

INTEGRATED MANAGEMENT OF DOWNTIME IN MOBILE EQUIPMENT

Heriberto Salort

Director of Services & Senior Business Consultant

BITION[®] Ltda. Temuco – Chile

ABSTRACT

This work presents the automation of a business process that is not considered at all in the mining industry, the integrated logistic management of downtime of mobile equipment due to maintenance. This process is located in the middle between maintenance and operations (production) and allows the identification of improvement opportunities, through the measure of inefficiencies and efficiencies.

The measure includes time delays, equipment downtime, operational support to maintenance areas, labor hours, etc. The equipment downtime also allows the possibility to deploy regular maintenance services controlling the level of backlog tasks. Every task is synchronized with each other areas and the information source and repository is unique.

The automation include changes in maintenance organizational structure and some business practices, including a software system integrating the real time world (production systems) with the transactional world of ERP and EAM systems.

The work performed by BITION[®] and one of their customers is a mix between business improvements and information technology innovation applied to the mining industry.

INTRODUCTION

Generally, when one speaks about integration between systems in real-time and transactional systems, there is mentioned the possibility of transfer only certain information that are of interest for the management that is carried out with the latter. However, this type of integration does not allow the business processes integration and, therefore, it becomes almost impossible to speak about a real integration.

The real integration happens when the systems in real-time are capable of being aligned with the business processes and, on the other side, when the business processes are capable of incorporating the information of the productive processes in real-time.

The mining is an industry where the system integration is very critical, and in which many systems and applications have proliferated, so much corporate as of very specific business processes. Perhaps it is the complexity of the processes and the information what has not allowed to develop commercial systems (ERP/EAM) that reflect completely integrated processes, from the mining

planning up to the shipment of the mineral. This explains one of the reasons for which they have arisen a big quantity of applications of IT that come from the most varied houses of software and with very different standards between them.

For it the fact is that to integrate systems in real-time with transactional systems, in the mining, it is almost a challenge and probably any development that points in this direction will be considered to be a technological innovation.

When the systems integrate, the approach must be put in the integration of the business processes, and it is for it that when integration software applications are developed, the business processes are affected of different ways, already for changes in the procedures and standards of work, like also in the organization itself.

In case of the processes of mining production, in which there are included the processes associated with the equipment operation as the processes associated with the maintenance of the same ones, the integration it produces a synergy that is capable of fulfilling the goals of production with an optimal use of the resources. The challenge is to find that optimal point, and for it the fact is that the flow of information is essential. In this case, the IT happens to be a powerful agent that acts as catalyst in the search of the best business practices.

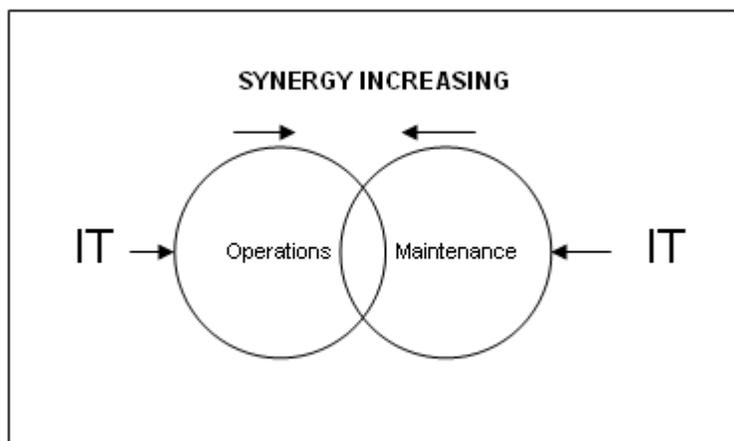


Figure 1: Operations and Maintenance synergy increment due information technology.

This paper explains partly the previous concepts, and it is the first application that integrates in real-time a production control system (PCS) and an enterprise asset management system (EAM). At the beginning the software application (BITION[®] EVENT) was seen as an interface between both systems, but as it was used there was discovered the possibility of invoking business processes that were not a part not of the system of operations and of the system of maintenance either, but that were an essential part in the integration between the business processes of operations and maintenance.

METHODOLOGY

The methodology that was applied in this project is equivalent to any other methodology of implementation of a software system, but it differs that at the end of the first phase were developed two consecutive phases to realize adjustments and to add requests that were checked by the users once they experienced the white march of the basic system developed in the first stage.

The stages and y sub-stages were as follows:

First Stage (Basic Software Solution)

- Requirements review and analysis;
- Functional and technical design;
- Basic software solution programming;
- Go Live.

Second Stage

- Use of basic software solution;
- Administrative procedures and standards adequacy.

Third Stage (Advanced Software Solution)

- New requirements review and analysis;
- New functionalities design and adequacy;
- Advance software solution programming;
- Go Live;
- Technical support.

Next there are detailed important aspects of each of the previous stages:

First stage

One of the principal targets of this stage was of making operative the functionalities of the basic solution of such a way of which the users were familiarizing themselves with the application and with the target to be detecting the improvements and new functionalities to incorporate in the third stage. Between the functionalities implemented in the first stage they are counted:

- Automatic detection of stop and start times of equipment downtime event;
- Time measurement of logistics delays (see figure 2) in each equipment downtime (waiting spare parts, traveling, etc.);
- Related work orders
- 6 level structure failure codification (using ISO 14224 standard)
- Search filters
- Basic reporting.

Second stage

At the second stage the most important issues were focused in to improve the basic software solution, make changes in maintenance organization, and adjust procedures standards.

One of the main tasks during this stage was to enable an electronic card for each mobile piece of equipment in terms to detect when the equipment is received and released by maintenance people. With this card is possible measure the time between the equipment stop and maintenance reception (delay in maintenance reception) and the time between the maintenance release and equipment start (delay in operation reception), as is showed in the next figure:

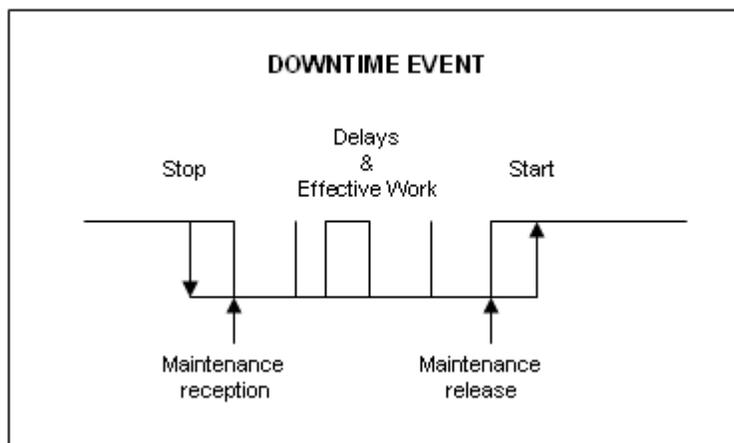


Figure 2: Downtime event diagram.

The electronic card information card was transferred from the equipment to the Software Solution through the production control system (PCS).

Third stage

At the end of this stage was released the Advanced Software Solution including functionalities and improvements detected in the second stage.

Inside the important tasks realized in this stage they are counted:

- Incorporation of dedicated maintenance people working as users of the software solution each shift (night and day) for each equipment fleet;
- Modification of software solution adding electronic card information from PCS;
- Addition of functionality for structured completion comments to each work order;
- Addition of maintenance people to each downtime event work order to measure labor time spent in each job;
- Automatic fill of data (cost centers, work groups, etc.);

- Integration with RCM Expert Software through the information passed to ERP/EAM system.

The following diagram shows the final software integration solution:

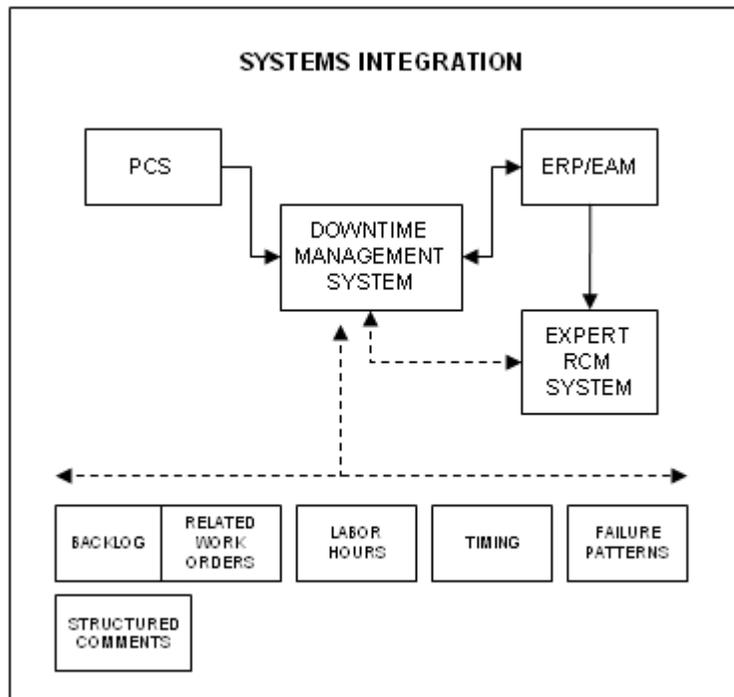


Figure 3: Advanced Software Solution diagram.

The BITION[®] EVENT advance software solution (DOWNTIME MANAGEMENT SYSTEM) receive the information from de PCS and allow the users to fill additional information that can remain in the system database and transferred to ERP/EAM system according to business rules and corporative maintenance standards and procedures. Also some static information from the ERP/EAM system is automatically updated each day in the EVENT database, which ensure the validation of data according to maintenance business process definitions. The information coming from PCS is also validated according to operations business rules.

RESULTS

The implementation of this software solution is carrying benefits to the maintenance and operations areas because it take business process from both and produce real-time information increasing the possibility of improvement in equipment downtime management.

After the implementation, other benefits detected by the users are the following:



- The implementation of the system makes much simpler the compilation of the technical relevant information of every stop of the equipment, simplifying and guiding the technicians in the structured record of the event;
- The procedures of support of the area of IT included a major integration between the managers of different services inside the computer network of the company;
- There was created the position of the DOWNTIME MANAGEMENT SYSTEM administrator, which not only has knowledge of the maintenance systems, but also of the operations systems;
- The system eliminates practically the work of treatment of information when it is needed to do a failure analysis, RCM, or a Six Sigma project, and allows that the analysts should concentrate on the opportunities of improvement and the identification and elimination of the root causes root of undesired failures;
- It allows doing a real-time tracking of the events of maintenance and/or delays associated with a specific work;
- The inclusion of the electronic card added safety and quality in the realized work since with her integrated to the application; it allows the control for the technicians in charge of the jobs;
- Allocation and automatic record of field labor hours;
- Structure of configurable comments and structure of failure codes compatible with MPD systems;
- Administration of competing works to the moment of the equipment downtime;
- Decrease in the digitations time and simplification in the data input (almost all on the same screen);
- Ratification and update of the information of failures associated with the equipment and with the RCM exercise;
- Advantage of having, almost in real-time, the state of advance of the maintenance jobs totally open to the interested areas (operations and maintenance);
- Administration of the information not only for equipment but also for fleets;
- Measurement of logistic delays that earlier were not measuring themselves and that will allow a better control of the resources and times in search of the optimal point for the equipment downtime management;
- Simple and validated classification of equipment failure structure in 6 different and related levels;

- Improvements in the opportunity and quality of the information.

CONCLUSIONS

The development of this system proposes a different way of implementation of a business corporate system, introducing a new concept of development of customized software applications in the mining industry.

For the correct functioning of the RCM expert systems, the input of big quantity of reliable data is a way of assuring that the predictions should be also reliable.

The IT solutions that integrate maintenance and operations systems help to the mining production area to obtain a synergy through business process integration.

For the success of this type of integrations it is needed not only of the commitment of all the actors but, also of a high grade of knowledge of all the business processes involved.

The development of this type of applications of software, oriented to the business processes more than the transfer of specific information, will bring with it multiple benefits that are deduced of the implementation of the solution of software presented in these paper and that are summed up, partially, in the following diagram:

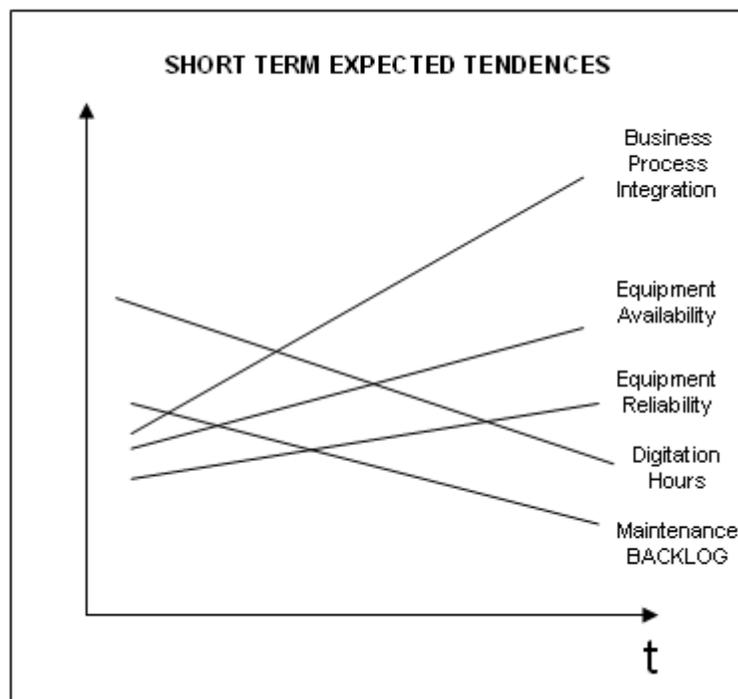


Figure 4: Benefits of a integrated Downtime Management System

ACKNOWLEDGEMENTS

BITION® EVENT, the solution explained in this paper, has been started to commercialize at some Mines in Latin America. We are grateful to our first client for his comments and anonymous suggestions to prepare this paper.

ACRONYMS

PCS	Production Control System
EAM	Enterprise Asset Management
ERP	Enterprise Resource Planning
EVENT	BITION® EVENT Software Solution
IT	Information Technology
RCM	Reliability Centered Maintenance
MPd	Predictive Maintenance

REFERENCES

- IEEE Computer Science, Mark J. Christensen and Richard H. Thayer (2001) The Project Manager's Guide to Software Engineering's Best Practices
- ISO 14224 Industries of Oil and Gas - Compilation and Exchange of Information of Equipment Reliability and Equipment Maintenance