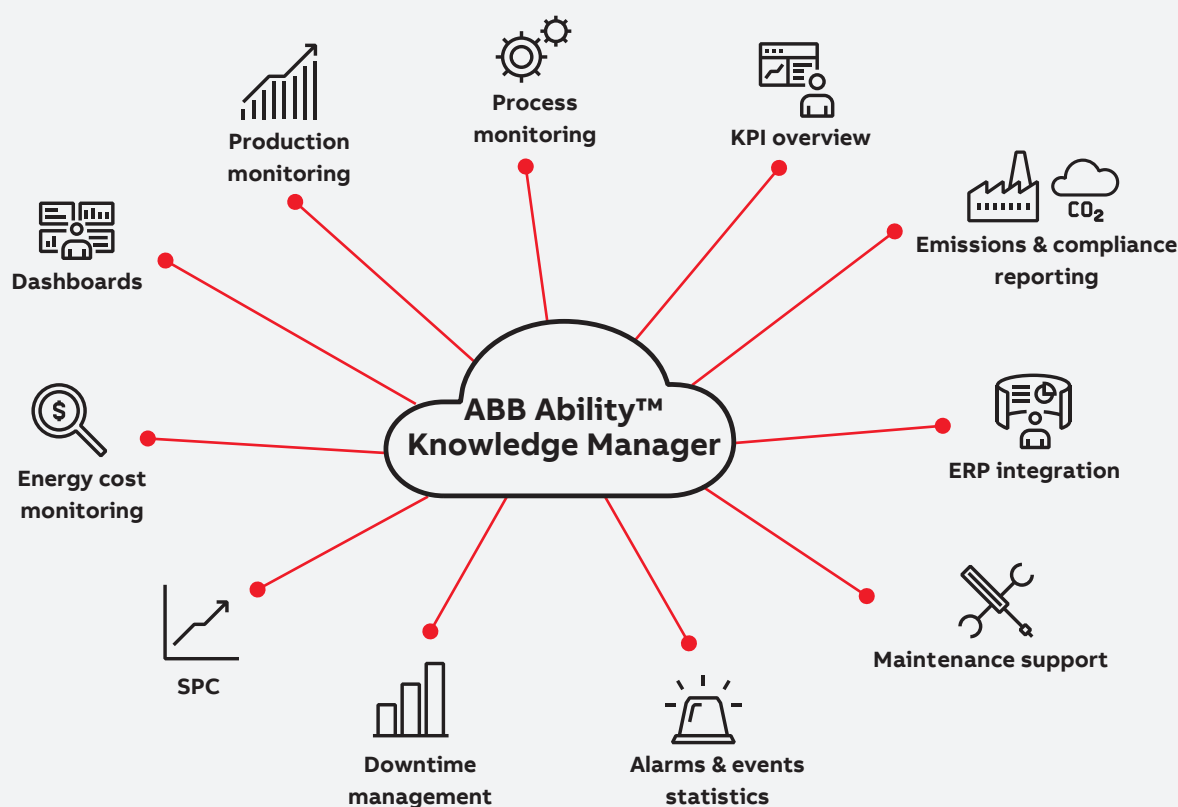


ABB Ability™ Knowledge Manager for cement

True integration using consistent and validated information



- Empower continuous improvement
- Integrate business processes and plant information
- Take goal-oriented decisions

Production information management

Goal-oriented decisions that meet production targets

Cement production consumes a huge amount of thermal and electrical energy and generates significant amounts of greenhouse gases, such as CO₂. Managers must continuously take actions to increase equipment efficiency, reduce the use of traditional fuels and introduce more alternative raw materials.

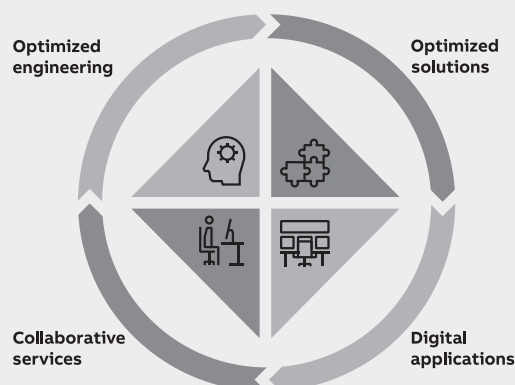
These challenges introduce a complexity that must be managed at business and operations levels to maintain the required quality, productivity and cost. Managers need to know when they are on target to meet their production, operational, quality and cost objectives. It is critical that they have the relevant information, on whichever platform they use, wherever they might be.

ABB Ability™ CementOptimize

ABB Ability™ CementOptimize is a framework that simplifies and unifies engineering, optimized solutions, digital applications and collaborative services to bring new levels of performance across the cement processing enterprise. Collectively, this framework helps the cement industry achieve the most efficient design, build and operation of any processing facility.

The digital applications aspect of ABB Ability™ CementOptimize supplies advanced libraries and software that maximizes visibility, reliability, productivity and energy efficiency. One such application is ABB Ability™ Knowledge Manager, which incorporates leading-edge digital capabilities and technology to provide end-users in mining with the ability to easily view, analyze, and act upon critical process data from any mobile device.

Meanwhile the collaborative services aspect of ABB Ability™ CementOptimize enhances day-to-day equipment efficiency, ensuring performance is on the highest level and making it easy to access expert guidance whenever and wherever required.





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With ABB Ability™
Knowledge Manager
plant staff at all
levels can take goal-
oriented decisions.

Consolidated, consistent and clean information

ABB Ability™ Knowledge Manager provides a single platform that integrates data from operational, control, optimization and business systems. The data is converted into consistent information that can be accessed by the right person at the right time via clear, concise reports and dashboards. Deviations can be readily identified, and best practices implemented to keep production on target.

Reduced lead time and risk

ABB Ability™ Knowledge Manager is easy to learn and therefore quick to implement. It features a set of ready-built, yet configurable objects that represent industry-specific applications. This avoids the lead time associated with custom programming while reducing risk and ensuring on-site knowledge management is available much sooner.

Flexible and scalable functionality

The core of ABB Ability™ Knowledge Manager provides functions which enable industry-specific process and quality data warehousing, with resulting information displayed in a meaningful way. It can be adapted and expanded to meet a businesses' specific requirements like adding advanced downtime and production management routines. Several users can be added over time to meet growing demand.

Features

- Enforces information consistency across the business by using data validation and period-closing functions. Improves proof of performance and compliance
- Ensures implementation of best practices and working processes
- Improves production and maintenance management, thereby lowering production costs
- Simplifies route to environmental, energy, production and quality goals
- Provides true integration of process, production and quality information

Benefits

- **Up to \$300,000 per year** saved through real-time, automated key performance indicators (KPIs) that support decision making, enabling best-in-class manufacturing
- **Two person-weeks** saved each month through:
 - emissions tracking and compliance certificates
 - advanced material balancing tools
- **\$200,000** savings through enterprise resource planning (ERP) integration and consultancy

A powerful aid to monitor plant performance

Production information management

With ABB Ability™ Knowledge Manager, production information management is simplified by considering:

- Production tracking
- Process operations monitoring
- Material storage management
- Energy and emissions monitoring
- Reporting of all information

Understanding how process parameters affect product quality, production capacity, energy consumption and emission levels is now easier than ever through a range of powerful analysis tools, accessible via a web browser.

Production management functions available include calculating, consolidating and reporting. ABB Ability™ Knowledge Manager integrates production-related data, process variables, energy indexes and run-time quality parameters in comprehensive process operation reports.

Supporting planning, operation and production at multiple levels

Immediate access to up-to-date information is essential to production planning and for better utilization of energy, equipment, inventories and capacities. ABB Ability™ Knowledge Manager provides reliable online reports about a plant's conditions, such as product inventory, capacities of process equipment and availability.

ABB Ability™ Knowledge Manager helps process managers to identify the influences that process parameters have on product quality and production capacity. Advanced consolidation and centralization functionalities enable managers to obtain a new level of regional and corporate KPIs, allowing for performance comparison dashboards.

Performance monitoring key functions

- Visualization and analysis tools
- Reports, charts, trends and dashboards
- Operation and process reporting
- Energy reporting
- Material and stock tracking
- Environmental reporting
- Production reporting
- Operation and production limits
- Calculation of KPIs
- Unique data validation and drill-down methods
- Visualization of consolidated, consistent and transparent information





Minimizing downtime

Providing reliable maintenance feedback

ABB Ability™ Knowledge Manager features a downtime management solution that removes maintenance guesswork, by identifying the most damaging downtime challenges facing a process or plant. By applying Pareto analysis, the costliest and weakest links in a production process are mapped, giving an early warning of equipment failure.

Forecast the next maintenance events

Analyzing event and alarm statistics is used to spot failing equipment, with results available daily and weekly or by frequency of failure. Maintenance events for specific process equipment are forecast using run-time counters, production totals or cumulative energy utilization. ABB Ability™ Knowledge Manager features multi-dimensional, product-related Pareto analysis tools. The system can separate low production periods from production stops, helping to focus maintenance analyzes on further reducing production costs.

Root cause analysis tools

Using plant-specific and configurable cause and effect trees enables Pareto analysis. Reliable sta-

tistical information about the causes of downtime provides the basis for corrective action. This information is crucial to justify investments in equipment or personnel training.

Integrate with maintenance management systems

ABB Ability™ Knowledge Manager integrates with Enterprise Resource Planning (ERP) systems bringing access to maintenance management systems at the ERP level. It is easy to transfer data such as stops, run-time and downtime statistics to maintenance management systems, such as the SAP PM module.

Key functions of downtime management

- Tracking of production stops
- Monitoring of low production rate periods
- Maintenance forecasting support
- Alarm and event recording and statistics
- Reporting, charts, trends and dashboards
- Pareto analysis
- Multi-dimensional cause categorization
- Root cause analysis tools
- Calculation of KPIs

Integrated ERP connectivity links process and business

Integrate manufacturing and business

An ERP Connector extends the reach of the ABB Ability™ Knowledge Manager by integrating manufacturing information with the ERP system. This seamlessly connects manufacturing and business information and applications. Although integration is automatic, ABB Ability™ Knowledge Manager allows for validation, manual correction and approval of information before it is transferred to the ERP system.

Applications

- Product costing
- Production planning
- Materials management
- Plant maintenance
- Quality management

Integration made simple

An Application Developer Toolkit provides the engineering and configuration for the ERP Connector, using the same tools and methods applied in report and KPI configuration. Using, configuring and maintaining the ERP Connector requires no specialist programming knowledge. Furthermore, no customization is required in most of the ERP modules, while the use of electronic data transfer replaces the need to re-enter data.

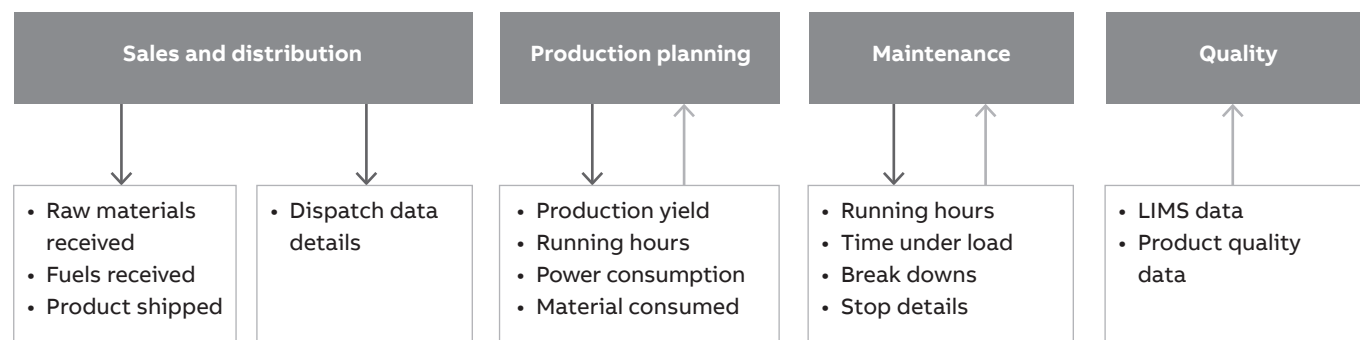
Advantages of the ERP interface

- Online integration of manufacturing in the overall business process
- Pre-packaged solution based on standard methods
- Short implementation time
- Easy to maintain; no ERP experts required
- No specific knowledge of ERP programming required

Key functions of the ERP connector

- Manufacturing information integrated in the ERP system
- Business information integrated in ABB Ability™ Knowledge Manager
- Can be integrated with, for example:
 - SAP PP-PI connector
 - SAP PM connector
 - SAP MM/SD connector
 - SAP QM connector
- Online exchange between ERP and ABB Ability™ Knowledge Manager
- Engineering and configuration through ABB Ability™ Knowledge Manager toolkit

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Bi-directional exchange
of context-relevant
information

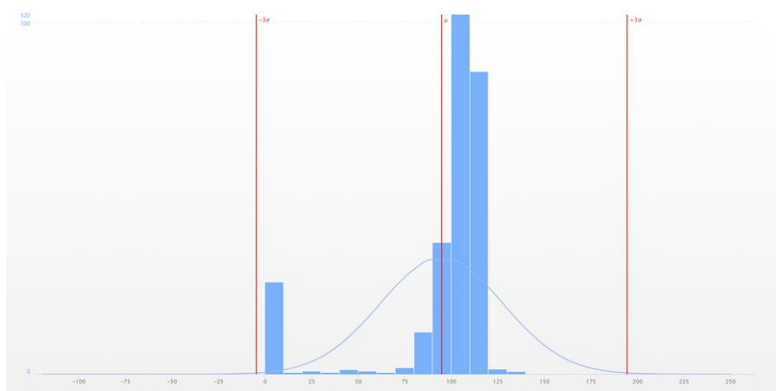
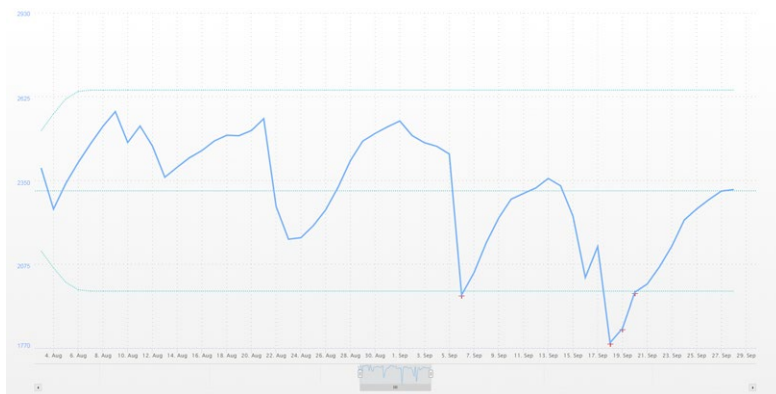
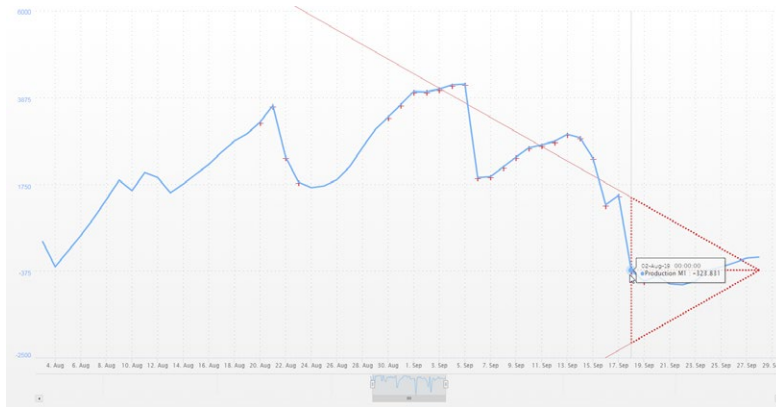


Statistical analysis boosts production and quality information

Correct product quality during production

Statistical Process Control (SPC) information lets operators compensate for, or eliminate, problems thereby avoiding production of out-of-specification product.

Understanding process and quality variations with statistical analysis. Examples of CUSUM, EWMA and histogram analysis.



With ABB Ability™ Knowledge Manager's statistical production analysis, trend functions such as X, EWMA and CUSUM charts are selected to match specific requirements of manufacturing processes. X-Y graphs show the correlation between two variables, with compensation of time delay. Histograms allow for readable statistics of run-time quality measurements.

In SPC, quality is emphasized as a process characteristic. If the process is controlled and improved, product quality will be automatically maximized. Product specifications, therefore, are normally excluded from quality improvement activities until the process is optimized. Once the process is stable, product specifications are compared with process control limits to determine if the process can manufacture the product to those specifications.

Process and quality improvement

SPC charts contribute to process and quality improvement by:

- Providing snapshots of processes' conditions and quality improvement over time
- Providing information for problem correction and process improvement
- Indicating what the process can do during cause correction and process improvement activities

Statistical production analysis provides powerful tools to:

- Effectively monitor quality-related process variables
- Verify whether the variables are randomly scattered around the mean and normally distributed
- Detect variability and statistical process changes to prevent the process from becoming unstable

Tools

- X charts (Shewhart)
- EWMA charts
- CUSUM charts
- Histograms
- Multivariable X-Y correlation graphs

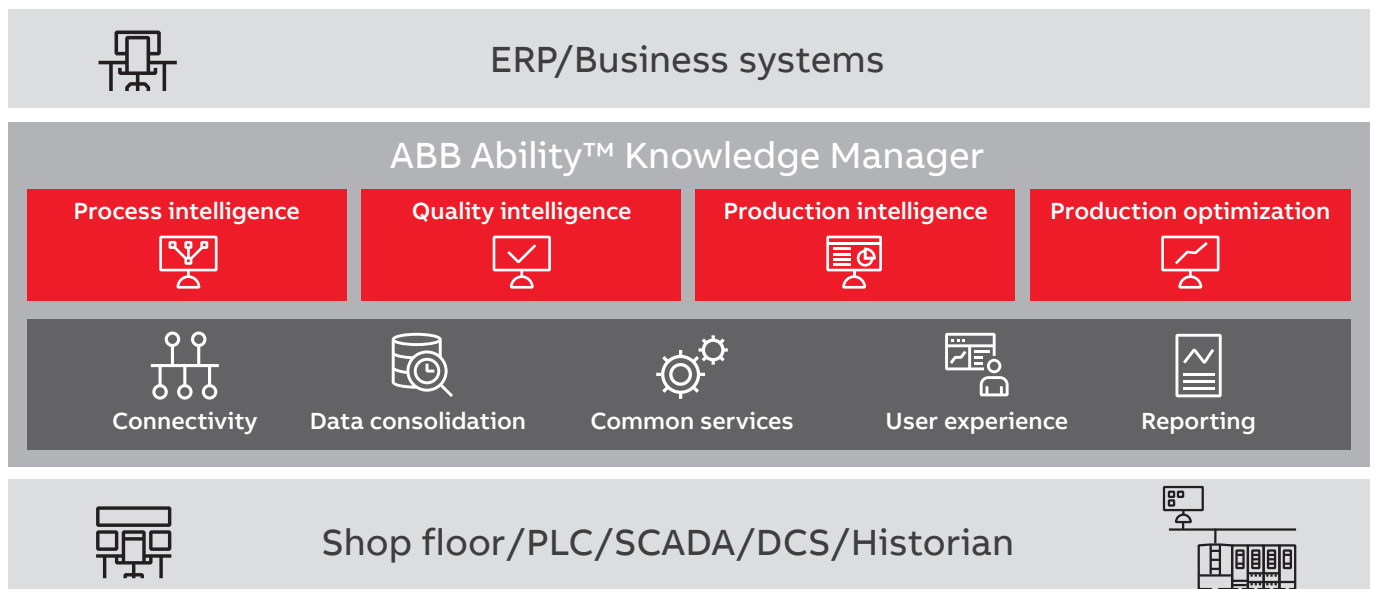
Flexible and reliable system architecture from edge to cloud

Maximum information availability

ABB Ability™ Knowledge Manager offers open, intranet solutions for the acquisition and distribution of plant information. It is based on industry standards, ranging from the hardware and operating system to database management. Desktop functions use Windows environment and Internet browser standards. The software is developed to support a modular structure, and its service-oriented architecture (SOA) consists of data collector nodes, application and database servers, and thin clients. Redundancy can be provided at all levels when the site situation demands high reliability. Data collectors can gather live data from different sources and provide store-and-forward data buffering, when required. OPC standards are used to communicate with ABB and other vendors' control and PLC systems.

The business logic is within the application server, which is the software component responsible for all server and user applications. It provides services such as data integration and consolidation, visualization of information, user authorization and client access management. Interfaces to laboratory instruments and ERP systems also run on the application server. The process and quality data warehouse, managed by the database server, houses all historical information and process-based knowledge. Data can be kept online for years. Server hardware performance and storage space are scaled for the quantity and the lifetime of data required within an organization.

ABB Ability™ Knowledge Manager seamlessly connects manufacturing and business information systems



Access to information using thin clients

The only software that needs to be installed on client computers is a web browser. Critical process data is easily viewed, analyzed and acted upon from mobile devices. Using thin client web-based technology, information is analyzed and reviewed from various perspectives. In addition, focused reports and dashboards are generated that help make informed management decisions. By exploring historical and current process and quality information, new opportunities can be discovered. Users can easily navigate through the system to view dashboards, reports and graphs, and even make manual entries or modify personal pages using a standard web browser.

Role-based system security settings and client access control incorporate the Windows user accounts from the plant's domain.

Auditing reports are available to ensure actions of individual users can be traced. ABB Ability™ Knowledge Manager provides self-diagnostic tools that support the system administrator without requiring prior knowledge of any specific technology.

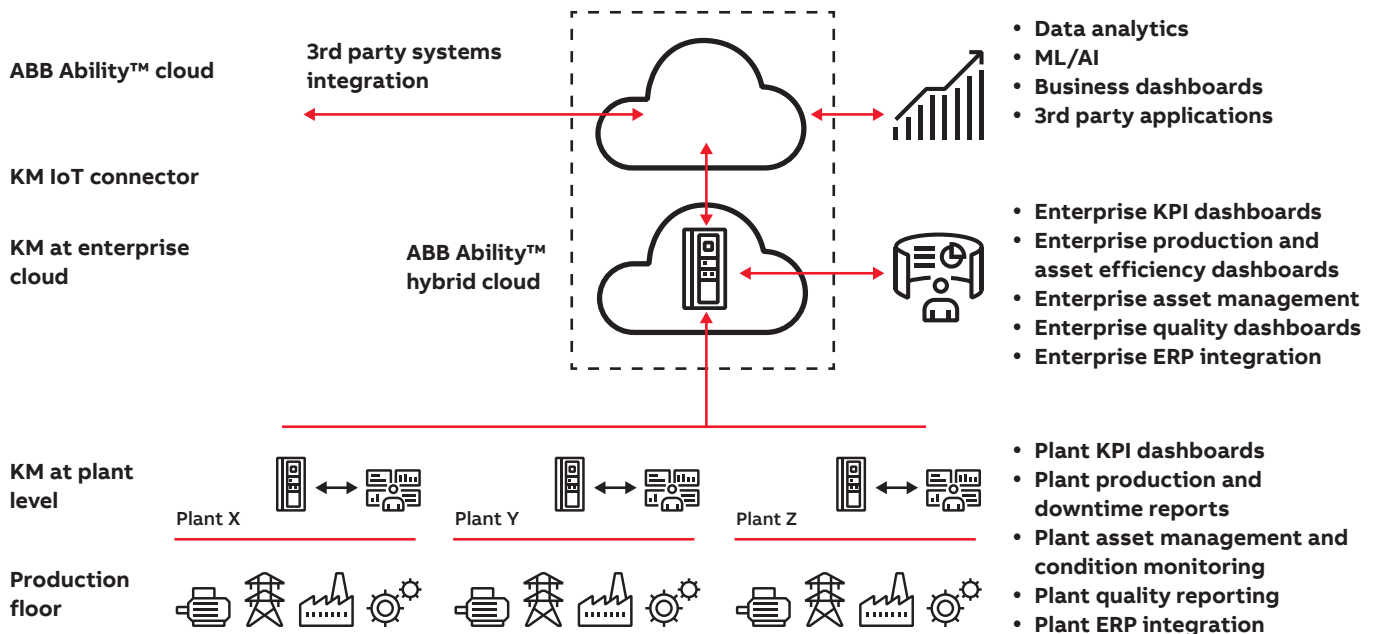
ABB takes care of cyber security throughout all product lifetime phases – from design to development to deployment – thereby ensuring the evaluation of critical requirements as an integral part of the overall process.

Keeping data secure and auditable

ABB Ability™ Knowledge Manager provides:

- User authorization and management
- Status monitoring
- Data retrieval and processing
- Configuration handling
- Consistency checking

Architectural example
integrating information
from edge to cloud



Adapt and customize to meet your needs

To meet specific data evaluation and information acquisition needs, ABB Ability™ Knowledge Manager provides a range of easy-to-use configuration tools.

The ABB Ability™ Knowledge Manager Toolkit is a graphical and menu-driven configuration tool used to set up process tags, logs, calculations, trends, templates and reports using simple drag-and-drop editing.

With this all-in-one toolkit, users can create and customize displays, reports, trends, manual entry forms and survey sheets and make them available to other users.

Templates for reports and graphs, together with dashboards, are created from a comprehensive library of pre-built graphical elements and widgets. The ABB Ability™ Knowledge Manager Toolkit embeds various scripting tools for additional complex processing of data and advanced reports.

Complete flexibility

- No specialist programming or web development knowledge required
- Toolbox with preconfigured elements
- Simplified editing
- Full system configuration setup and management

Cement Production Scheduler

Optimize and harmonize your operational planning

To save energy, optimize stock and enhance equipment performance, plant and production managers must be able to respond with agility to correctly adjust production, against constantly varying constraints.

The Cement Production Scheduler helps managers to easily adapt to changing goals and operational constraints. It takes into accounts variables like restrictions in material transport and storage, planned and unexpected maintenance activities, complex energy tariff schemes and equipment power start-up curves.

Cement Production Scheduler significantly increases the efficiency of cement plant management. Ready-made scenarios enable production teams to assess “what if” situations and the consequences, before deciding on appropriate actions. Managers can create and save scenarios

that can be readily implemented should a deviation occur that impacts on the planned task. Saved scenarios can be compared at any time based on their impact on operational situations such as forecasting inventories or energy costs. Production planners can choose which scenario is officially published, leading to it automatically converting into a list of actions for the operators.

The benefits include:

- Optimized short-term production schedule per mill and per product
- Reduced overall production costs
- Increased equipment efficiency
- Overcome complex scheduling constraints
- Apply consistent decision-making criteria
- Increased efficiency and agility of planning tasks
- Increased efficiency and agility to quickly adapt to changes

Laboratory Information Management System (LIMS)

Control and improve your product quality

Laboratories supporting cement manufacturers rely on LIMS to track and test the quality of raw material, including traditional and alternative fuels, intermediate and final products.

LIMS supports laboratories complying with ISO 14000 and 17025 and manages information from routine quality control to final product tests and compliance certificates. LIMS supports managers in their daily quality decisions while ensuring that the information is easily accessible and transparent so that all plant personnel have a greater insight into how the cement process is performing.

- **Sample registration and identification:** manual and automatic registration mechanisms provide sample identification and generation of bar-code labels.
- **Dynamic sample and test management:** monitor progress of laboratory samples and tasks and adjust at any time.
- **On-line collaboration with other laboratories:** share analysis equipment between several production laboratories, fully supported in LIMS, thereby saving costs across multi-facility enterprises.
- **Validation and approval:** provide manual and automatic mechanisms with multiple levels of specification limits.
- **Reporting and statistics:** table-like and graphical reports can be used for evaluating analysis results and calculated values, as well as trending and statistical correlation analysis tool.

Benefits

- **Higher manpower efficiency** through standard and managed workflows can be shared across sites, facilitating collaboration and reducing training effort.
- **Increased productivity** achieved by automated procedures that give analysts more time for testing while avoiding manual data handling and validation.
- **Enforce information consistency** by promptly providing accurate and transparent information to users in the laboratory and beyond.
- **Seamless integration of quality and production information systems** improving business processes while reducing total cost of ownership.



ABB Switzerland Ltd
Local Business Unit Process Industries

Segelhofstrasse 1K
5405 Baden-Dättwil
Switzerland
Phone: +41 58 586 84 44
E-Mail: minerals@ch.abb.com

For contact details, please visit our website
www.abb.com/mining