

Getting your ERP system online

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Abstract

Special conditions need special solutions. Especially in the cement world, where we see raising constrains by legislation on emissions, raising fuel and energy costs and a high demand on product flexibility, market price pressures, it is getting essential that the decision makers from the management using ERP applications get accurate online information from the operational data in the plant to ensure their operations are aligned with targets. In this paper ABB and Fujitsu showcase a solution, which the ABB Knowledge Manager and ERP solutions such as SAP can be integrated completely online to give a seamless view of plant operations for the management.

Knowledge Manager is a proven Production Information Management System (PIMS) with more than 400 installations world wide. With its interface to an ERP system it provides minute by minute data from the production process, equipment down time, quality parameters and final product stock to the ERP system. Proper production accounting in Knowledge Manager reduces the risk of wrong information in the ERP system ensuring that your cement plant in financially healthy state.

Fujitsu has best practices for the cement industry and has built a template on SAP. Fujitsu specializes in providing online integration with the ABB Knowledge Manager Tools.

Process level structure and software architecture

Production processes are divided in different levels and each level has its specific purpose in the production process and has to respond in different time frames.

The standard process definition is based on a 5 level structure.

Level 0, 1 and 2

These 3 levels are consisting of Sensors, Actuators, Logical Devices in the plant itself and they are communicating with the installed control system. Time frames for responses can vary from milli-seconds to minutes, depending on the process requirements.

Level 3

Level 3 is the Management Execution System (MES) level. This level consist of various tools for the production team to learn about their process and enables them to make the right decisions to their process dependent on production feedback coming from the below levels and constrains they see from equipment availability and external influences like material or fuel availability. Time frames for the response to the process can vary from seconds to hours and statistical information has to be available on a daily, weekly or monthly level.

Level 4

Level 4 is the Enterprise Resource Planning (ERP) level. This level consist of various tools for the management team to react to production information, maintenance requirements and human resources to create relevant production schedules, plan maintenance actions and stock on spare parts and raw materials, as well as handling all orders and dispatch documentation.

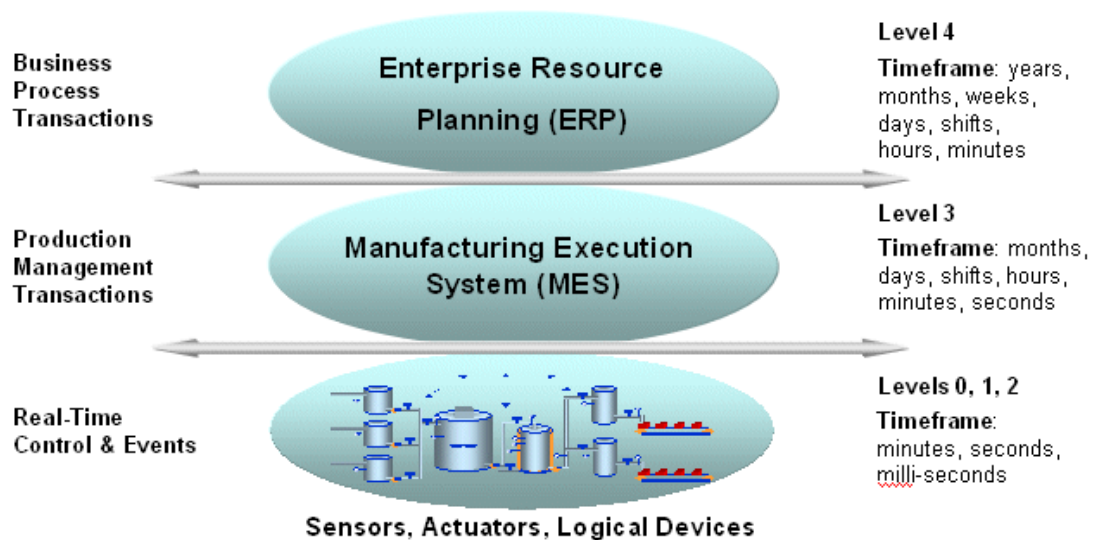


Figure 1: Production levels

Manufacturing Execution System (MES)

In most of the cases customers rate a historian for production data or simple Information system as an MES system. But a MES system has to provide more than just simple tables of data reflecting what has happened over time.

That's why ABB has developed their Collaborated Production Management (CPM) System which is based on several Knowledge Base Solutions (KBS) applications which offer much more than just a production historian.

The Collaborated Production Management (CPM) suite creates a detailed software structure to the level 3.

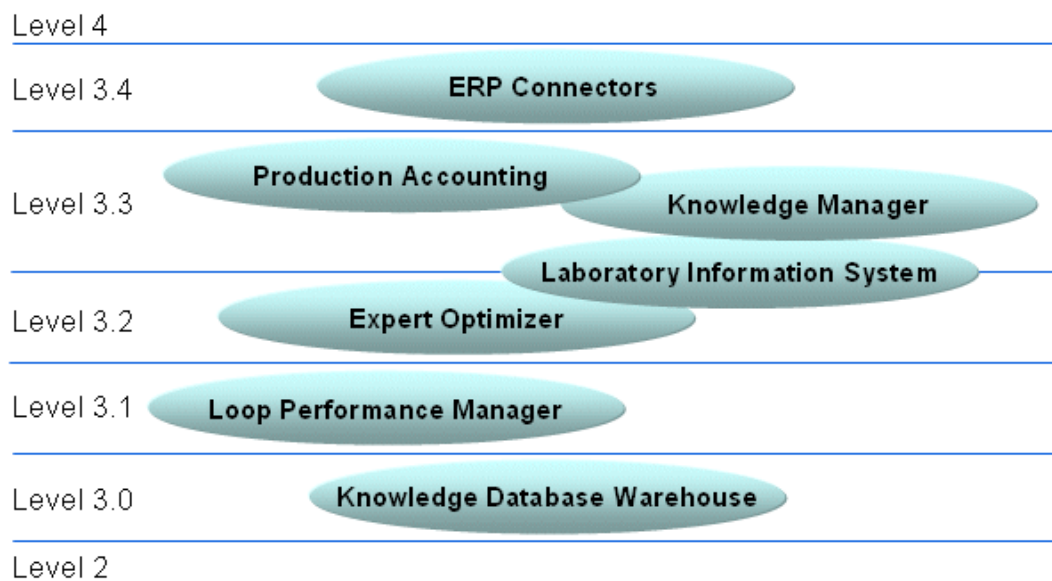


Figure 2: CPM - Level 3 structure

The package of ABB's Knowledge Based Solutions (KBS) within the CPM suite provide a flexible approach to collecting, optimizing, organizing and distributing of production and quality information throughout the production process. Using service oriented architecture (SOA) KBS cover fast data acquisition and network communication, historical database with plant specific structure and reports, trends, graphs and menus for the web-based user interface.

Important to this structure is a single Knowledge Database Warehouse as a single interface downwards to the level 2 control system and a single ERP Connector Package as the interface upwards to the ERP system. This structure ensures that that no data duplication can happen and that all KPS applications work on the same information base.

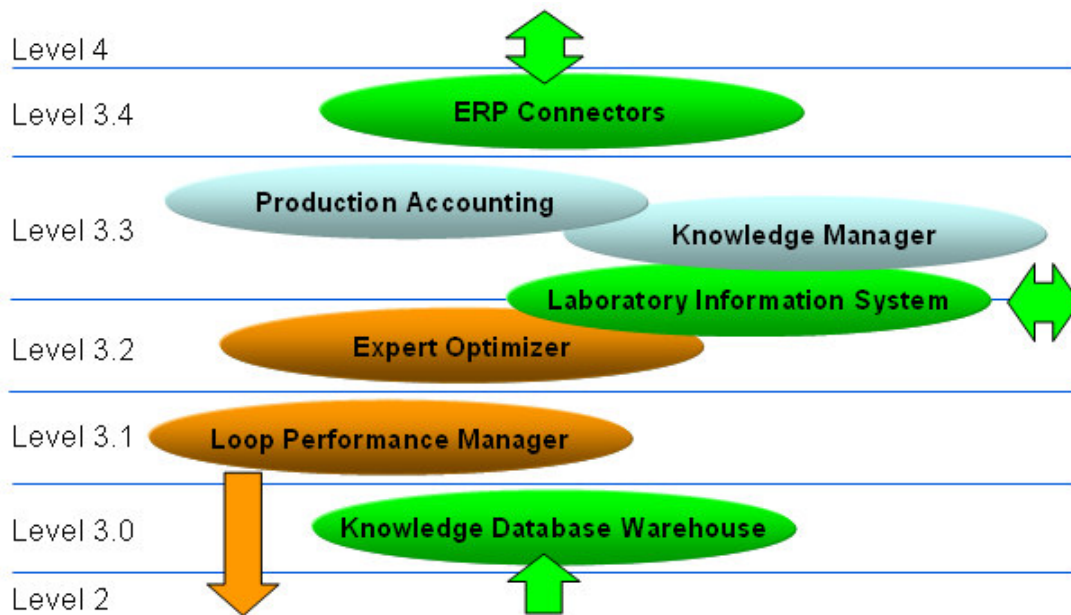


Figure 3: CPM – Data flow

The interface from the Level 2 control system is read only. ABB's 800xA connects directly to the Knowledge Database Warehouse; all other control systems are connected via an OPC Server.

The Laboratory Information Management System (LIMS) has its own interfaces to the laboratory equipment. Final quality results are stored in the Knowledge Database Warehouse.

The ERP Connectors as the interface to the Level 4 are bi-directional.

Only the Loop Performance Manager and the Expert Optimizer are communicating back to the Level 2 control system for real time Loop and Process Optimization.

Knowledge Manager and Production Accounting

The Knowledge Based Solutions perform process data management on data collected from any process via different sources, and through functions and components needed for industry specific process and quality data warehousing and focused information presentation. They are adapted and expanded to meet specific requirements, and can incorporate up to several hundred users.

Knowledge Based Solutions encompass many user and plant dependent applications can then be added, whether they be metal, mineral, cement, phosphate or aluminum specific. These applications include the Knowledge Manager (KM), which provides for Production Information Management and the Production Accountant for data validation and data approval.

The Knowledge Manager functions include:

- Core functions – Reporting, Trending, Mimics, Graphs
- Core functions – Calculations, KPIs, RtPIs
- Process and Production Management
- Emissions and Energy Monitoring
- Visualization and Configuration of Process and Production Limit Handling
- Maintenance Support
- Downtime Management and Pareto Analysis
- Alarm and Event Management

All functions can be used for real time, daily, weekly or monthly reporting. This enables the Production team to analyze their process at any time and shortens the decision making process for changes to be applied.

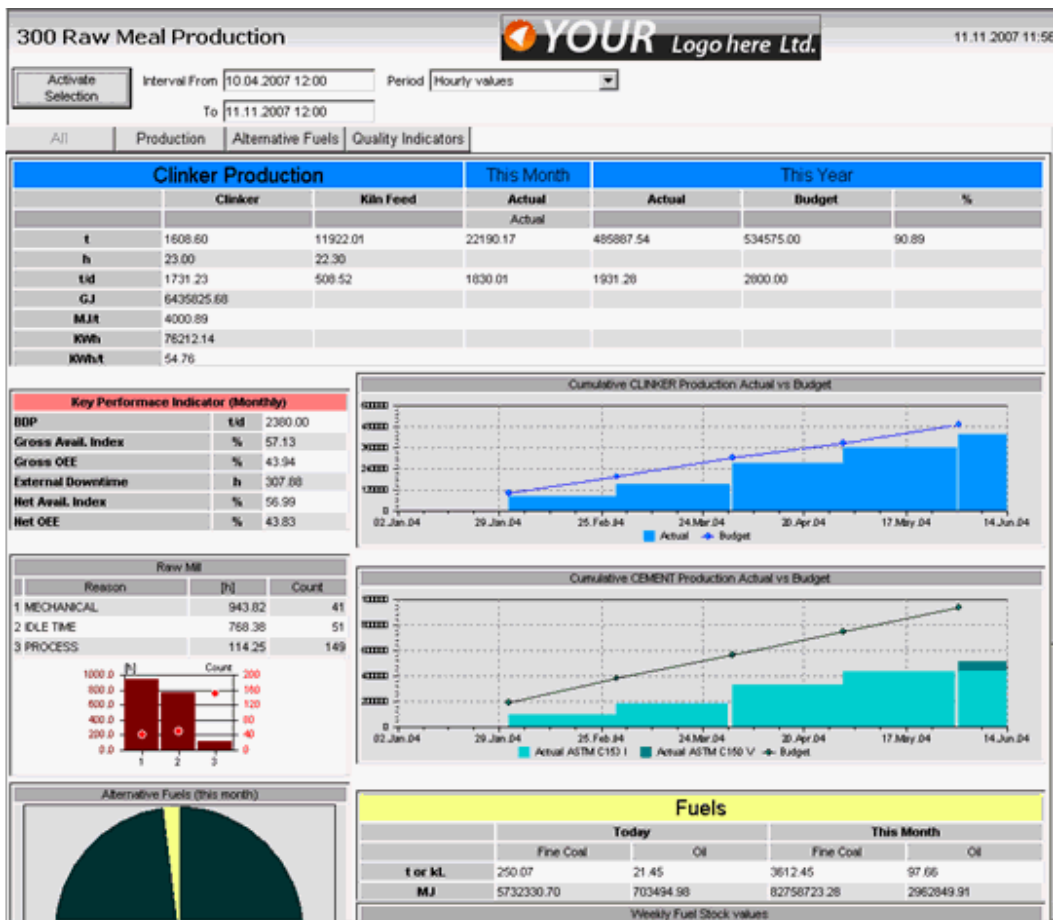


Figure 4: KM Production Report

Production Accounting functions include

- Real time stock management
- Drill down functions to analyze data
- Validation of production data
 - Get “wet” production/consumption counters from instrument measurements
 - Apply correction factors to compensate for measurement errors
 - Use humidity factors to obtain production/consumption “dry” totals
 - Reconcile all these figures for a given reporting period (daily, monthly)
 - Use conversion and correction factors that vary according to the material processed
- Manual correction of false data
- Commenting and track of data changes
- Freezing of Data at end of period

Production accounting is the most important function related to the ERP integration. Only validated data should be send for the final ERP calculations.

Balancing cement bulk		YOUR Logo here Ltd.															02.11.2007 00:09						
Interval From		02.06.2007 00:09					Period		Monthly values														
To		02.07.2007 00:09																					
CEMENTO 42.5R II/A-LL																							
Data	Start	Produzione					Consumi	Spedizioni			Calcolati			Sincroni			Clinker				Errore	Fatt.di	
Ultima	Stock	CM1	CM2	CM3	CM4	CM7	Totale	Insaccat	Vendute	Trasferit	Totale	Fine	Fine	Cambio	CM1	CM2	CM3	CM4	CM7	Assolut	Correz.		
Misura												Stock	Stock	Stock						Stock			
-	38501.5	58.68	10683.0	22254.6	974.84	33971.2		20546.3		20546.3	51926.5	54567.8	16066.2	6.00	8682.00	18050.0				2641.35	1.08		
Production Balancing																							
Correction Factor		1.077752					Apply		<input checked="" type="checkbox"/> Update Current Value														
CEMENTO 32.5R II/B-M (LP)																							
Data	Start	Produzione					Consumi	Spedizioni			Calcolati			Sincroni			Clinker				Errore	Fatt.di	
Ultima	Stock	CM1	CM2	CM3	CM4	CM7	Totale	Insaccat	Vendute	Trasferit	Totale	Fine	Fine	Cambio	CM1	CM2	CM3	CM4	CM7	Assolut	Correz.		
Misura												Stock	Stock	Stock						Stock			
-	83545.8					7191.34	7191.34		24355.3	2226.20	26581.5	64155.7	66634.0	16911.8						3975.35	2478.30	1.34	
Production Balancing																							
Correction Factor		1.344622					Apply		<input checked="" type="checkbox"/> Update Current Value														

Figure 5: Production Accounting Report

Why On-Line Connection of the ERP system

Normal plant operation only updates the data to the ERP system once a month, in rare occasions once a week. This delay in the information flow creates a lack in business decisions. By using the KM system the production personal is already taking actions to resolve some of the bottlenecks that they have been observing, but the business part of the plant is still working on the schedules and assumptions on how the production was planned.

On-line data integration to the ERP enables the business management to also take immediate actions to reflect the changes in the production area and adjust their overall business approach.

Four major areas are the most important once for an on-line connection to an ERP system

- Production Planning
- Material Management / Sales and Distribution
- Plant Maintenance
- Quality Management

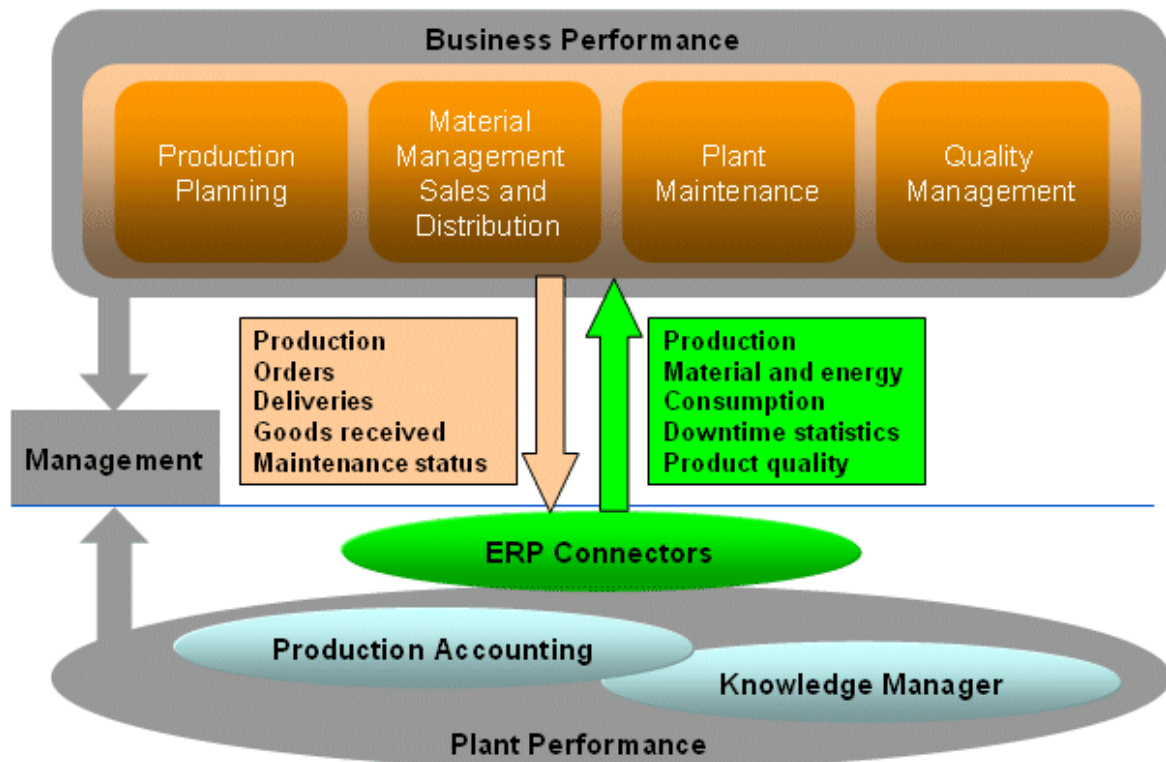


Figure 6: CPM / ERP Connectivity

Figure 6 shows the CPM / ERP Connectivity and the bi-directional information exchange that takes place. The KM system receives information from the ERP system on

- Production schedules
- Orders receives
- Deliveries to perform
- Goods and Materials received
- Maintenance schedules

The ERP system receives information from the KM system on

- Production performed
- Materials and Energy Consumption
- Downtime statistics of the equipment
- Product quality

The information from the KM system can either be transferred automatically based on not validated information or through the Production Accounting module on validated information.

The on-line connectivity of all relevant information ties Plant Performance and Business Performance together and gives the plant Management a total overview at any point in time.

The different ERP / SAP Connectors

In the following we will show which information is distributed to each of the ERP / SAP modules. In general the data communication has 3 routes

- Route 1 Information from the ERP / SAP system to the KM system (Brown indication)
- Route 2 On-Line / real time un-validated information from the KM system to the ERP / SAP system
- Route 3 Validated information from the Production Accounting module to the ERP / SAP system

The communication gateway to the SAP system used by ABB is the SAP Web Service Gateway

Production Planning for Process Industries PP/PI

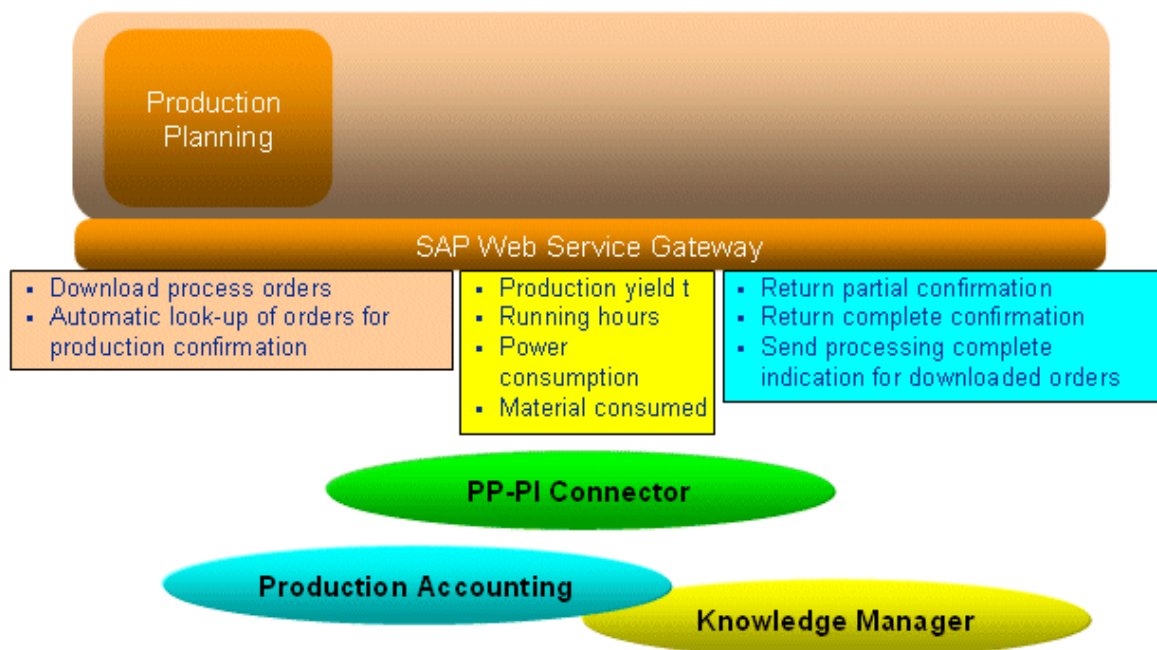


Figure 7: SAP PP-PI Information exchange

The KM system receives the list of orders to process (left data flow marked in brown) from the SAP system. The SAP system constantly monitors the downloaded list to see if production is confirming the production list.

KM sends in real time information about the current production (mid data flow marked in yellow). The SAP system can validate in real time whether the production is in line with the assumed production rate, power and material consumption.

From the Production Accounting Module the production sends at pre-defined production milestones partial accounted confirmation data (right data flow marked in blue). The SAP system can then validate the production cost while the production batch is produced. At the end of the production batch production will send the accounted completion confirmation. This will trigger the SAP system to send the new production list and the cycle starts again.

The benefits are:

- Production costs are visible at any time
- Material and energy consumption are tightly monitored and stocks can be reduced
- Process orders can be reviewed at intermediate steps and product pricing can be verified on-line
- SAP receives final production order information which is validated resulting in less time for final cost calculation.

Material Management and Sales and Distribution MM/SD

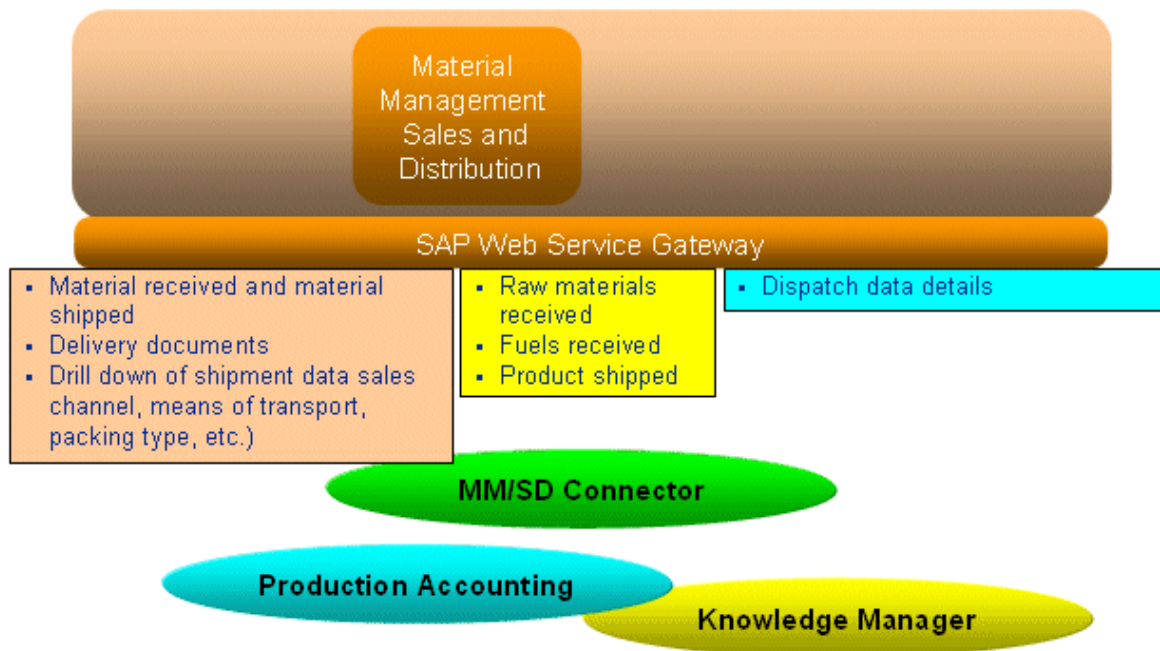


Figure 8: SAP MM/SD Information exchange

The KM system receives the information which materials have been received and which materials have been shipped (left data flow marked in brown) from the SAP system. The production also has the ability to review delivery documents and drill down on details of shipments that have been processed. KM confirms in real time information about the real amount of materials and fuels received and which products have been physically shipped (mid data flow marked in yellow). The SAP system can validate in real time material and fuel losses and has the confirmation of shipped product. From the Production Accounting Module the production sends the validated dispatch details (right data flow marked in blue). The SAP system can then validate the final shipped product and can cost balance the received materials versus the shipped product.

The benefits are:

- Close track of received materials and fuels
- Dispatch information is available to production at any time
- Dispatch information gets validated by production, meaning less time needed for final cost calculation in SAP
- On-line cost balancing of received materials and shipped product, meaning shorter reaction to market pricing for materials and products

Plant Maintenance PM

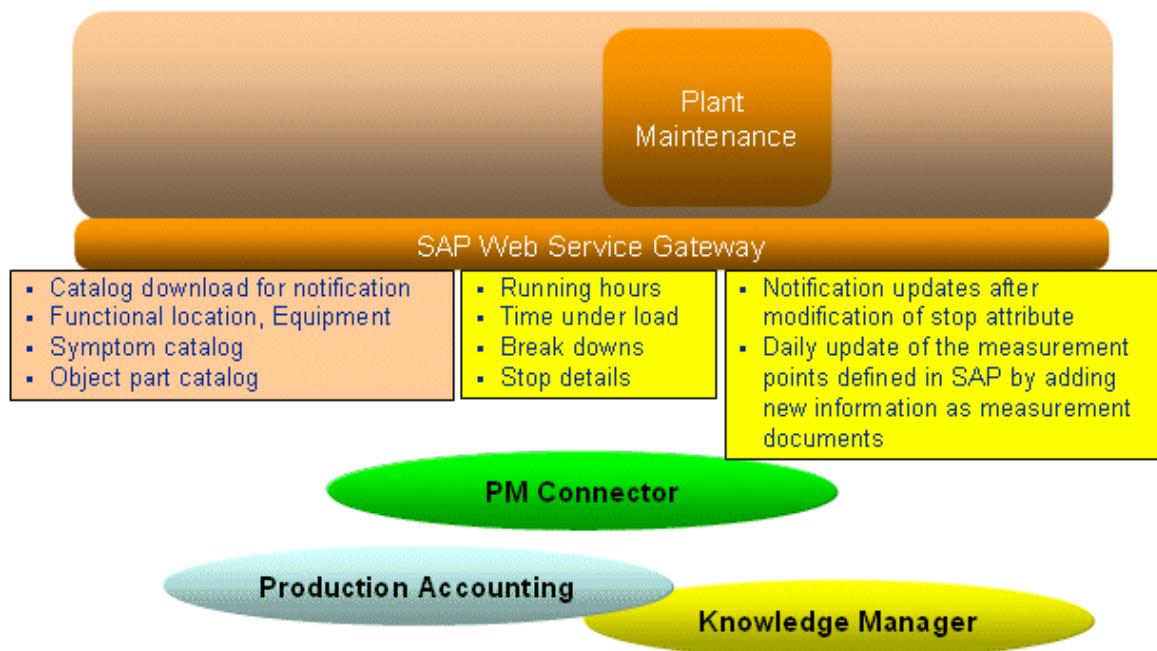


Figure 9: SAP PM Information exchange

The KM system receives the notification, symptom and object part catalog as well as the functional location for each equipment (left data flow marked in brown) from the SAP system.

KM sends in real time information about the running hours, time under load, break downs and stop details. (mid data flow marked in yellow). The SAP system uses the information to schedule planned maintenance; schedules spare parts stock and re-schedules production batches based on equipment availability.

Typically once a day the SAP PM Connector automatically creates a measurement document for each measurement point for each equipment.

The benefits are:

- Real time information of equipment status in SAP
- Better scheduling of planned maintenance
- More efficient spare parts stocking
- Better utilization of assets
- Possibility for predictive maintenance

Quality Management QM

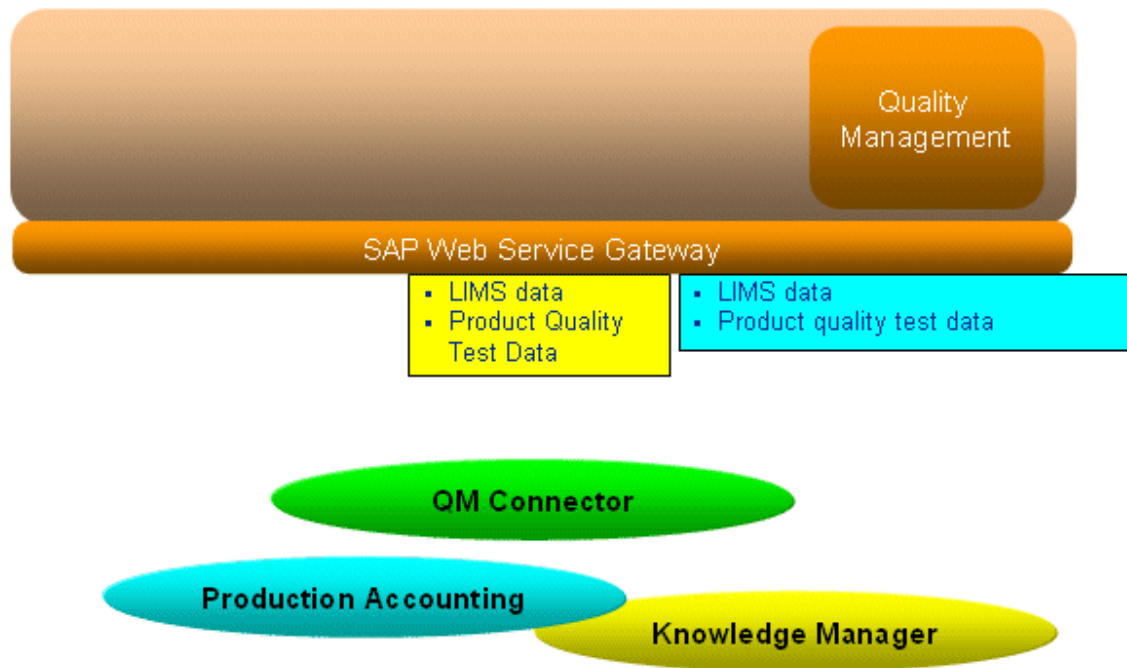


Figure 10: SAP QM Information exchange

Via the SAP QM adapter KM sends in real time the available quality data to the SAP system. For each final production batch the quality data and the production data get correlated by the Production Accounting module and a final quality report is send to SAP. Based on the information received from the production Accounting, SAP can create quality documents for each shipment automatically.

The benefits are:

- Real time quality information in SAP
- Correlated product / quality information available for each batch
- Automated quality documentation for each shipment
- Easy access to quality data in case of customer complains
- Minimized risk of shipping bad quality

Conclusion

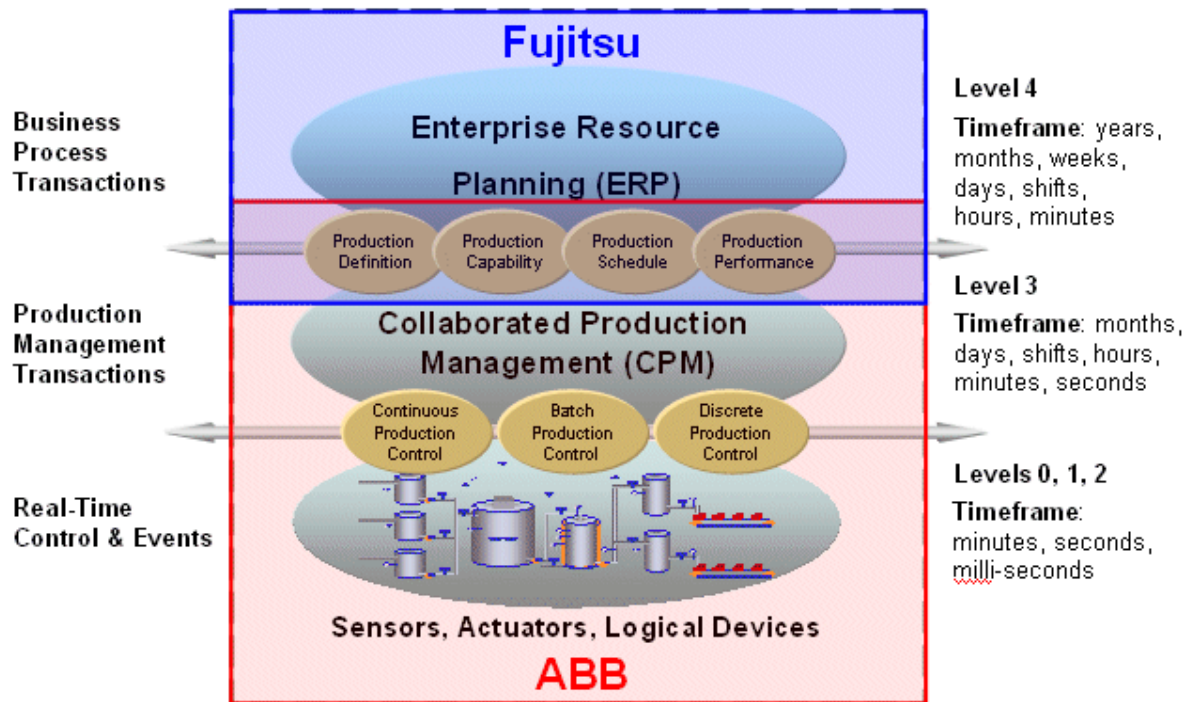


Figure 11: CPM/SAP Integration at its best

In this paper we have shown the benefits of a real time ERP / SAP integration. Data integrity from Level 0 to level 4, fast data transfer and accounted production data improve the SAP performance significantly. The management team has all the data, from production and business view, available at all the time and decisions can be made much faster.

Following key points should be mentioned

- Production costs are visible at any time
- Material and energy consumption are tightly monitored and stocks can be reduced
- Close track of received materials and fuels
- Real time information of equipment status in SAP
- Better scheduling of planned maintenance
- More efficient spare parts stocking
- Better utilization of assets
- Possibility for predictive maintenance
- Real time quality information in SAP
- Correlated product / quality information available for each batch
- Automated quality documentation for each shipment
- Minimized risk of shipping bad quality