail an example of a successful implementation project for a computerized maintenance management system, outlining the resulting improvements that benefitted the case study in question.

2. IMPLEMENTING A CMMS

A maintenance management software nowadays is a popular tool that is often used. Assisting in the day-to-day organization and management of the maintenance department, it offers numerous benefits for the organization. In order to reach this stage of maintenance maturity, there are two important steps that must precede implementation. The logical sequence starts with the analysis of the different systems, followed by the selection of an adequate solution based on the presented systems [1].

A key part of this initial stage is identifying the need to implement such a system, which should be the first management decision to be made. With this, a number of issues pertaining to maintenance should be considered, namely: determining the additional costs of maintenance when compared to the previous five years; to know if the management is aware of the maintenance costs per asset; understanding if the equipment breaks down at inconvenient times without any prior warning [1].

Once these two stages are complete, the final phase should commence – the implementation of the system. Here, the consultant responsible for the project must perform a series of tasks. In brief, they should:

- Collect information on the performance of maintenance in the organization;

- Formulate a strategy for the consultancy process;
- Execute an improvement plan for the performance of maintenance;
- Evaluate the implementation of the consultancy process, according to the defined plan;
- Provide the necessary training sessions;
- When applicable, propose specified and needed investment in maintenance;
- Monitor and evaluate the project after implementation.

This chapter has not assessed the more detailed aspects, rather the authors have highlighted an important set of macro-level actions that are essential to the overall success of an implementation project. The next section details the routine steps of an implementation project, using the Bodum Project as a case study – CMMS "ManWinWin" implementation between October 2018 and March 2019, at the Tondela industrial unit.

3. CASE STUDY

3.1 Bodum

Bodum is a Danish multinational that was established in Copenhagen in 1944. The brand is renowned worldwide for its unique product design (kitchen and household products), such as in one of its most iconic pieces – the French press coffee maker with a gold, copper and nickel coating, for example – with millions sold worldwide.

In the 1980s, Bodum acquired Fertugal, a subcontractor at the time, which led to the production of a wider range of branded products in Portugal. This resulted in the Tondela unit (Bodum Portuguesa Produção, S.A.) accounting for the total volume of production. More recently, in 2018, they opened a new unit in Aveiro, Portugal which specializes in plastic injections.

Currently, the Tondela factory has approximately 230 employees and produces more than 4,000,000 units/year, which are delivered to dozens of countries worldwide (the volume exported is 100%), with notable clients in its portfolio including two of the largest global distribution chains (retail) and the largest network of coffeehouses in the world.

The maintenance department of this unit, comprising seven technicians, manages roughly 600 pieces of equipment, with three technicians assigned to over 100 stamping tools. Among the various production and auxiliary equipment, the facility contains, namely: 25 presses; 2 automatic lines (galvanizing and coating); 10 welding machines; 6 automatic washing machines; 65 assembly stations; 25 pieces of transport and lifting equipment; 1 thermal power station; 1 compressed air central unit.

3.2 Maintenance management before implementation

Since the shift in maintenance management was strategic for Bodum, the present fundamental maintenance practices were taken into account when deciding to change the maintenance management structure. With these considerations acting as a cornerstone, other decisions followed, namely the move towards preventive maintenance as a way to increase the performance of the equipment. In fact, prior to the implementation project, the predominant mode of management was corrective maintenance, since 95% of interventions occurred after failures.

Other maintenance issues were also identified, such as:

- Scattered and insufficient quality of information (e.g. poorly updated information);
- Absence of a complete equipment register, as well as a unique coding standard;
- Lack of a complete and centralized identification system for the technical specifications of the equipment;
- No effective control of maintenance requests;
- Difficulty in acquiring data (equipment downtime, intervention costs, etc.);
- Ineffective warehouse management (outdated inventory, lack of stock control, no spares-equipment relationship, etc.);
- Difficulties in supplying components led to a long period of downtime for equipment and a consequential increase in equipment unavailability.

3.3 The implementation project

Based on the scenario outlined in the previous point, there was clearly room for improvement. With a maintenance management software merely acting as a tool for the overall strategy of the company, Bodum defined a set of objectives for the project. Through the implementation of a CMMS, inter alia, the following aims should be

achieved: having a structured equipment inventory; managing maintenance plans; forecasting resources; supplying the spares needed; offering effective consultation on maintenance (e.g. maintenance history) and indicators for better decision-making.

Alongside the points noted in # 2, the project was undertaken across a series of steps [2]. The following checklist is a summary of the implementation stage of the Bodum Project.

Step 1 – Project characterization and designation of key personnel

The technicalities were assessed, the project objectives were defined, and the people involved were identified. Modes of communication between personnel involved were also established.

Step 2 – Preparation of administrative information

Updated cost center lists, organization charts, personnel and supplier lists were obtained from other departments of the company. During this stage, the coding standard for maintenance assets was also defined.

Step 3 – Definition of the sequence of work to survey the assets

A convenient plan of action for the field work and subsequent documentation of information for the maintenance assets was established, comprising central equipment for the production process, stamping tools, HVAC equipment, auxiliary energy and fluid systems, etc.

Step 4 – Establishment of an implementation schedule

Specific dates were scheduled for the completion of each stage, including training sessions. The schedule included the start date of the project, the target end date with the planned profile and the start dates of new maintenance practices, such as: implementation of preventive work orders; corrective work orders; user records; implementation of maintenance requests.

Step 5 – Survey of information on maintenance assets

Following the structure of events established in step 3, the available information about the equipment was collected, making it accessible to those involved. At this point, updated drawings and diagrams of the installation were collected, as well as the most up-to-date equipment lists.

Step 6 – Definition of functional systematization

- Abbreviations identifying the facilities were agreed upon (units, buildings, etc.);
- The large systematic groups existing in each unit above were developed, and the system was subsequently prepared for the extension of the units in Aveiro and Bodum AG;
- The systems within each large group were developed based on the installation diagrams obtained in the previous step, with detailed descriptions outlined and aligned with the company's current practices;
- When necessary, the functional systematization underwent adjustments and developments throughout the course of step 7.

Step 7 – Registration of maintenance assets in the management system

- Recognition and surveying of the equipment where information was collected from in step 5;
- The registration of the assets in the CMMS was carried out, achieving: standardization of coding (step 2); availability of equipment's technical datasheets; pictures, manuals, certificates and other documentation attached.

Step 8 – Registration of materials

- Materials coding standard was defined;
- The materials directly related to maintenance were registered in the CMMS, leading to: availability of technical data; association of pictures; identification of materials with codes assigned by the CMMS; establishment of the relationship between materials and equipment.

Step 9 – Definition of maintenance plans

After analyzing the respective documentation, the preventive maintenance plans were prepared in the form of maintenance schedules, directed towards the management asset.

Step 10 – Implementation of operational data and running records

Implementation of running records of the equipment where maintenance management is determined by records (e.g. compressors, forklifts, electric pallet trucks and vehicles).

Step 11 – Implementation of preventive work orders

Following step 9, preventive work orders were prepared, assessing the availability of workers to ensure that preventive maintenance plans are feasible, thus avoiding interventions that would lead to an unrealistic work program.

Step 12 – Implementation of corrective work orders

The procedures for documenting all corrective interventions were implemented, as well as the procedures for reporting work orders, including diagnoses.

Step 13 – Implementation of maintenance requests

The procedures to carry out maintenance requests in the CMMS were implemented.

Passo 14 – Maintenance indicators and analysis

Maintenance indicators were defined, starting with the commonly used ones (MTBF, MTTR, etc.).

This project also included two other areas of importance – warehouse management and maintenance supplies. In order to carry out the maintenance, under the most suitable technical and economic conditions alongside the needed parts and materials for the equipment, the necessary procedures for the implementation were defined.

Two areas of importance were prioritized: work meetings and training sessions. For the fourteen prior steps, several coordination and work meetings were held. The work meetings were held to assess work progress and clarify the strategy for the team's work. The training sessions were held to carry out effective technical work, including: clarification of drawings and diagrams, equipment lists, field surveys and records in the system. The training sessions were of equal importance, directing the relevant work into the hands of the technicians involved.

Throughout the project, ensuring that the information collected was to a high degree of quality was stressed, in the context of standardizing the data recorded on the system (e.g. coding applied to the documentation). In order to systematize and standardize concepts, processes and work instructions, whilst also identifying personnel's responsibilities, a procedures manual was prepared which included the various procedures defined during the consultancy sessions.

To guarantee the overall success of this type of project, it is recommended that a monitoring and evaluation stage is included – as mentioned in # 2 – so, after the implementation in question, an additional phase followed. Comprising a number of individual sessions, this stage sought to: monitor compliance with the defined objectives; audit and validate the information registered in the CMMS; consolidate the training; clarify doubts.

4. POST-IMPLEMENTATION MAINTENANCE MANAGEMENT

Due to the effects of the project as mentioned in the previous point, Bodum's maintenance management has undergone a series of changes, largely due to the optimization of several aspects of their maintenance management presented in # 3.2. The company's current situation is summarized in the next section.

Configuration and equipment information

Following an arborescent structure when coordinating the equipment, the defined functional systematization provided advantages when obtaining relevant data such as equipment availability, number of failures, and intervention times – per area, production line or equipment. Other improvements are identified as the following:

- Quick and easy access to the inventory (through the equipment lists, production line, location, etc.);
- Reduction (80%) in time spent accessing information (e.g. technical specifications, maintenance history and documentation);
- Definition of the equipment criticality, with emphasis put on the planning of the work and the consequential reduction in downtime.

Maintenance plans and work orders

The proper definition of the maintenance plans led to a significant reduction in the intervention times, also enabling a rigorous calculation of costs. There have also been improvements in the planning of work, especially in terms of the control of pre-planned interventions – via calendars, visual alerts, degrees of urgency, etc. Largely due to better planning of work, the following

improvements can also be highlighted:

- Simplifying of intervention preparation process, resulting in a significant reduction in the number of delayed tasks;
- Establishment of a detailed history of interventions, with clear advantages for the decision-making process;
- Very considerable increase in the number of preventive interventions (accounting for 60% of the total maintenance work), indicating a rate of compliance with the preventive maintenance plan of over 90%.

Warehouse management and maintenance supplies

In using a permanent inventory, warehouse management helped drive a gradual decrease in equipment unavailability, whilst also contributing to an important reduction in intervention costs. Other improvements included:

- Centralization of information (e.g. technical datasheets, history of spare parts application and item-supplier relationship), with clear benefits in terms of reducing the time taken to locate and physically collect parts by 50%, and in terms of obtaining better commercial conditions;
- Optimization of the physical space available in the warehouse (over 20% increase);
- Reduction of risks pertaining to stockouts and effective mitigation of failures when supplying stock items and critical spare parts.

Maintenance costs and indicators

The information related to financial documents became increasingly retrievable and interlinked with the respective activities when made available in the CMMS (e.g. work orders and maintenance contracts).

When combining the consistency and accuracy of the information that integrates the costs and indicators, several key performance indicators become more prominent (technical, economic and organizational). Other improvements included:

- More accurate calculation of the overall cost of each unit produced, as this can include the maintenance cost involved;
- Reduction in maintenance costs, at 1.12% of the total company costs;
- Significant increase in mean time between failures.

Several improvements were made to Bodum's maintenance management in the months following the implementation, henceforth in addition to these ones noted, others may be visible. These set of topics are substantive in that they represent the most significant improvements following the completion of the project.

Since it takes time for certain improvements to materialize before the desired effects are visible, the scale of the company's evolution in maintenance may be significantly greater after a period of time.

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