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CASE STUDY: ICT FOR NEW PRODUCTION TRACKING (NPT) – INTEGRATED E-BUSINESS INNOVATION IN OFFICE PAPER PRODUCTION

Abstract

This case study describes the e-business activities of a globally operating European producer of office paper[1] and its implementation of production tracking software system for supply chain management based on RFID-technology.

Being part of a wider innovation policy and investment scheme, the integration of the new system within the existing production processes resulted in higher machine utilization, greater process efficiency, and improved order throughput times. However, new demands on workers' skills, high investment costs in complementary physical structures, and huge RFID data output that needed to be "translated" into managerially useful information, arose as main challenges to value creation.

Case study fact sheet

Main business activity:	*Business and packaging paper, converted packaging*
Primary customers:	*Other businesses from various industries*
Most significant geographic market:	*global*
Main e-business applications studied:	*RFID use, supply chain management*
Key words:	*production management, warehouse management, process efficiency*

Background and objectives

The firm under study is a globally operating paper manufacturer and part of a bigger group which serves markets all over the world. It has a total production capacity of more than 2 million tonnes of uncoated woodfree (UCWF) paper per year.

This case study looks at issues of RFID technology for integrated SCM (supply chain management) in the P&P industry. Objectives of the case study are:

[1] The company does not want to be named.

- to describe the technical architecture of the newly employed IT software (technology dimension);
- to analyse how e-business RFID technology was adopted, and is being used;
- to assess the impact on individuals, business processes and organisational performance in general terms (impact dimension).

The information is based on interviews with decision-makers who are responsible for managing both the implementation in the branches and the development of the new software.

e-Business activity

The business vision and its implementations

The business vision, funded in 2005 by a budget of 137 million euros, is to set the industry benchmark for operational efficiency and successful supply chain management in paper production, as well as to establish theme leadership with regard to innovation and environmental protection. The current project, and subject of this case study, focused mainly on the development of information technology and new processes, comprised eight sub-projects ranging from the optimisation of product portfolios and cycles, to the launch of an integrated planning system. The funding for the supply chain elements of the wider programme amounted to 8.5 million euro.

A core element of this strategy was the early decision to develop an integrated new production tracking software system based on RFID technology. This RFID-supported SCM system is described and assessed in terms of its functionality and impact on the realisation of the business vision.

SCM in business paper production – How the systems are integrated

In 2004, an IT consulting company was engaged to develop a comprehensive mill management system for order handling, planning, production management, warehouse management, and bill of material handling management (see Exhibit 1 below). The tailor-made solution was designed to optimise integration between the existing ERP system and various specialised systems in the mills (e.g. automatic mother reel storage, palletizer).

The decision to develop a tailored solution was taken only after extensive detailed talks with standard software suppliers determined that this was the only way to meet the business expectations. After nine months of software development, a small-sized paper production process (A3 and A4) started operating on the basis of the new software in July 2004. In spring 2005, all other paper formats bigger than A3 were produced by means of the new integrated IT software. However, the introduction of this new software system required substantial hardware investments into the production system, particularly for fully automatic reels in the master warehouse and a state-of-the-art automatic palleting centre.

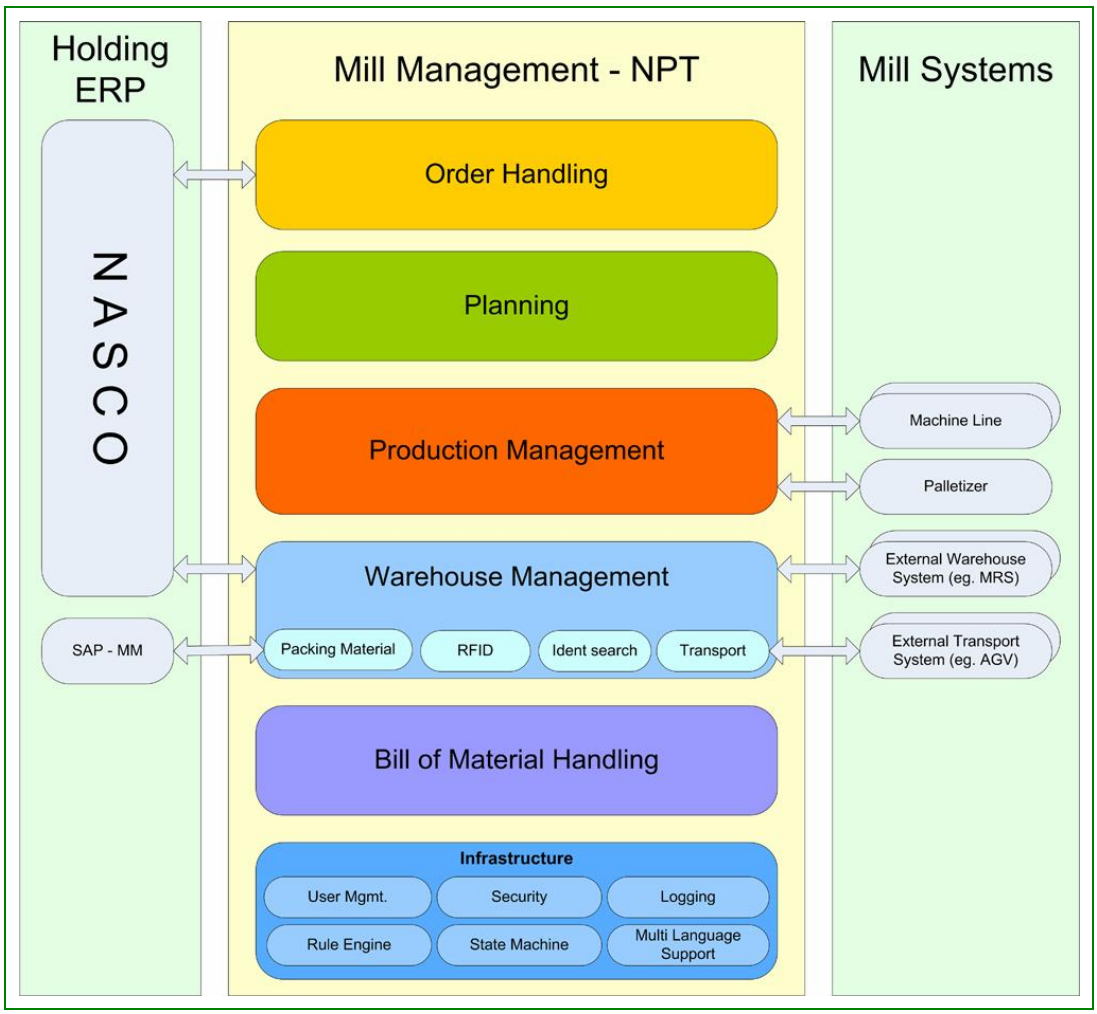
System integration is organised as follows (see Exhibit 1): The legacy system holds the original customer orders and all logistic information. The new production tracking (NPT) system then receives all necessary article information and transforms these data into a flexible hierarchical bill of material (BOM) structure. This is a major requirement for loading customer orders into NPT.

During the planning and production management, the customer order passes through various states tracking the production process. All status changes are reported to the legacy system, thus supporting customer support and logistics. Additionally, the planned and concrete consumption of packaging materials are sent to the SAP system for further disposition of material requirements. Packing material orders and their delivery dates are sent back to warehouse management, goods receipts are booked in NPT and transferred back to the SAP system.

The production and transport systems are tightly coupled with NPT. When production of a specific order starts, NPT generates all necessary transport orders to supply the production lines just in time (back stand materials, packaging materials needed for the production steps). Each machine unit in a machine line reports the actual production data for each customer order. When an order is finished on a machine, NPT is informed of the completion.

The last machine in the production process produces customer pallets (palletizer). The pallet information is reported to NPT, checked against tolerances and transferred to the full-automatic warehouse for finished goods. After final transport the pallet-data is transferred back to the ERP legacy system (NASCO) and further product-management is done by the holding ERP-system (dispatch-management). This solution provides online (real time) information and transparency for the whole production process.

Exhibit 1: New Production Tracking – The modules



The main modules of the firm's new automatic production tracking system (shown in Exhibit 1) have the following functionality and scope:

Order handling: The mill management system process chain starts with the transfer of customer orders from the holding ERP system (NASCO). Internal orders for the production of semi-finished material (e.g. mother reels), which are required for the different production steps, are created automatically. Order management modules display an in-depth view of all related order information such as the current status, the history of what has happened with the order, which form pallets have been produced when, by whom and based on which mother reels. This information is available later on for backtracking over the various production steps on batch-level.

Planning: The NPT planning mechanisms are based on the requested delivery date of customer orders and a production calendar (shifts, planned downtimes etc.). Production plans are optimised by merging similar orders (e.g. colour, grade, grammage[2], packaging material) for a certain machine line for outmost machine-efficiency (prevent change-over-costs and waste). Another step of the production planning is to plan the just-in-time-delivery of all needed input-material (Bill of Material) for production. Furthermore, the planning modules allow lead-time calculation and detailed capacity planning.

Production management supports the execution of production plans by usage of online work-order management. All machine-events (production, changeover, waste, standstills) are tracked in the production management.

Warehouse management: The warehouse module provides lifecycle management for inventoried materials (mother reels, semi-finished and finished form pallets, packing material). This functionality can be extended by the use of specialised sub modules for (a) packaging materials, (b) item search, (c) RFID, and (d) transport.

Bill of material (BoM) handling: Hierarchical BoMs provide information about the inventoried and non-inventoried components used to fulfil a production order. These data are vital for identifying, rating and combining the necessary semi-finished and packaging materials for detailed planning and production management.

The warehouse management module is based on radio frequency identification (RFID) system technology placed on both stationary and mobile readers fixed on staplers. By this, the firm built a general-purpose technology in order to support item search and the transport system. In practice, forklift drivers in the mills now receive transport orders to deliver the crates from the storage area to the packaging machines on an item-per-item basis. The drivers not only drive the goods but also hand-scan barcodes on the crates to trigger the new RFID-based tracking system (parcel data are transmitted via Wireless LAN (Local Area Network) to the storage management system). The main advantage of this online-supported parcel delivery system lies in improved process and parcel control.

When interviewed, firm representatives identified the following benefits of the usage of the installed RFID-based NPT system: more accurate production planning, just-in-time delivery to production lines, exact booking of orders, lower search costs of items, improved incoming orders control, better inventory management, as well as better control of supply chain data and data tracking of produced paper rolls from the mill to the warehouse and on to the carrier.

[2] "Grammage" is a measure of paper weight based on the same square meter sheet of paper, regardless of paper grade.

The firm's IT developer added the following system benefits: "*At the time of the project start, there was no consistent data tracking application for managing data coordination at the production lines. The new NPT system, however, offers a user-friendly web-browser-based interface for the online production management system that provides information on status of the stock and limits of the enterprise's working assets. This includes information about the current stock of raw and auxiliary materials and finished products in the company's warehouses and the related costs.*"

Since August 2005, the RFID-based NPT system is also in place in a second mill. When asked why the management chose this plant for the systems change to the RFID-based NPT-system, firm managers interviewed affirmed that this mill "suffered" from the same legacy system as the other paper mill. Both works had 10-15 year-old predecessor systems installed which needed to be upgraded. Therefore, the company decided to use these two works as test-beds for an applied RFID solution.

Impacts and lessons learned

The firm's business managers admitted that the impacts of its new SCM on the overall performance would not be easy to isolate and assess. This is because only by the end of 2006 would the new strategy be fully operational and strengthen process integration for suppliers and customers alike. Although the firm is only halfway through the process, its integrated new supply chain strategy has already proven to be very successful, yielding a 12% improvement in delivery reliability and 40% reduction in lead times. When interviewed for the impacts of the firm's ICT-induced SCM innovations, management considered them as being massive. These high-level impacts are visible on the following levels.

Impact on individuals

The firm reports a noticeable impact on increased specific skills requirements for workers. Workforce used to handle paper-based orders prior to the implementation of the new system; now, people had to get accustomed to use computers and online technology. This created some pressure for workers to comply with the faster throughput times in the mills. According to the management, these requirements for complementary skills met some resistance among workers, particularly in the second mill. Workers felt that they had "to follow the rules imposed by the system" and were no longer in command of the work processes, according to their own needs. This created resistance, and it took some time until the new working style was accepted.

Impacts on business processes

Another important impact of the newly installed NPT-software is the increased degree of automation. Management observed and report improvements of process efficiency and order throughput times. In comparison to older paper-based order management which took 3-5 days in lead time from intake to fulfilment of order, online management has substantially shortened the time necessary for dealing with incoming orders. This further increases the flexibility, efficiency, and subsequent value created by these time-saving processes.

Organisational performance

Concrete figures on the impact on business performance are not available. Some anecdotal evidence on the effects include the following general observations: Management reported performance benefits such as general efficiency gains and the

optimisation of batch size for production. These efficiency gains are mainly attributable to the RFID-powered SCM information systems which allow the firm to adjust their production planning and effectively improved production accuracy. Further efficiency benefits are gained by tracking manufacturing equipment usage, which has led to the elimination of manufacturing bottlenecks and to the enabling of smoother workflows. In effect, machine performance, run times, and, consequently, machine utilization (e.g., of reels) were optimised.

Critical issues

The company's management identified two critical impact issues: initial investment costs and problems of managing the large amounts of data. Furthermore, achieving the full potential of the RFID technology requires costly integration with existing enterprise systems. Moreover, it requires a redesign of business processes in all areas of the value chain where the technology is used.

In addition, management warned against the risk that RFID can easily become just another tool for "data collection", while missing targets in terms of its return on investment. To avoid this, software applications must be used which can be embedded into business processes. Only in this way can data be translated into managerially useful information. The firm claims that it has succeeded in meeting this challenge: the IT department successfully delivers useful information to management.

References and acknowledgements

This case study was conducted by Paul Murschetz on behalf of the *e-Business W@tch*. Sources and references used:

- In March 2006, the author conducted two interviews with management representatives from the firm's headquarter and with the IT consultant / software developer.