THE PAPER MILL of the FUTURE:
Why Change Agents are the Key to Digital Transformation
INTRODUCTION

The pulp and paper industry is changing. With a graphic paper demand declining worldwide, it’s easy to think that the entire industry is in decline as well. But that couldn’t be further from the truth. In actuality, it’s changing and evolving faster than ever before. According to McKinsey, the industry is growing thanks to increased demand for packaging as well as the addition of pulp production for textiles. As markets continue to evolve, mills must evolve, too — and efficiency is crucial to that evolution. In the quest for even greater efficiency, technology will continue to be a key driver towards digital transformation and, ultimately, a mill’s future success. However, achieving true digital transformation goes far beyond deploying technology.

It is the interaction between people, process and technology that will enable the industry to advance, change and expand. Change agents within the mill are key enablers for progress and, without them, digital transformation is simply impossible.
The Fourth Industrial Revolution, or Industry 4.0, is profoundly affecting the pulp and paper industry — and has been for years. McKinsey defines Industry 4.0 as “the next phase in the digitization of the manufacturing sector, driven by four disruptions: the astonishing rise in data volumes, computational power and connectivity…the emergence of business analytics and business-intelligence capabilities, new forms of human-machine interaction…and improvements in transferring digital instructions to the physical world…”

For those in the pulp and paper industry, Industry 4.0 is nothing new. What is new is the scale and speed of the changes coming at the workforce. The transformation happening at different levels of the digital mill is a function of the variety of technologies available and the rate of adoption. However, notice that Industry 4.0 is not defined as digital transformation, but rather, the next phase of digitization. It’s an important distinction, as true digital transformation runs much deeper.

In the technology sphere the terms digitization, digitalization, and digital transformation are used interchangeably, but they are not the same. Digitization covers ISA-95 levels 1 and 2, which encompass having intelligent devices for sensing and monitoring physical processes and the control systems as shown in Figure 1. Most of the production line of a pulp mill and paper mill already has a high degree of automation. Digitalization covers the real-time capturing of the information for its integration with higher levels of ISA-95, and it implies having a digital representation of the process to understand and manage operations outside of a control systems domain.

Digital transformation goes even further. It fundamentally alters the production process and allows businesses to find new ways to interact with their community of vendors, suppliers, and customers. This transformation requires both digitization and digitalization, but technology alone is not enough for transformation to happen. Across pulp & paper and other industries, digital transformation can and will create a more interconnected supply chain. In the coming years, the scope of digital transformation will move beyond the walls of the enterprise, making it more important than ever to have the right combination of people, processes, and technology.
The Paper Mill of the Future: Why Change Agents are the Key to Digital Transformation

Digital transformation is still uncharted territory for most pulp & paper companies. It promises big gains, with estimates that more than 3.3 billion machine to machine (M2M) connections will exist by 2025. Forget gigabytes — these M2M connections will produce yottabytes of data. To put that in perspective, if a byte is a single grain of rice, a yottabyte would be a rice ball the size of the earth.

With exponential amounts of new information being created and stored every day it’s a daunting task to determine how to best manage and analyze it all. Currently, only 15 percent of endeavors are eventually deployed successfully in production, often due to the lack of a clear priority and resources, or people and investment.

While technology lays the groundwork for managing and analyzing this data, success is dependent on people using the resulting insight, and that is where the challenge lies. While automation and other systems will certainly replace various activities, such as data cleansing, people are and will be the key differentiator in the adoption of the new digital technologies. Machine learning, artificial intelligence and other automation tools in the market today are just that, tools. Subject matter experts, data scientists, and the vision of industry leaders are what will drive pulp and paper towards true digital transformation.
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Subject matter experts will continue to play a key role in the digitalization of the mills and to interpret the results provided by advanced analytic tools. They are the ones who construct models for machine learning tools, enabling the automation of menial and repetitive tasks like fetching, cleaning and populating reports using object-based models.

Additionally, data scientists are bringing new skills into industry that make it possible to work more efficiently with mathematical models. Data scientists understand the new tools (configurable or programmable) available to construct advanced analytics, and know which model to choose depending on which questions need answering. They can also help subject matter experts construct answerable questions and then can help gather clean and relevant data to find new correlations and insights between the variables of the process.

Technologists or innovation groups are also critical to driving change by making sure that the IIoT solutions are able to share data with other enterprise tools and that data is both secure and available to subject matter experts, data scientists and other stakeholders. Most of the time, Information Technology (IT) is responsible for integrating all the systems at the mill: PLC, DCS, SCADAS, to MES, LIMS, and ERPs. As architectures expand in scope, the IT-OT collaboration is increasingly crucial to successful digital transformation.

SUCCESS TAKES:

1. CLEAR VISION AND SUPPORT FROM LEADERSHIP

   Digital transformation requires coordinated efforts across different parts of the organization. Support from leadership is a key first step to building digital transformation into an enterprise’s vision and culture.

   Additionally, when transformation is supported and driven by executives, it ensures funding for key technological investments and more effective and coordinated change management as people adopt new ways of working.

2. DEFINING AND MEASURING LONG-TERM SUCCESS

   Without goals, ROI is difficult to determine, but when companies set specific short and long-term goals, it’s easily quantifiable. For example, one company set a goal for waste reduction within a specific timeframe.

   With this baseline, they were able to determine that their efforts surpassed the goal by 2.5 percent, which was equivalent to $2 million better than the initial target.

3. THINKING BIG, BUT STARTING SMALL

   Not only does this lower the risks associated with adoption, or lack thereof, it gives employees the opportunity to become familiar and comfortable with new systems and technology before a project expands. This is critical because people and their expertise is what makes the difference between successful digital transformation efforts and failure.

   With the help of innovative leadership, a clear vision and strategy and the right change agents that understand the needs of the different parts of the organization, digital transformation is possible—and it has the power to keep pulp and paper mills flourishing well into the future. From progressive savings to prevented excursions or shutdowns, improved product quality, faster response to clients, or faster analysis of information, the potential of millions of dollars of gains are waiting for the innovators who are willing to make the right changes.
EVERGREEN PAPER: REDUCING OFF-QUALITY PRODUCT BY 60%

Evergreen Paper is a fiber-based food and beverage packaging manufacturer that operates multiple facilities around the world. The mill uses the PI System, which is the open infrastructure that connects their operational plant data.

After analyzing data from the PI System, Evergreen noticed that finished paper rolls were becoming lapped, or stuck, during the slitting and winding process, resulting in significant costs due to lost product. They collected machinery data for both good and poor quality production runs, and the data analysis highlighted a variance between recipe set points and process running points.

They realized that operator knowledge of these set points was minimal, so Evergreen established a system that would display set points against the current running parameters. They retrained mill operators and worked with them to identify optimal production points. Thanks to this newfound knowledge and system-generated alerts, mill operators can now see when a winder is running above or below set points and make necessary adjustments in real time. By aligning its people, processes and technology, the mill has seen a 60 percent reduction in off-quality product.
WestRock produces a variety of packaging products, including over six billion beverage cartons per year and 40 million corrugated containers every day. The company needed to standardize KPIs on assets across multiple mill locations and display that information in a way that would be digestible for all levels of the organization. It was no small feat, but it was the only way to benchmark the production process and make critical improvements across every location.

But WestRock couldn’t simply deploy new technology and expect to get intended results. To start, the WestRock team worked with the brownstock washers in the production process to improve pulp fiber quality as well as chemical recovery. For this project, they first determined the people who would be using the data and assessed their needs in a hierarchical manner. From there, they addressed people’s interest at all levels and determined KPIs for each. They knew that to be successful they needed to meet the needs of all employees, regardless of job title.
From there, they created a process that would enable people to use technology effectively. Using the Asset Framework, part of the PI Server™, the team built template models that could be deployed to all of the mills and visualized across all levels of the organization.

**THE WESTROCK PROCESS:**

1. **DETERMINE** KPIs for each level
2. **STANDARDIZE** KPIs across all mills
3. **DETERMINE** required inputs for the calculation
4. **IDENTIFY** corresponding tags or create if it didn’t exist
5. **MODIFY AND ENHANCE** the AF structure
6. **CREATE** a display that allows for easy end-user consumption

But they didn’t stop there. Building upon the hierarchical approach, WestRock built additional KPIs at higher levels in order to easily find and show efficiency across all mills. They then divided those KPIs according to job titles, enabling users to immediately see the KPIs that were most relevant to them.

**HIERARCHICAL KPIs IN ONE DASHBOARD:**

**LEVEL 1**
General Managers
- OEE and other high-level information

**LEVEL 2**
Superintendents, foremen process and engineers
- Trends and ratios, such as washwater per ton
- Trends and XY plots

**LEVEL 3**
Operators
- Trends and ratios, such as washwater per ton

For WestRock, success was not possible without the expertise of its people tailoring the technology to individual needs. It was the people who made the difference, and by putting data into the hands of experts, they were able to standardize processes to ensure that they were quickly able to get the results they needed to better understand mill efficiency.
MONDI: BRIDGING THE GAP BETWEEN IT AND OT

With over 100 operations and 25,000 employees spread across 30 countries, Mondi creates a variety of consumer packaging, paper and specialized liners. The Release Liner segment has seven manufacturing plants, three extrusion plants, two sales offices and one logistics center located in multiple countries. To gain operational insights necessary to optimize processes Mondi implemented the PI System over ten years ago. Mondi has deepened its use of the PI System to achieve operational transparency, support lean projects, ensure performance and implement a track and trace initiative under the umbrella of the “Digital Future.”

While Mondi was achieving goals and moving closer to operational excellence, the team knew future success meant clearly defining the long-term goals and benefits of digitalization and smart operations to bridge the gap between OT and IT. Mondi set the goal of anticipating any operational anomalies that would cause a faulty product. They then launched initiatives that combined information systems such as machine learning, predictive maintenance and business intelligence with finance, customer and performance data to proactively monitor plant performance.

Thanks to a team of change agents, Mondi used proactive monitoring, predictive analytics, visualization and smart devices to reduce the number of rework hours, customer claims, silicone cost and improved process stability allowing for higher OEE standards.
For 120 years, Klabin has been producing and recycling paper products. Located in Brazil, the company produces 3.5 million tons of pulp per year, 1.5 million of which comes from the Puma site alone. The Puma unit is Klabin’s largest plant operation, the company’s largest investment in its 120-year history, and the largest private investment in the history of the Brazilian state of Parana.

The Puma site processes both long and short wood fibers and produces 270 MW of electric power — enough for a city of one million people. While the majority of pulp mills produce their own power, the Puma site produces 10 times more power than most mills.

Klabin uses the PI System to monitor asset performance across multiple sites, including the Puma plant. To collect and contextualize the data, the team used Asset Framework to create a digital twin of plant operations. Using a combination of PI System data and process engineer expertise within this digital twin, Klabin now has complete visibility into the entire production line within the Puma plant, making it possible to trace production, simulate production changes, and improve production forecasts and process stability.

**Full Traceability**

With its digital model of production, Klabin can track cellulose pulp from the entrance of logs all the way through the final stages of drying. Calculations dynamically illustrate when materials move from one line setup to the next and predict when it will move to the next. Klabin visualizes the entire process and correlates material variables, such as cutting time, age and density with production and process variables at each stage of production. When an anomaly occurs, they can quickly identify where the issue occurred.

**Faster Decision-Making**

The digital model has also sped decision-making. Previously each time Klabin wanted to adjust the production pace, it would take 1-2 hours for process coordinators to evaluate the effects of the change. Now, they can now simulate and make decisions in real-time. The result: an additional 3400 air dry tons per year of production.
Dashboards, Reports and Applications

With Klabin’s advanced instrumentation and a digital model that keeps all the process data in context, they have built a number of different applications, including:

- **MANAGEMENT REPORTS & DASHBOARDS**: these are drill down dashboards that start with high level process, quality and cost gauges. From there, they can see how parts of the line are operating compared to hourly, monthly and annual KPIs, as well as to historic production levels.

- **DAILY ENVIRONMENTAL REPORT**: this is a single report that shows emissions, water, wastewater, and effluents. They use it not only to ensure legal compliance but to emphasize the importance of Klabin’s core value of sustainability.

- **PREDICTIVE MODELS**: This is used for forecasting brightness and other quality properties based on current operational data.

Automated Notifications of Atypical Production Conditions

Every time a boiler shuts down unexpectedly is 80 hours of lost production, the equivalent of $4.8 million dollars per incident. However, by monitoring the process in real time and then setting quality and contamination boiler alerts, Klabin has avoided seven boiler shutdowns. The first five were avoided by monitoring PI System data and seeing a change in operating parameters. The most recent two were caught by automated notifications based on setting acceptable operating parameters. To date, Klabin saved over $9.8 million dollars by better optimizing and monitoring boiler performance.

Next, Klabin plans to implement a daily report on KPIs that are not on track so management can focus on issues, as well as improving the bleaching process. Bleaching currently takes three hours, but with better batch monitoring, they hope to prevent bad quality and reduce chemical consumption and associated costs.
ABOUT OSIsoft

With the belief that people with data can transform their world through operational intelligence, OSIsoft created the PI System as an open data infrastructure to capture and store sensor-based time series data. Today, the PI System is embedded in critical infrastructure around the globe. Our customer base includes 65 percent of the Global 500 process industry companies, including all 10 of the top pulp & paper companies (as listed by PWC and RISI).

OSIsoft remains faithful to its original mission—to push the edges of innovation and create an open data infrastructure that brings data from disparate operational sources to people in all corners of our customers’ enterprises, wherever, whenever and however it is needed. OSIsoft is a privately held company headquartered in San Leandro, California, U.S.A., with offices around the world.

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