By **MONICA SHAW,** Editor

Untangling the supply chain

For Sappi Fine Paper North America, a raw materials planning and costing project has optimized IT and process control to provide information on costs at the product level

Today, many pulp and paper mills are filled with information and control systems that allow production groups to optimize their efforts. However, because there is often a disconnect between helpful mill floor data and data that is contained in an upper-level application, such as an enterprise resource planning (ERP) system, business groups often do not truly comprehend the costs associated with these production efforts in a timely manner.

In recent years, the paper industry has focused on information technology (IT) projects that better integrate and optimize diverse systems. However, these projects have often focused on the visibility of finished goods in the supply chain and have not fully exposed the capabilities for raw materials planning, consumption reporting and actual costing for paper products.

At Sappi Fine Paper North America, the importance of optimizing the first part of the supply chain has not been overlooked. As part of a large IT optimization and reorganization effort called "Project Impact," the Boston-based company completed a raw materials planning and costing project in 2006 that tightly integrated and optimized its IT and process control systems to implement product costing for raw materials at the grade/basis weight/asset level. In addition, because of the "real-time" information derived from the product costing system, Sappi was able to take advantage of the SAP centric demand-based raw materials planning tool.

"The primary reason we undertook this project was to develop costing and analytic capabilities so that operations management and accounting could better understand what our raw materials consumption was versus target at the product level," says Michael Paulin, business process engineer. "This allows us to course correct much more quickly, which is important from a cash flow standpoint. The project also provided an important tool for our planning and procurement group."

Sappi did not overlook optimizing the first part of the supply chain using its IT and control systems. The company now has a handle on raw material costs at the grade/basis weight/asset level, and its planners make better decisions with real-time inventory information.

Key systems in place

Sappi produces 1.3 million tons of specialty, technical and coated fine papers at its four North American mills in Westbrook and Skowhegan, ME; Muskegon, MI; and Cloquet, MN. In 2003, the mills began using Version 4.6C of the SAP ERP system, and in 2005 upgraded to Version R3, which provided much of the capability for the materials planning and costing project.

"Before the R3 upgrade and total integration of our business and manufacturing systems, we had shop floor systems and information available to reach the project goals," says Paulin. "But we did not have the SAP modules and integration to aggregate data so that it made sense at the ERP level, nor did we have the business processes to go with it."

Currently, Sappi uses the following SAP modules: financials (FI); sales and distribution (SD); plant maintenance (PM); production planning for process industries (PP/PI), materials management (MM); controlling for internal cost management (CO); and advanced planning and optimization (APO). The latter four modules were the ones most critical to the materials planning project, and all modules have been installed at all four mills.

In addition to the SAP standardization, Sappi also standardized on GE's Plant Applications quality system (Proficy) and OSI's PI 3 system for its manufacturing systems layer in North America. Another critical system included in this layer is Sappi's in-house developed manufacturing execution system (MES) called MICS, which handles machine scheduling, order trimming and roll/product tracking.

Project goals and implementation

Although costing at the product level was the main goal of the materials planning and costing project, Sappi realized a variety of goals were possible given the tool set in place:

- Implement product costing for raw materials at the grade/basis weight/asset level
- Provide a raw materials planning tool based on demand

- Standardize business processes across the enterprise
- Utilize automated consumption information from the mill floor
- Reduce inbound logistics costs (freight/demurrage)
- Provide better visibility of material requirements to vendors
- Enable a larger group of business and process users to see problems sooner at the process level and to be proactive with corrective measures

While the R3 upgrade meant much of the functionality to accomplish these goals was in place, interfaces were still needed to connect the MES, PI system and quality system to the ERP system with a stated goal of minimal custom coding. In all cases, "off-the-shelf" interfaces were used, with the exception of Sappi's in-house MES integration to the PI system. A custom interface to synchronize the events in the MES system with the data in PI was developed so two data types, batch and time series, could be combined and aggregated for RLink, OSI's certified interface to SAP, to pick up and send to the ERP system. RLink was critical in allowing this integration to work successfully.

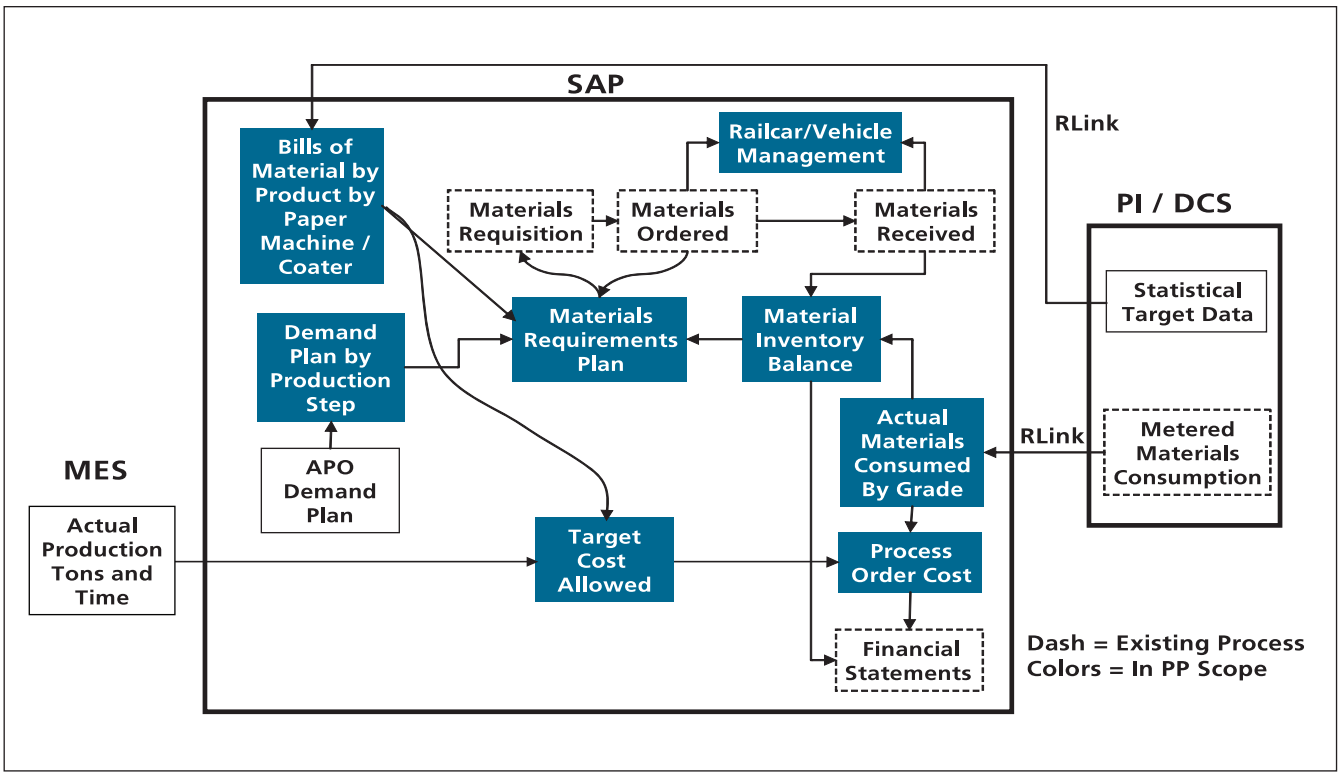
"Our use of RLink is unique in the paper industry in that we are able to take the batch or raw material data, merge this with the flow data, aggregate the data and synchronize all of it with actual events on the machines so actual product costing of raw materials can be realized," says Tom Bolen, Sappi's North American project manager for IT manufacturing systems.

Another key task involved in managing data for the most accuracy is the use of rigid business procedures, which have evolved over time at Sappi. For example, the materials planning process requires that budget data is input for comparison with actual data, and this input, as well as that for other data, is closely controlled.

In November 2004, Sappi simultaneously upgraded existing SAP modules at all mills to R3. The new functionality that supports materials planning and costing, which includes the SD, APO, PP/PI, and CO modules, was rolled out one mill at a time starting in January 2005, with the last mill going live this April.

For each rollout of the new modules and implementation of the product costing system, five people were dedicated at the mill

FIGURE 1.
System diagram for the raw materials planning and costing system



site: two Sappi IT employees, two Sappi business employees and one IT consultant. Also, each mill had user representation involved in testing, training and decision making around the development, since many issues encountered in the mill roll-outs were site specific.

According to Bolen, Sappi's four North American mills are the first to deploy IT systems for drilling down to granulated costs comprised of actual fiber and chemical usage at the process order level. Prior to the materials planning project, the North American unit had benefited from SAP experiences at Sappi's European and South African sites, but the new requirement for seeing granulated cost per process order presented a real challenge, with no complete installation in the global paper industry to use as a guide.

"We talked to a chemical company up front to explore how they were using the OSI to SAP interface, RLink, and we then proceeded to walk through the process and identify our own needs," Bolen describes. "We had to learn as we went along, going back to other sites when we discovered a better way at another mill. Our first mill implementation was painful, but it gave us a tremendous amount of insight and experience for the future implementations."

Data flow through IT systems

In the materials planning and costing process, the APO module creates a forecast block schedule for the year, or some period of time, based on historical data, which is used monthly to create a predicted block schedule that looks out from 0-3 months. From this, SAP creates a demand plan for raw materials against each order.

Next, the PP/PI module "explodes" this demand plan, along with real orders from the in-house MES (MICS), against the bill of materials, which is created based on statistical data of raw material usage from the DCS. This "explosion" provides planned independent requirements for each raw material associated with making the order's particular grade/basis weight on a specific paper machine. These requirements, combined with information from the raw materials inventory, are also used to create a purchase plan and a plan for in-bound logistics. It is important to note that demand-based planning is not used for all raw materials; some are planned based on consumption.

Every three to 10 days, on average, orders are sent to the MES, which determines the orders to run on a particular machine and trims the orders in a trim optimizer. When a particular product is being manufactured, the MES "triggers" the PI historian to capture real-time raw material usage data from the paper machine's DCS, as well as tonnage produced. PI then sends this information from the run via RLink to the PP/PI module, until the MES indicates the run is complete.

Next, SAP functionality for product costing (the CO module) multiplies the actual product quantity times the budget target per ton produced for each raw material, as defined in annual budget targets. The module can also calculate against other targets, as long as a standard bill of materials is set for each target. For example, Sappi also sets actualized targets, taking the shop floor recipe and comparing how it actually performed against that current operating target. Reporting functions let Sappi view

data accuracy

Materials planning and costing project offers valuable IT lessons

Sappi's raw materials planning and costing project offered valuable lessons related to integrating its ERP and shop floor information systems, according to Michael Paulin, business process engineer. Many of these lessons related to the following areas:

1. **Master data maintenance:** With any information system, particularly ERP systems with tight integration between modules, the data it provides is only as good as the data put into it, says Paulin, and this calls for strict business procedures.

   "Our business procedures related to the system help us keep the master data maintained properly, so there are very specific steps about what is maintained, when it is done and by whom, as well as how to do that in the system," Paulin explains. "We developed the procedures early on, but they've evolved as we learned through installing the systems and modules related to the project at the various mills. If you don't maintain the master data, the whole process falls apart."

2. **Accuracy of the information stream:** In using the systems for planning and costing, Sappi discovered data in the information stream that was not accurate enough for what the process demanded.

   "In certain cases, the absolute numbers we were getting from shop floor instruments and how they were treated in the shop floor system weren't giving us an accurate enough portrayal, so we've improved the quality of that data by fine tuning some instrumentation and the calculations associated with them," says Paulin.

3. **Bill of materials methodology:** Sappi discovered that its methodology for developing the standard bill of materials did not always provide an accurate portrayal of the expected consumption. To improve the methodology, Sappi "tightened up the data stream," Paulin describes.

price variance paid for the raw material vs budget, as well as variance in the amount used vs budget.

In addition, because consumption is posted on a somewhat real-time basis, SAP has updated book inventories for each raw material, which in turn feeds back into the next demand planning cycle. The ERP system can then update its predictions because it knows what was used and, therefore, what is still in inventory.

Figure 1 shows the data flow developed for the materials planning and costing process. The data flow through the system described here for the paper machine is similar to that for other assets, such as the off-machine coater.

Making the most of new data

The data reported during demand planning and materials costing next goes into what Paulin refers to as a "management process" at each mill, and the new, more detailed information on raw material consumption has lived up to being justification for the materials planning and costing project.

"Consumption data was previously only available as a monthly total for a paper machine, and we could not determine if a variance occurred on a particular product or when it occurred during the month on that machine, as we now can," says Paulin. "The new data helps us better forecast our monthly performance, but, more importantly, the now weekly analysis of the information allows us to course correct and assess that correction in a period of two weeks rather than two months, which is critical on machines with daily grade changes."

Because the rollout of the new modules was staggered, some mills are more advanced in their use of the data than others. For the more advanced mills, month-to-date performance is reviewed weekly by the management team responsible for the results and by accounting, and they determine whether the variances were expected or unexpected and how much it has cost.

"Unless you use the system to make wise decisions, its value is limited," says Michael Paulin, business process engineer, shown here (left) with Jennifer Reed, procurement business process manager, and Tom Bolen, Sappi's North American project manager for IT manufacturing systems.

"If we have an operating issue or performance issue with the asset, we can see how much it has cost, so it helps prioritize what we work on and where we must improve," Paulin explains. "The data also indicate problems we were unaware of, leading to action plans for addressing them."

Comparing the raw materials budget against actual consumption has helped the mill adjust its process to become more cost effective. As an example, Paulin cites a reduction in the use of a very expensive chemical at one mill that removed several million dollars of production cost. "By isolating the costs for this chemical, the system helped us evaluate its cost impacts, leading to a process change," he says.

While the raw materials consumption data was the primary reason for the project, many planning and procurement processes have also been streamlined, according to Jennifer Reed, procurement business process manager at Sappi.

"Because we have real-time inventory information, our planners can make better decisions, such as whether it is more cost effective to adhere to demand-based purchasing of a particular raw material or min/max-based, " Reed describes. "The system also provides proposals for what procurement should order based on upcoming runs."

Due to a better integration with the run schedule as a result of the materials planning and costing project, Sappi has also reduced inbound logistics costs and lead time. Many IT lessons were learned as a result of the project (see sidebar, p. 26), but Paulin does not overlook the human factor.

"Unless you use the system to make wise decisions, its value is limited," he comments. P&P