ADVANTAGES OF MONITORING THE PERFORMANCE OF INDUSTRIAL PROCESSES

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Abstract: To remain competitive in today’s global market, it is crucial to manage information efficiently. Yet, even the most modern companies can struggle with instrumentation measures. To control strategic process variables and optimize the usage of human resources, specific methodologies must be adopted. Managers must ensure that all resources are affected where they are the most needed so that they generate added value; process control equipments must be maintained in an optimal state so that they provide the best performance; and final products must be produced at least cost. Copyright © 2007 IFAC

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1. INTRODUCTION

As many industries, the mining industry capitalizes on economic variables and benefits from a favourable market cycle. To remain competitive, managers try to leverage human and strategic resources. They adopt “best practices” and set performance incentives, while complying with security, health, and environmental norms.

In that context, information is a critical resource: if used and managed properly, it can become a solid competitive advantage.

Thanks to network protocols, information is ever more accessible. However, companies often lack resources and processes to exploit the available information at its full potential.

This article presents the case of Québec Cartier, a company that excels in all its spheres of business, which decided that wasting information was unacceptable. Québec Cartier wanted to adopt a global approach based on a long-term vision. To improve its processes and profitability, they established a modern and efficient structure to manage and process information.

2. HISTORIC

The Québec Cartier Mining Company began its operations at Lac Jeannine (Québec, Canada) in 1957. Since almost 50 years, the company evolves in an increasingly competitive global market which is strongly influenced by Australia and Brazil, the two main producers.

Québec Cartier has always attached great importance to technological development for its mining, railway, and port activities.

Originally, Québec Cartier used to produce three types of products: acid pellets, melting pellets, and low silica content pellets for direct reduction.
Through years, demand for new specialized products has forced Québec Cartier to innovate and keep abreast of market trends. Today, the company has a very strong capacity of adaptation.

The pelletizing plant produces over nine million tones annually. Originally, the plant was designed to produce six million tones. In fact, the exact production capacity is unknown. In that context, the employees’ objective is to constantly increase production.

Through the last twenty years, Québec Cartier has modernized its control systems by investing on industrial data processing. This implied major changes with regards to human resources, processes, management, and organizational culture.

Québec Cartier’s pellet plant used to be managed with a segmented departmentalized approach (from 1977 until the beginning of the 1990’s). The plant’s departments included electrical maintenance, mechanical maintenance, production, and process. Over time, this structure became more flexible. In the 1990’s, a first reengineering allowed to create the energy department and to enable the mechanical maintenance and production departments to work more closely together. The benefits were immediate. Later, the adoption of new business processes (like World Class Maintenance) provided even greater benefits.

3. CONTROL STRATEGIES

Québec Cartier has adopted a structured approach to take decisions with regards to control strategies. Even if the plant processes are very complex, they opt for simple and robust control strategies that enable them to reach optimal production objectives. Instrumentation is constantly adapted to needs; new measures and advanced strategies can be chosen when performance objectives increase.

4. PARTNERSHIPS

Through years, Québec Cartier has made partnerships with research centers, universities, and specialized consultants. Various initiatives allowed to develop efficient, profitable and visionary practices such as information management tools and performance monitoring systems.

For a company like Québec Cartier, consultant services have many advantages. Consultants are experimented and can bring a new vision of the company’s processes, which enables them to identify problems and propose innovative solutions. Working with consultants is also a good opportunity to mobilize employees, make different departments work together, and adopt long-term approaches.

5. CHOICE OF TOOLS AND CONSULTANTS

Québec Cartier has developed rigorous approaches to choose its tools and consultants. To implement the monitoring performance system, the following strategy has been adopted.

5.1 Objective

The objective was to implement a monitoring performance system that (1) detects, with pertinent indicators, any performance deviation of loops or sectors (according to the pre-set reference), and (2) proposes actions to correct deviations. The system must detect all problems related to control loops, process equipment, operation, and production.

5.2 Steps

The project included five steps:
- Test various tools and consultants during six months
- Choose a plant sector to evaluate tools
- Buy and install the two tools selected for evaluation
- Prepare an evaluation grid
- Evaluate the two selected products

5.3 Scope

For the evaluation, 100 loops from different plant sectors were selected. The two systems analyzed the same loops. For the final roll-out, 300 loops were supervised by the selected system.

5.4 Training and Support

Québec Cartier has always attached great importance to training. To ensure the project’s success, process control training has been planned for technicians and engineers from production, process development, maintenance, and engineering. To put the emphasis on team work, both groups were combined for the training.
In addition, there has been training on performance measures, optimization tools, and performance monitoring tools.

Four criteria were selected for the evaluation grid:
- Management
- Specifications
- Use
- Perspectives

Quantitative and qualitative analyses have been made for the four criteria:
- Product installation
- Maintenance/configuration
- Specification
  - Accessibility
  - Operation performances
  - Parameterization
  - Integration with other systems
  - Historian
  - Additional options
  - Cost
- Use
  - Browsing
  - Link with optimization tool
  - Report and results
  - Training
- Perspectives, future

6. EXECUTION

The system set-up was executed in less than three weeks. After, performance indexes and the system’s structure were adapted and refined in successive steps, in collaboration with various plant departments. The complete process was supervised by Top Control.

A work team is set up since September 2005; it is composed of engineers and technicians from different plant departments, and two specialists from Top Control. Their efforts ensure that the tools meet the objectives. The team prepared a roadmap to note milestones.

6.1 Follow-up and Coaching

Top Control has done a constant follow-up (from its office and from Québec Cartier’s plant) between January 2006 and December 2006. Precise milestones were reached at each step.

- Monthly follow-up: visit to the plant by Top Control’s specialists
- Quarterly follow-up: visit to the plant and training by Top Control’s specialists

Québec Cartier and Top Control have a partnership relationship; they meet on a regular basis. To ensure good communication among Québéc Cartier, presentations have been made to managers and all concerned parties.

6.2 Learning from Other Sectors

Some employees have visited other plants where similar systems have been installed by Top Control. These visits led to interesting exchanges between the different teams – plants have different processes but they all have high performance standards. (For example, the pulp and paper sector is more concerned with reducing costs and running closer to constraints in order to use assets more efficiently.)

In particular, the team has visited a chemical plant in the U.S. and a pulp and paper mill in Canada. Later, the plant manager from the chemical plant came to visit Quebec Cartier’s team.

7. PARADIGM SHIFT

Historically, the production and process departments did not use to work so closely together since there is a supplier-client relationship between them. Yet, in order to maximize their performance, they must collaborate, define roles and responsibilities, and try to create synergies. The next section presents the approach used by Québec Cartier’s pellet plant to integrate its various departments.

Using the performance supervision project and tools as common ground for these departments, management decided to encourage collaboration through projects.

The cultural changes are important and the human factor has to be managed properly.
8. PARTNERSHIPS AND INFORMATION SHARING

The pellet plant is composed of three departments:
- Energy
- Production
- Process

The roles and responsibilities of each department are represented in a Venn diagram (fig. 1). In the blue area, the departments must share resources and knowledge while respecting each other’s responsibilities.

![Venn diagram showing the overlap of departments]

Fig. 1. Information sharing between departments

9. DESCRIPTION OF EFFICIENCIES

9.1 Energy and Process Departments

The energy and process departments must support their respective needs based on various process control objectives. It is imperative that they work together to meet these objectives.

For example, in 2005, the two departments developed a collaboration program aimed at exploring advanced process control. With the collaboration of Top Control, they implemented two performance monitoring systems for industrial processes. An exhaustive study was conducted to compare the two products.

The performance of a hundred of control loop has been examined based on specific criteria that were equitable for both products. The system maintenance (1) is handled by the two departments with a conjoint monitoring program that uses a hybrid mode. Top Control’s specialists acted as coaches; they communicated with the plant’s personnel through remote communication, and made some interventions on-site to solve a few problems.

9.2 Production and Energy Departments

Synergies between the production and energy departments are essential to make the modifications and continuous improvements that are necessary to maximize the plant’s utilization time (which is about 93.5%). For example, an operation employee works full time on the control system, interpreting and handling all demands coming from the production department.

To reduce maintenance costs and avoid production losses, it is important to adopt proactive maintenance and plan shutdowns.

For example, in a section of the production department where maintenance activities were considered to be “normal”, some binding valves used to be replaced every six or eight weeks. Each time, the unit had to be shut down during several hours. The operation values of this component were not respected and this caused premature deterioration.

To solve that issue, the energy and production departments adopted a new approach that extended the useful life of the component up to 125 weeks, which represents an improvement of over 1400%. The payback period of this investment was a couple of hours.

Actually, Québec Cartier is also developing a platform integrating the system and information technologies. This initiative aims to meet all the business units’ needs based on a global approach. Although 250 miles separate the pellet plant from the mine, the new structure will allow all employees to work together in a virtual way. This will facilitate knowledge sharing.

In 2006, the energy and process departments implemented an important monitoring program for the pellet plant’s processes. With the support of Top Control, a task force has been created with engineers and specialized technicians. Their approach focuses on training, skills acquisition, and new process control methods based on proactive actions. The results are so impressive that Québec Cartier wishes to implement that program within all its business units. The collaboration between the plant’s task force and Top Control’s specialists allowed to make the most of their expertise.

Furthermore, this initiative will allow Québec Cartier to create a control chart that will include all the steps involved in the global control specialization of a plant.
9.3 Production and Process Departments

The process department is in charge of providing technical services and insuring that clients’ specifications are met at low costs. The performance of the pellet plant is therefore related to the expertise of this department.

In collaboration with the process department, the production department implemented an important program aimed at increasing the filtering capacity of the hematite pulp. At the beginning, it was impossible to exploit the equipment to its fullest potential because of a clogging problem. The two departments worked together to find a solution (which was simply based on basic principles). Thanks to this initiative, the equipment is not only meeting the manufacturer’s specifications, but it is exceeding them.

9.4 All Departments

To ensure that the three departments work together effectively, it is important to set common objectives and focus on continuous improvement. Each department must be willing and able to dedicate time and resources to collaborate with the other departments.

10. SUSTAINING PERFORMANCE

10.1 Performance Decline

In any plant, performance continuously declines:

- Operation procedures vary
- Quality of raw materials varies
- Equipment wears out
- Maintenance modifies equipment
- Configuration changes are made
- Process is modified
- Etc.

Using a performance monitoring software can allow to sustain performance. When a threshold is reached, an alert is sent.

10.2 Small Gestures that Count

It is essential to establish a workflow with daily, weekly, and monthly procedures to maintain the employees’ interest. Also, a champion should take the lead of this project.

Over time, interest will decline, support will tend to decrease, and regularity will become erratic.
To sustain the project, it is essential to quantify gains, diffuse them, explain them, and build on successes.

11. CONCLUSION

The objective of this article was to demonstrate the benefits of integrating different business units. When different departments collaborate and share their knowledge, resources are not added but multiplied: synergies are created, creative ideas are generated, costs are reduced, and performance is optimized. In sum, the integration of business units can become a considerable competitive advantage. Thanks to employees’ commitment and management’s involvement, Québec Cartier’s rigorous approach and Top Control’s expertise, the project was a success.

REFERENCES