For pulp and paper companies, operational challenges directly impact mill profitability. Highly optimised paper machines help meet demanding product specifications and quality requirements. When a machine is tuned properly, there are lower rates of product rejection and lost production, which can have a significant impact on a paper company’s bottom line.

The following article describes how optimisation throughout the production and maintenance cycles drives increased mill profits. The latest Industrial Internet of Things (IIoT) technologies and outcome-based support programs couple experts with critical information to achieve continued high performance.

INTRODUCTION

In the pulp and paper industry, there is an urgent need to drive profitability, achieved by production efficiency and flexibility while maintaining quality. Traditional maintenance programs tend to focus on quality Key Performance Indicators (KPIs) such as 2 Sigma spreads, but achieving tight quality performance doesn’t necessarily equate to higher profitability.

What papermakers need is an operational and maintenance approach based on continuous data collection and analytics, advanced multivariable Machine Direction (MD) and Cross Direction (CD) controls, and remote expert-guided optimisation to gain the visibility and flexibility to “tune for profit.”

A paper machine incorporates a number of complex and rigorous processes in the manufacture of paper products. The machine uses fibre from trees to make paper and employs chemicals to achieve a variety of unique properties. Steam is relied upon to dry the paper material, and clay is applied as a coating. By optimising these processes, paper mills can reduce their energy and fibre consumption, minimise chemical usage, improve the quality of final products, and help their customers make more money.

At many sites, however, experienced personnel are retiring, and on-site resources cannot be experts in every aspect of system handling – from CD and MD control to grade change tuning. Very few people have the knowledge and skill to optimise three-dimensional, high-speed paper machine controls employing a host of specialised algorithms. Tuning and optimisation requires tools and expertise to address control limitations while maintaining uniform sheet properties in length, width, and thickness.

Remote Expert-guided Tuning and Optimisation Takes Paper Machine Performance and Mill Profits to a New Level

By Peter DeNicola, Honeywell Process Solutions
Running a pulp and paper mill has never been easy, and in recent years it has become even more demanding.

Figure 2. Processes degrade over time, requiring periodic intervention.

Mill performance improvement starts with expert insights, access to critical operating information, and the ability to identify and analyse data to capture higher productivity and improved profitability.

CHALLENGES FOR PAPER COMPANIES
Running a pulp and paper mill has never been easy, and in recent years it has become even more demanding. Higher energy and raw materials costs, downgraded or reject production, and late shipments can all result in significant financial losses and customer complaints.

Paper industry operations need to identify variables that impede productivity and impact quality on paper machines and flat-sheet production lines, and then address them quickly and efficiently. The goal is to produce a more uniform product within the same tolerances. This requires the ability to process large amounts of data, which increase with the complexity of production.

Among the requirements for effective operations are:

- Simultaneously optimise dry weight, moisture and caliper profiles
- Optimise wet press and reel moisture profiles to improve CD draw uniformity and runnability
- Optimise moisture profiles and energy usage by optimising steam and moisture application
Data, and then close the loop by maintaining optimal process control. It is crucial to sustain performance gains through plant changes and disturbances, and ensure the overall health of production assets. Leading QCS technology suppliers like Honeywell now provide remote expert-guided tuning and optimisation services to help customers perform at their best—all the time. These performance-based support services, employing 24x7 data collection and analytics, identify opportunities to improve control performance, and with outcome-based contracts, allow experts to engage with customers to drive higher profitability while maintaining quality production.

A key feature of remote expert-guided tuning and optimisation is the ability to help papermakers take machines from “safe” quality production (e.g., everything looks great—the quality profiles are excellent) to pushing the machines towards their maximum capabilities. Mill operators generally avoid this push, and tend to accept stability over maximising production. Typical examples include using more chemicals than necessary to keep process...
As experienced operators retire, less-experienced resources may not know how to drive paper machines harder. To keep machines at the top end of their performance curve through the production and maintenance cycles. Leveraging robust scanner/sensor-level fault detection logic and diagnostics, they encompass control performance assessment and recommendations, remote tuning and optimisation support to implement improvements, and valuable before/after performance reports. Mills are able to:

- Address low control utilisation, poor performance, and process variation
- Benchmark paper machine performance against peer machines
- Respond to timely notifications on performance deviation
- Sustain overall performance through process changes and disturbances
- Improve Overall Equipment Effectiveness (OEE)
- Lower cost for net production

An important distinction with the latest intelligent services is the ability to utilise process and machine data to notify mill personnel of a possible control or performance issue within minutes of it occurring, and then engage proactively to take appropriate correction action.

As part of the expert-guided service solution, the service provider collaborates with the customer to develop valuable know-how and augment their internal workforce to tackle resource challenges. The solution also provides assistance with developing an automation and quality control “roadmap” in order to stay current with technology, and help with proactive system remediation, software updates and patches, hardware upgrades, system migrations, etc.

Automation suppliers can add value to an on-site QCS through implementation of cloud technology enabling lifecycle optimisation through continuous data collection, 24x7 analytics, immediate notification, and proactive remote expert-guided tuning and optimisation. This performance-based solution augments on-site QCS maintenance and support and helps drive profits regardless of the on-site support arrangements. Critical operating and quality data are streamed to the cloud, where advanced analytic engines and fault detection logic are applied to the information. Data are transformed into actionable insights for improved process quality and production performance. Users can enhance quality control with 75 percent less support cost than traditional solutions.

Figure 4. Data analytics provide automated 24x7 performance monitoring and serve the information in an easy-to-understand dashboard.
Unlike approaches where manual data collection, analysis and tuning are required, the latest solutions digitally connect the paper machine, scanners and other crucial assets in the paper production process. An analytics engine can be used to deliver control information in real-time, presented to stakeholders via performance and health dashboards. Authorised personnel are able to access system data using a smart device with browser support.

With new connected QCS optimisation, support personnel and control engineers receive a “call to action” when QCS system health or control/process performance issues are detected. The call to action leverages mobile devices, enabling “anytime, anywhere” notification. This minimises the engagement cycle from days/weeks/months to minutes.

Another recent technology innovation, intelligent wearables, enables proactive QCS health and control performance monitoring by connecting field workers with remote experts in real-time so they can assimilate skills and knowledge while working to speed problem resolution. The wearables feature a head-mounted visual display that responds to voice commands and brings live data, video, photos, documents and work procedures, as well as health and safety information, into view.

In addition, immersive competency training helps develop internal skill levels faster. It enables mill personnel to improve their confidence with complex tasks and test their knowledge in a safe, virtual environment prior to working on a live system. This cloud-based training lets workers access complex, simulation-based scenarios anytime, from anywhere.

**HOW OUTCOME-BASED SERVICES WORK**

Control system suppliers can offer remote expert-guided tuning and optimisation services as part of an outcome-based service contract ensuring agreed service levels with guaranteed results. As a strategic partner, the service provider is responsible for providing the necessary skilled labor and materials to achieve the defined outcomes with payment adjusted by the results attained. This differs from a traditional approach based on prescribed quantities of materials and labor. The goal is to help mill owners/operators by tying the service delivered as closely as possible to the mill’s business outcomes, helping drive profits while optimising Total Cost of Ownership (TCO).

Leveraging cloud technology innovations, remote expert-guided services for tuning and optimisation focus on:

- **Cloud-based training lets workers access complex, simulation-based scenarios anytime, from anywhere.**
- **How Outcome-Based Services Work**
  - Control system suppliers can offer remote expert-guided tuning and optimisation services as part of an outcome-based service contract ensuring agreed service levels with guaranteed results. As a strategic partner, the service provider is responsible for providing the necessary skilled labor and materials to achieve the defined outcomes with payment adjusted by the results attained. This differs from a traditional approach based on prescribed quantities of materials and labor. The goal is to help mill owners/operators by tying the service delivered as closely as possible to the mill’s business outcomes, helping drive profits while optimising Total Cost of Ownership (TCO).

Leveraging cloud technology innovations, remote expert-guided services for tuning and optimisation focus on:

- **Remote Tuning & Optimisation**
  - World Pulp & Paper
  - Honeywell QCS 4.0 Solution
  - QCS 4.0 Dashboard and Messaging
  - Analytics Engines and Fault Detection Logic
  - Cloud Historian and Infrastructure
  - Honeywell Cloud
  - QCS 4.0 Dashboard and Messaging
  - Analytics Engines and Fault Detection Logic
  - Cloud Historian and Infrastructure
  - Paper Machine Scanner & Sensors MD CD Controls
  - Any Smart Device, Anywhere

**Figure 5.** Agile infrastructure provides powerful, fully-automated performance tracking and analysis tools and easy access anytime, anywhere.
• CD/MD control tuning (optimise process performance)
• Grade change cycle time reduction
• Sheet break recovery (minimise lost time)

The service delivery platform automatically gathers large amounts of data, and performs initial analysis on this data to expeditiously find trends that may indicate impending control problems, so that remote service professionals can more quickly help site personnel find and mitigate issues that impede availability, quality and productivity.

Key information is monitored by experts on a real-time basis and compared against established performance benchmarks. This capability leverages and vastly expands the reach of the service provider’s remote QCS specialists while enabling lower-skilled site resources to accomplish key tasks with expert guidance. It also digitises critical knowledge and skills.

The tuning and optimisation process begins with a discussion of production objectives and issues. Process models and operating logs provide valuable details and help identify improvement opportunities. The production schedule determines expert analysis and implementation timing. Bump tests and tuning changes are covered to ensure close expert-site coordination for all tests and process changes. The Six-Sigma DAMAIC process is employed as part of this procedure.

A best-practice cycle is utilised for each grade/grade group. New and historical bump tests measure the process response, and remote experts analyse the data to confirm or recommend modified process models and tuning parameters. Analytics and analysis tools speed the recommendation, leveraging the automated 24x7 QCS data collection. The recommendations are implemented and confirmed with automated monitoring and alerting of new control performance opportunities. Optimisation results are captured to quantify the improvements. In the outcome-based model, this cycle repeats when triggered by an analytics alert.

The use of a “balanced scorecard” covers the support, maintenance and optimisation of systems. The scorecard serves as a focusing tool to drive organisational behaviors and measure the effectiveness of the delivered services. The balance is achieved by balancing the mill’s business needs through selective KPIs in the areas of support (i.e., faster response and incident resolution), maintenance (i.e., best practices to reduce resource needs and resolution time, improving overall up-time) and optimisation (i.e., monitor and provide tools for assessing loop performance, identifying poor performers, analysing system performance and reliability through sensor data monitored 24/7, and alerting of any potential failure or anomaly in the system).

**BENEFITS TO MILL OWNERS/OPERATORS**

Thanks to a performance-based QCS service contract, pulp and paper mills can proactively monitor paper machine control/performance and engage as needed when a per an issue arises. This solution enables them to find and correct any automatic control problems before they negatively impact production, quickly identify opportunities to improve performance to maximise quality, and improve paper machine reliability to ensure high availability.

**Figure 6. Intelligent Wearables provide immediate access to maintenance documents and videos, and live video conferencing to remote experts.**
The use of 24x7 analytics and a real-time “call to action” enables more QCS tuning activity. Experts are not glued to screens monitoring machine performance; rather, they are engaging at just the right time to deliver effective tuning and optimisation. This approach also removes variation in results by decoupling the dependency on local (resident) skills. Supplier experts “talk” local resources through the optimisation cycle for any steps that can’t be done remotely. The service provider does not charge for the expert engagement itself – only for the upside that helps the customer achieve lower energy costs, reduced raw materials, increased production, fewer machine disruptions and, ultimately, more salable product out the door.

By employing a remote expert-guided service solution, pulp and paper companies can:

- Reduce machine breaks
- Maintain system availability
- Minimise MD and CD variation
- Reduce break and start-up loses
- Decrease grade change loses
- Reduce edge control and level losses
- Minimise downgrades
- Improve consistency
- Reduce product rejects
- Lower operating costs

With an outcome-based QCS support program, paper companies can push profits, maintain or improve quality, and improve their reliability of their QCS measurement and control system. Indeed, a service subscription can often be justified within one tuning and optimisation cycle. Experience has shown that papermakers employing this type of service can achieve up to 25 percent improvement in 2-Sigma spreads for conditioned weight, moisture, and caliper.

The supplier service expert follows the entire production cycle, ensuring all grades/grade groups are optimised, without the added costs of on-site travel and accommodations, unconstrained by long grade cycles. At the same time, local resources learn best practices, build confidence and skill levels, and are better equipped to sustain machine production performance.

**CONCLUSION**

Leading automation suppliers now offer a comprehensive QCS technology and service solution to the pulp and paper industry. Paper companies are finding that remote expert-guided tuning and optimisation services can leverage their control vendor’s quality control system experience and expertise to help maximise the performance of critical production equipment – driving higher product quality and improved downstream customer satisfaction.

This innovative type of service solution employs the latest secure, cloud-based, IT-friendly fourth generation industrial technologies to deliver significant value to papermakers at a fraction of previous costs.

![Figure 7. Outcome-based Paper Machine Service Program includes Continuous Monitoring and Remote Expert-Guided Tuning and Optimisation.](image)