PLANTCockpit
Production Logistics and Sustainability Cockpit

SEVENTH FRAMEWORK PROGRAMME

PLANTCockpit Use Case Brochures

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ACCIONA Use Case Description

acciona Infrastructure

Company Background

ACCIONA Infrastructure was formed in 1997 with the merger of Entrecanales, Távora y Cubiertas, and MZOV to become a solid national and international benchmark. In its sector of construction and engineering it is a consistent contributor of new and innovative techniques in the planning and execution of works.

ACCIONA Infrastructure covers all aspects of construction, from engineering to project execution and maintenance. This includes the management of public works awards, especially in the area of transport (roads, motorways) and building construction, among which the most significant projects have been concessions awarded for hospital services and education centres.

The company works along two main lines of business: civil works and construction. Additionally, its organisational structure has special support units for construction, among which the most important units are the Metal Structures workshops, the Machinery service, the Infrastructure Maintenance area, the Facilities area and the Engineering area, as well as various specialised auxiliary companies.

ACCIONA´s innovation efforts are grouped around three Technology Centres which are the pillars of the competitiveness of its business model:

- **Madrid**, where research focused primarily on Construction and Sustainable Transport.
- **Pamplona**, specializing in renewable energy.
- **Barcelona**, where research is centred on water technologies.

Researchers at these centres are looking into the most innovative technologies, form nanotechnologies and the re-use of construction materials, to Information and Communication Technologies (ICTs), and those related to the production of alternative energies: wind power, PV solar and CSP, hydrogen and sustainable water treatment and desalination.

R&D and Innovation activity at the **Madrid Technology Center** is focused on three main areas: Infrastructure, Environment and Transport.

PLANTCockpit use case

Problem Area

Increasing production productivity is an important objective that all production managers have to face. However, productivity involves a lot of variables from different sources and it is quite difficult to take the right decision without having a global vision of the process. One of the aims of the R&D Centre of Acciona Infrastructures is to increase productivity in a continuous process such as the pultrusion. Pultrusion is a highly complex system with many parameters to check and its control is highly complex. Pultrusion is a continuous automated process for manufacturing composites with constant cross-sections (Figure 1 - Pultrusion process). The implementation of PLANTCockpit in processes like pultrusion will enable Acciona to have a global vision and easy access to different data from different sources in order to optimize its

production.

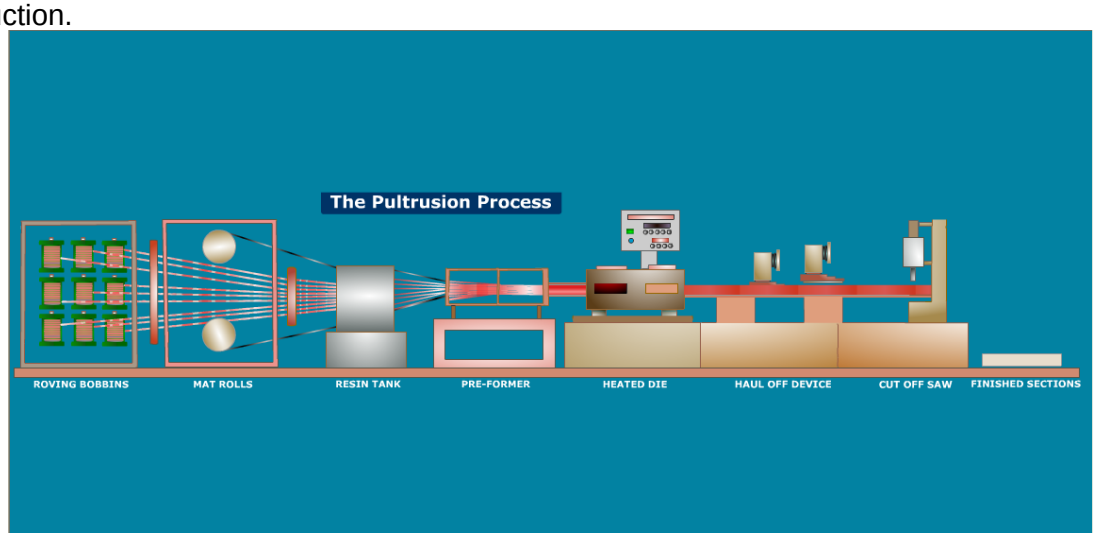

Figure 1 - Pultrusion process

Problem Description

One of the most important and difficult issues during the process is the production scheduling. During the planning, the production manager has to consider different factors such as: raw material inventory, equipment and personal availability, production stock, delivery time, etc. Therefore, it's quite difficult to schedule an efficient production without an asset analyzer tool, which can connect different systems of Acciona such as:

- Product request system: Database containing the requested products
- Production history: Database containing historical production and product left in stock
- Raw material inventory: Database containing the information of the material inventory (Material type, quantity, expiration date)
- Machine schedule: Database with the monthly availability of the machine.
- Personnel schedule: Database containing the schedules of personnel (Availability and skill level)
- Shop-floor Supervisory Control and Data Acquisition System: System consisting in WS capable devices providing gateway to sensor data and energy consumption of the system. Subscription to event provided as defined by the WS-event specification

Planned Solution and Innovation

PLANTCockpit intends to provide a tool, which can facilitate the scheduling process and making decision by integrating all the systems above in one cockpit.

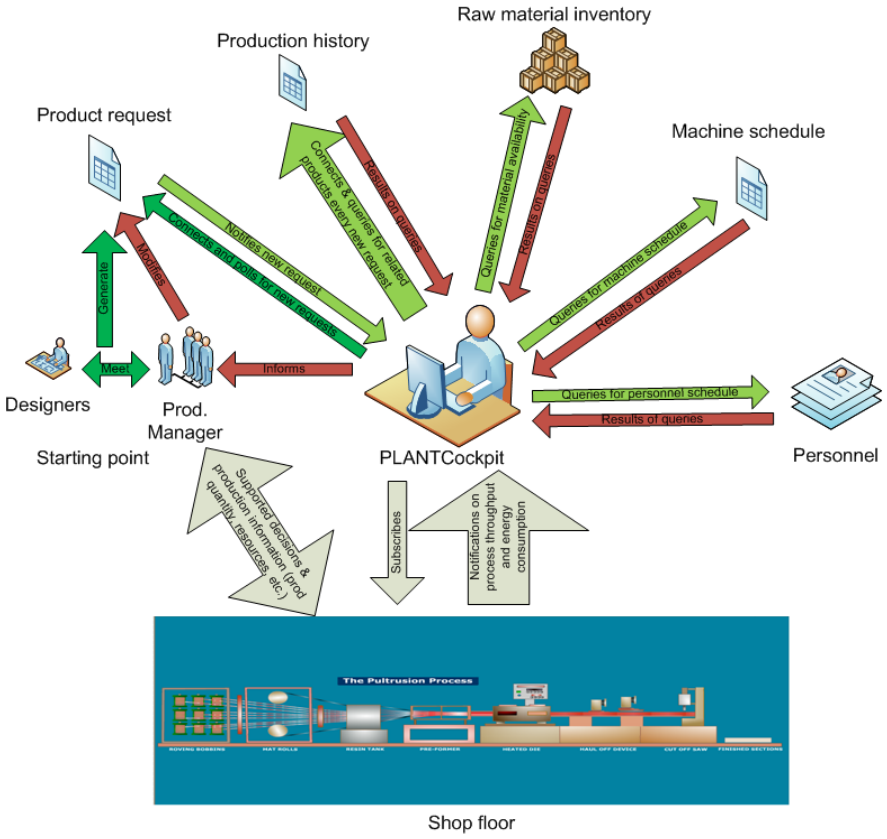

Figure 2 - PLANTCockpit connection systems

In ACCIONA use case the user will see the lasted production request and also will have access to different sections sucha as: stock, materials, schedule and personal. In each section the production manager will be able to verify the availability of all the involved parts during the production process, and will be able to define a production schedule in order to set the delivery date. The system should verify every part involved and give an alarm to advice an unavailability of any of the components.

Business Benefits

PLANTCockpit will provide a useful tool to manage and control the main parameters involved in our pultrusion production process. With its implementation, Acciona expects to have the following impacts:

- Reduction of process stop time by 15%
- Reduction of waste by 20%
- Increase of productivity by 30%
- Reduction in power and materials consumption of 10%
- Cost reduction by 15%

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BMW Use Case Description

Company Background

BMW Group Production network

Agility, profitability and economy are the foremost principles which apply to the worldwide production network of the BMW Group. The BMW Group manufactures its products at 25 sites in 14 countries on five continents: BMW automobiles are produced at 14 locations.

Apart from BMW, MINI, and Rolls-Royce cars, the BMW Group production network also builds motorcycles of the BMW and Husqvarna brands.

The backbone of BMW's production network is formed by six plants in Dingolfing, Leipzig, Munich, Regensburg, Rosslyn, and Spartanburg, as well as a joint venture in Shenyang. Wherever appropriate, the BMW Group integrates external partners into serial production.

The BMW Group operates the CKD plants in Chennai and Rayong, while in Jakarta, Cairo, Kaliningrad and Kuala Lumpur BMW cooperates closely with external partners.

Flexible structures

So-called "breathing" structures allow the BMW Group to respond flexibly to market needs. This includes flexible working hours and time accounts as well as the ability to build certain models in other plants in addition if required. Whenever the BMW Group plans a new plant or launches new models, the production network especially shows its strengths. The intelligent networking of expertise beyond the boundaries of each plant and the high level of commitment, personal responsibility and identification of staff contribute to high product quality at the very outset. Project-related co-operations complement the company's own capacities, creating space for new projects.

BMW Group Production

A car consists of up to 20,000 individual components. Innovative production technologies and experienced staff guarantee that they emerge as premium products "Made by BMW Group".

Up to 20,000 components make their way from the press shop through the bodyshop, paint shop and assembly to emerge as a perfect whole in the shape of a unique BMW or MINI. Every car that rolls off the assembly line is tailored to the customer's wishes in terms of model variant, colour, interior trim and engine. Since 2003, the Rolls-Royce Phantom has been hand-built by the Rolls-Royce Motor Cars Limited subsidiary at their factory in Goodwood, southern England. The company draws on the competence centres "Engine Construction Munich" and the "Aluminium Competence Centre Dingolfing", as well as the BMW Group's research and development facilities.

PLANTCockpit use case

Problem Area

The BMW Group faces a complex set of challenges characterized by diversity both inside and

outside the organization. A core challenge of BMW Group is to manage its complex production network in the context of the “order-to-delivery” process.

Now more than ever the BMW Group is dependent on reliable key performance indicators and current target values to cope with the challenges of an increasingly dynamic market environment and staying capable of making the right decisions and intervening to make fast corrective actions.

For steering such a complex network there has to be an abstraction layer, established as set of KPIs. These KPIs are an aggregation of all related data such as check point times from orders, quality measures etc. and is reported for a single process or organization for what they are calculated for.

Within the development of a holistic end-to-end view of processes there is an increasing relevance of process performance indicators and also a rising complexity of managing and understanding the interdependencies between related operating functions and the causes of missed targets.

Problem Description

The BMW Group tries to get a higher value out of its reporting by putting more information into the monitored KPIs. The goal is to connect KPIs reporting single processes or organizations by their relations to each other to have a better root cause analysis and even to enable forecasts. After an ongoing process analysis PLANTCockpit should provide the knowledge base for tracking all “order-to-delivery” processes with their interdependencies by the KPIs they are represented with. This will lead to a faster reaction and an improvement on steering the “order-to-delivery” process.

The main objective of the BMW Group use case is the visualization of Key Performance Indicators (KPIs) in order to control various complex production and logistic processes. The provided visualization should be adaptable to the target groups (management level, engineers, factory floor, etc), with the ability to adapt dependant KPIs to each group of the process or sub process ensuring that a historical view of the KPI is also included.

Planned Solution and Innovation

The BMW Group use case consists of two parts: design/configuration time of business relevant KPIs and visualization on run time. Also there has to be displaying/alerting of KPI status at different levels and reporting on mobile devices.

The functionality of the application should include the following capabilities:

- PLANTCockpit should provide different possibilities for drill down depending on the sub processes e.g. vehicle stock in total, vehicle stock of markets, vehicle stock in transit, compounds etc.
- Visualization of target/actual comparison of relevant KPI. e. g. vehicle stock exceeds target limit leads to red traffic light.
- Visualization of KPI interdependencies tree.

- Possibility to deliver more detailed information by supporting a quick root cause analysis e. g. shows the cause for a red traffic light, like target limit on compound A exceeded.
- Configuration tools to maintain KPI Meta Model.
- Visualization and access with mobile devices, in order to provide adaptive content on different platforms.

Business Benefits

PLANTCockpit will allow the user to have a customised view of the processes in his area of interest and immediate access to all aggregated information, in order to make optimal and transparent decisions.

Value nets will replace the traditional value chains. Cross-dependencies between different sectors of industry - like for automotive to high tech suppliers – will have a rapid and pervasive impact to area of supply, quality issues will have immediate global effects and customers want to get their vehicle on time even if there are problems in areas of supply or quality.

With PLANTCockpit, the BMW Group expects to have the following impacts:

- Proper bodies always available in assembly
- Reduction of production time
- Stable processes by ensuring on-time-delivery

Overall, the BMW Group expects to achieve a global optimum of its processes.

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COMAU Use Cases Description

COMAU

eCOMAU sustainable automation

Company Background

COMAU business

Comau is a global supplier of industrial automation systems and services mainly for the automotive manufacturing sector. Over the years, by acquiring and integrating other companies, Comau broadened its presence all over the world, becoming the ideal partner for the automotive industry in developing solutions for all industrial production programs.

Comau is organized into 3 Business Units: Body Welding & Assembly, Powertrain Machining & Assembly and Robotics & Service.

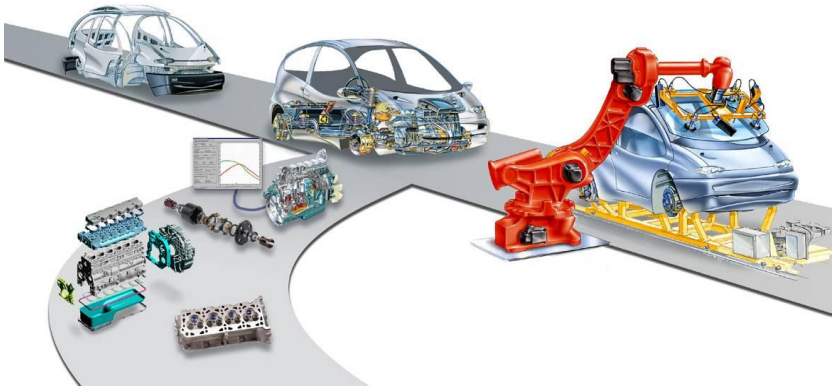

Figure 3 - Comau's 3 Business Units: Body Welding & Assembly, Powertrain Machining & Assembly and Robotics & Service

The offering of full services, from product engineering to maintenance activities, and the integrated global organization allow Comau to compete in the continuously evolving automotive global market, in the areas of: Sheet Metal Dies; Powertrain Machining & Assembly; Body Welding & Assembly Systems; Robotics; Aerospace Production Systems; Maintenance & Engineering Services.

COMAU Powertrain machining and assembly

Powertrain Machining & Assembly concentrates its business on the design, manufacturing and delivery of machining lines and assembly systems. PWT machines and systems are specialized for the production of Cylinder Heads, Blocks and Transmissions, though they have also found effective application in other fields, as the aerospace or the power generation industry.

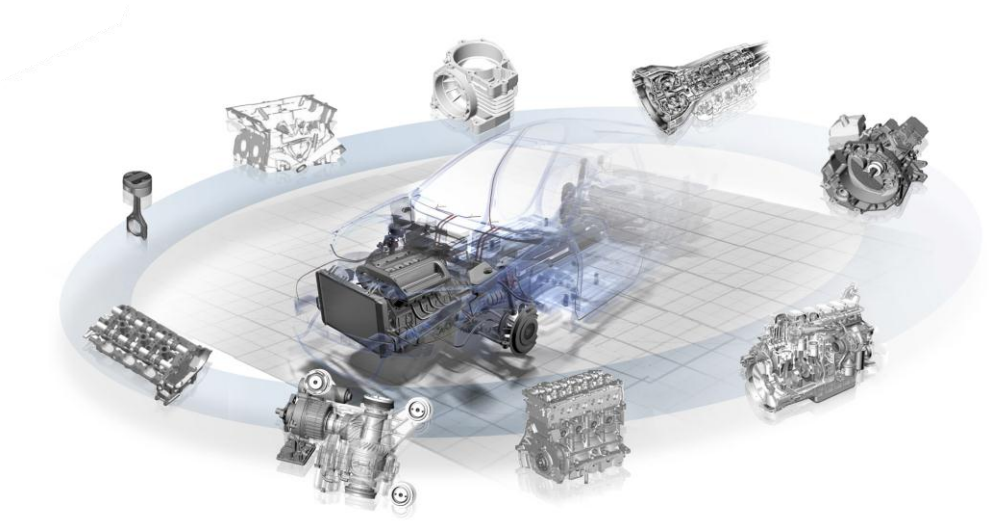

Figure 4 - Customer product range machined, assembled and tested on Comau's Powertrain systems

Product portfolio

Comau Powertrain Machining & Assembly follow Customers along the whole manufacturing chain with three product lines:

- Machining systems: for machining of Engines and Transmission cases covering production need from stand alone installations to Agile systems up to transfer lines for very high volumes.
- Assembly systems: module based assembly centers for Engines, Transmissions or components that ensure flexibility in product process or production volume
- Testing systems: hot, cold and in-process test solutions ensuring Quality of the assembly process and of the Engines or transmissions delivered.

PLANTCockpit use case - Optimization of Asset Utilization

The Comau use case in the context of "Optimization of Asset Utilization" will be implemented in the Business Unit Powertrain Machining and Assembly, in particular in the Comau France plant located in Castres.

COMAU PWT Castres facility

Castres facility is dedicated to the production and to the customization of machining modules, and in particular to the production of the Comau SmartDrive machine tool family.

Figure 5 - COMAU PWT Castres facility

The plant is organized in order to dedicate each area to the following activities: Stock areas, Machining of mechanical components, Assembly of subsystems, Final product assembly, Quality assessment and Prototype areas.

Problem Area

Comau has concentrated its analysis on the optimization of plant asset management, due to the fact that the actual organization doesn't provide updated asset utilization information.

The plant production process is organized in the following production zones that correspond also to four specific areas in the plant:

- Machining area (MA) – Machining of main mechanical parts
- Zone 1 (Z1) - Mechanical assembly of 3 axis Module
- Zone 2 (Z2) - Electrical and hydraulic devices assembly
- Zone 3 (Z3) - Customer Commissioning and Tests (fixtures and tools)

According to the categorization mentioned above, the production process can be presented also with a blocks visualization (Figure 6 - Production process), that shows the main flow from machining operations (only on main components) up to sub-systems assembly and through the three zones to the delivery to the customer.

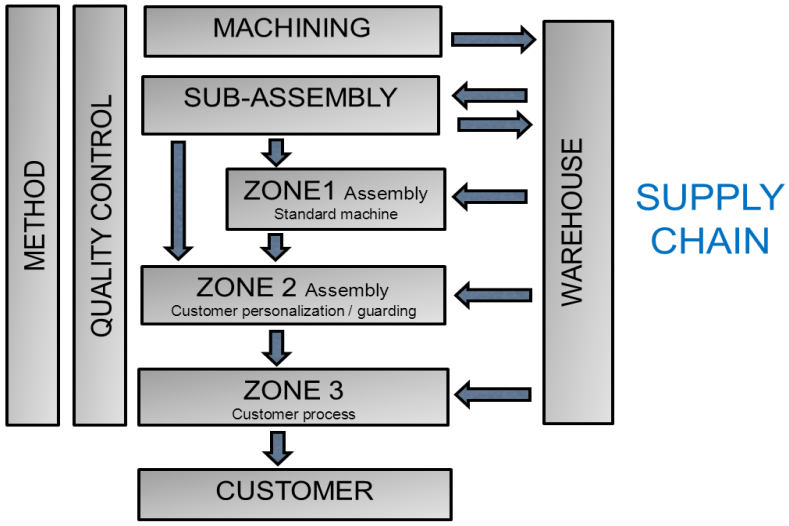

Figure 6 - Production process

Problem Description

Inside of this process a large number of tools are used by the functions involved in the different production phases (proposal, engineering, supply chain, manufacturing, production method, logistics). In Figure 7 - Tools involved in different production phases**Error! Reference source not found.** the type of tools and the relations between them are summarized.

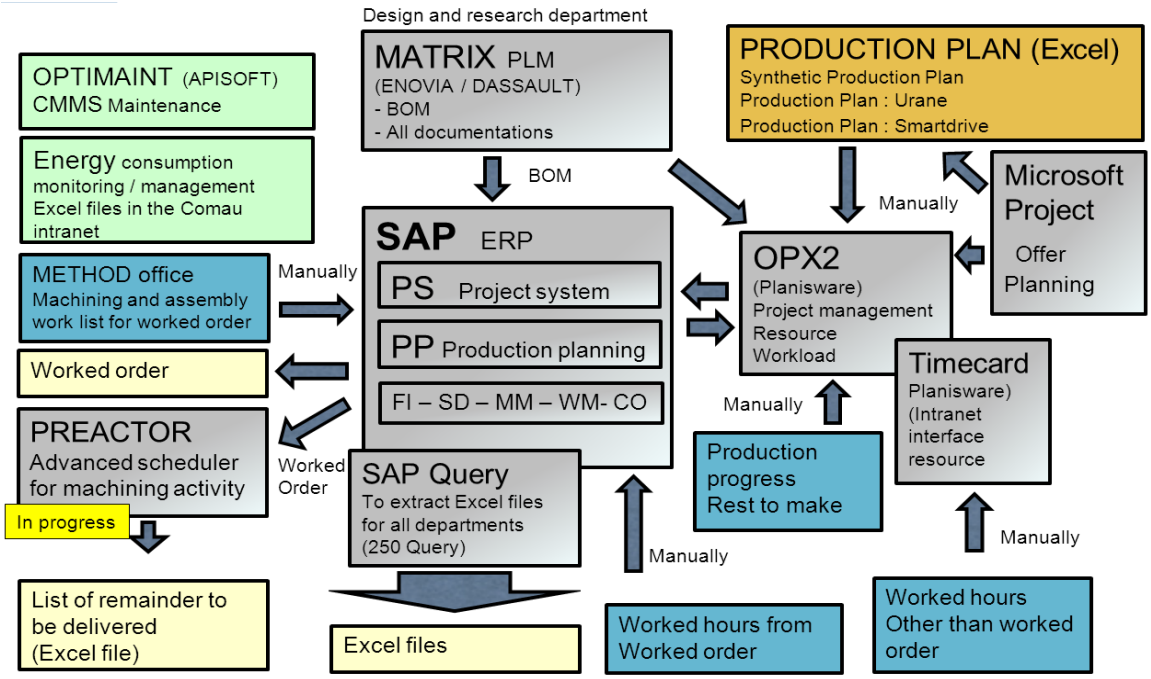

Figure 7 - Tools involved in different production phases

The main considered functional areas are respectively the proposal and offer planning, synthetic production plan, customer's project plan, detailed production plan design and engineering technical documentation, and enterprise resource planning.

Even from this short description it is clear that due to the large number of tools used, the connections and the quality of data exchange between them are critical points in improving the efficiency of the production process.

Although there are tools that are already interconnected, particularly the tools used in the project development phases, the other functional phases are characterized by independent applications that don't have automatic connections. All the data exchanges and alignments are done manually.

The lack of automatisms and integration between areas like the offer planning and the production planning generates the need for manual operations (i.e. documents comparisons and alignments) with high risk of mistakes, especially in case of many simulations and scenarios managed in parallel.

Planned Solution and Innovation

Considering the described production process, Comau use case will focus on the management of all assets taken into consideration in an extended enterprise environment, plus the production planning and scheduling.

Using the assets information coming from the field and the available existing data, it will be possible to create a new environment for the monitoring of asset utilization with a global view of the production process thought-out the complete plant.

The Comau use case on asset optimization will concern the complete production process, in particular focusing on following points:

- collection of relevant event indicators and KPIs from shop floor about machines and resources availability, work orders progress, up-down time;
- collection of KPIs and indicators from supply chain about suppliers orders confirmation, activities progress, delivery dates;
- graphic visualization of detailed production schedule by project including modules details, production KPIs and indicators status with related warnings, traffic lights, trends;
- graphic visualization of synthetic production plan including projects schedule, customer milestones, production capacity check with related diagrams, warnings, alerts

Business Benefits - Optimization of Asset Utilization Use Case

PLANTCockpit will help to overcome this problem by addressing these major topics and providing in particular solutions for the management of all assets taken into consideration in an extended enterprise environment. Both internal assets as the external supply chain will be considered. Finally all assets data and information will be used to improve the plant planning

and scheduling activities to respond to market demand.

The expected impacts of PLANTCockpit project are:

- lead time reduction of up to 15%
- cost reductions up to 20% (through optimized processes and better energy/resources management)
- reduction waste production of up to 20%
- overall efficiency of processes + 15%

PLANTCockpit use case - Energy Monitoring, Analysis, and Management

Problem Area

The Comau use case in the context of “Energy Monitoring, Analysis, and Management” will be implemented in the Business Unit Powertrain Machining and Assembly, in particular in the Comau France plant located in Castres.

In order to guarantee manufacturing efficiency, an organization needs to monitor accurately and manage all aspects of its operations. Moreover, benchmarking analysis must be applied to evaluate efficiency in performance by comparing actual versus planned productivity.

A key element in order to assure production efficiencies is energy management, since energy is becoming more and more expensive, and also new governmental regulations increasingly push towards a resources consumption reduction.

The plant production process is organized in several production zones that correspond also to specific areas in the plant. In particular, the production process takes into consideration the machining of main mechanical parts, the mechanical assembly of 3 axis module, the electrical and hydraulic devices assembly, and finally the commissioning and testing.

Considering the Castres plant, several sources of energies are used in the production process. The main energy vectors are respectively electrical energy, thermal energy, water and air, as shown in Figure 8 - Production process energy consumptions.

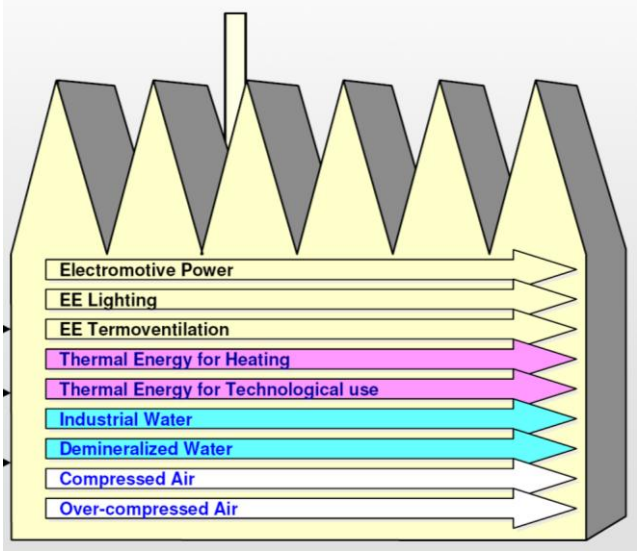

Figure 8 - Production process energy consumptions

Problem Description

Comau has concentrated its analysis on the energy monitoring, analysis, and management, due to the fact that no specific data and information are currently collected about these items in the considered production plant.

Energy monitoring, analysis, and management are becoming important for any company's decision makers in order to have important information on how to identify trending in energy use for its operations. Application of such systems helps the company management to implement process execution strategies while taking into consideration energy constraints. Graphical representation and an efficient reporting system, based on energy KPI's, further help to operate production plants according to sustainability requests.

Currently, the plant manager suffers from the lack or shortage of exhaustive real-time data and information related to the several sources of energies. Moreover, data are typically collected manually, at low frequency at the overall plant level, without any historical data storage.

Planned Solution and Innovation

Considering the described production environment, Comau use case will focus on the energy monitoring, analysis, and management of all energy sources. This will allow the company management to improve decision strategies related to the optimal energy use in the production process.

The planned solution will take into consideration the installation of new energy meters and the collection and visualization of specific data and information for the different production areas. This will allow the usage analysis and consequently the elaboration of energy consumptions reduction strategies. The use case will be focused on visualization of acquired data, energy costs and consumption trends, elaboration and analysis of energy KPIs and comparison between current status and potential alternative solutions.

The Comau energy management implementation will be based on the system architecture shown in the picture below.

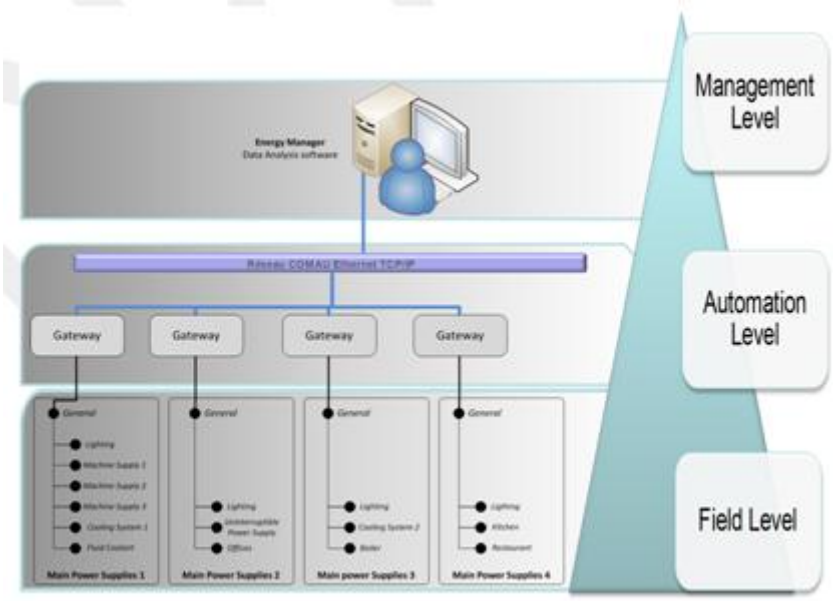

Figure 9 - Comau energy monitoring and analysis system

Business Benefits - Energy Monitoring, Analysis, and Management Use Case

PLANTCockpit will help to develop an advanced energy monitoring, analysis, and management system to help Comau plant management to overcome present limitation in the area of sustainable production.

The expected impacts of the PLANTCockpit energy management system are:

- Confirmation of the certification European Standard EN 16001 – Energy Management
- Cost reductions up to 20% (through optimized processes and better energy management)
- Increased overall sustainability of manufacturing processes

PLANTCockpit Production Logistics and Sustainability Cockpit

SEVENTH FRAMEWORK PROGRAMME

DoehlerGroup Use Case Description

DÖHLER NATURAL FOOD & BEVERAGE INGREDIENTS

Company Background

The DoehlerGroup is a global producer, marketer and provider of technology-based natural ingredients, ingredient systems and integrated solutions for the food and beverage industry. Doehler's integrated approach and the broad product portfolio are the basis for innovative and safe food & beverage applications which are developed for the customers.

The motto "WE BRING IDEAS TO LIFE" briefly describes Doehler's holistic and strategic approach to innovation. This comprises market intelligence, trend monitoring, the development of innovative products and product applications, advice on food safety and microbiology, food law as well as sensory & consumer science.

Headquartered in Darmstadt, Germany, Doehler has 19 production and 21 application centres, 50 sales offices and sales activities in over 130 countries. More than 2700 dedicated employees provide the customers with fully integrated food & beverage solutions from concept to realisation.

Figure 10 - Production Sites

Within the DoehlerGroup 500,000 MT are produced per year with more than 4,000 different raw materials. Beside the production more than 40,000 drums of raw materials are handled in one of the biggest cold store warehouses in Europe. The production site in the Netherlands is Doehler's centre of excellence for the entire range of citrus and exotic fruits of which more than 150,000 MT per year are produced.

PLANTCockpit use case

Problem Area

As a producer of natural products for the food and beverage industry, the DoehlerGroup has the task of producing finished products with a consistent quality to customers in time according to requested delivery dates. To accomplish these tasks in highly complex logistical systems in the process industry DoehlerGroup uses a group-wide ERP system and several subsystems to ensure a smooth supply chain.

In order to be informed of deviations in the logistical operations more quickly and to have the availability to respond to these differences, these processes must be monitored by highly automated decision-makers which have the opportunity to respond to these errors.

A central element in the control of process orders for production and filling is the procurement and timely supply of raw materials for the production site(s) in the DoehlerGroup. This primarily includes group-wide planning of raw materials on the basis of planned and contracted final products and the presentation of the available raw materials and deliverables in the entire DoehlerGroup (Use Case IV: ATP (available to promise) raw materials). Thereafter, the monitoring of raw material supplies from external partners and production takes place in foreign plants within the DoehlerGroup (Use Case I: inbound raw materials (horizontal)). In parallel to the inbound movement of goods, the actual production processes for production and filling are monitored at the production level. This is done particularly in conjunction with quality control (Use Case III: Production process (vertical)). After filling of the final products, the focus is on the exact time of delivery of the final products to the customer (Use Case II: Outbound final products). All these processes are to be summarized and presented in KPIs after the production process and delivery to the customer (Use Case V: KPIs).

The Use Case of Doehler will focus on monitoring the timely delivery of raw materials and semi-finals for production (Use Case I: inbound raw materials (horizontal).

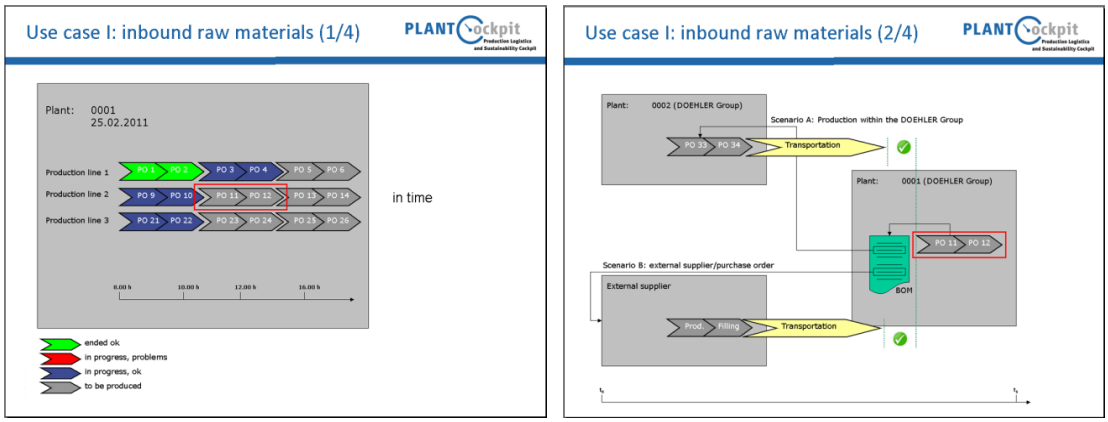

Figure 11 - "in time": Status of planned or process dependent orders

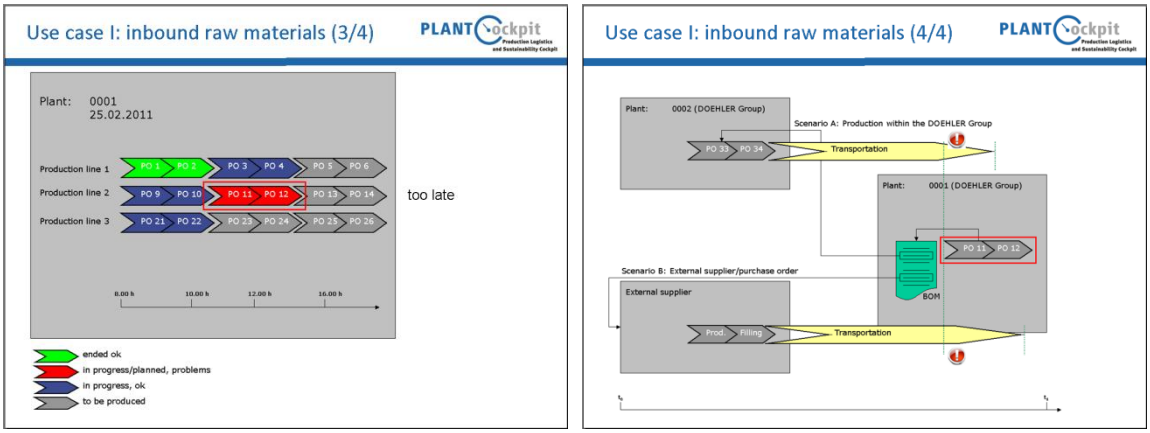

Figure 12 - "too late": Status of planned or process dependent orders

As a demonstrator for tracking process orders and materials in the process industry (WP 8) Doehler will focus on the above mentioned Use Case I: "Inbound raw materials", also including the intra-logistical processes.

Problem Description

In a production plant of the DoehlerGroup there are about 50-100 production and filling orders scheduled per day. These productions are based on raw materials and semifinal products, some of which are available on stock whereas others have to be produced in other plants of the DoehlerGroup or to be bought from external suppliers. All filling orders are based on customer orders, which must be supplied correctly in time and quantity.

With the currently existing ERP systems, the reality in the supply chain, logistics and production is not sufficiently closely mapped. All the planning of production/filling orders and purchase orders of raw materials is made only with the assumption that the master data of the ERP system (like production time, delivery times, transportation times, etc.) stand up to the reality. In truth, however, in most processes, the information of time delays and deviations rises up much too late (usually at the start of production or filling processes).

Information of delays in the procurement and transport of these raw materials and semifinal products today is not automatically redirected to the production planner. As a result, valuable time is lost in order to find alternative raw materials and/or reschedule production and filling process orders.

Planned Solution and Innovation

Based on event and alarm triggered processes and visualization of the condition representing the planned production and filling orders situation within the plant, the new PLANTCockpit solution will automatically collect the delays and deviations in the supply chain.

The system will allow production planners to have a very fast visualization of the deviations and variations on a monitor display and thus enable them to analyze the causes of these errors more easily by ensuring a rapid root cause analysis. With this information, decisions will be made faster and they will be visualized in the scheduled production and filling orders in a plant or at a production line.

Business Benefits

With the new monitoring tools of PLANTCockpit, Doehler expects to have an improvement through visualization of gaps in the supply chain and deviations in the actual production process.

As the main parts of the supply chain (Planning, Logistics, Production) will be made visible in the new PLANTCockpit, we aim to achieve:

- an improvement of the delivery reliability, the delivery service and customers satisfaction,
- an improvement in planning and processing times within logistics, production and quality control.

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SEVENTH FRAMEWORK PROGRAMME

Intel Use Case Description

intel

Company Background

Intel, the world leader in silicon innovation, develops technologies, products, and initiatives to continually advance how people work and live. Founded in 1968 to build semiconductor memory products, Intel introduced the world's first microprocessor in 1971. Our goal is to be the preeminent provider of semiconductor chips and platforms for the worldwide digital economy.

Intel develops advanced integrated digital technology products, primarily integrated circuits, for industries such as computing and communications. Integrated circuits are semiconductor chips etched with interconnected electronic switches. Intel also develop platforms, which we define as integrated suites of digital computing technologies that are designed and configured to work together to provide an optimized user computing solution compared to components that are used separately.

The Intel Ireland Campus at Collinstown Industrial Park, Leixlip, County Kildare, is one of Intel's largest manufacturing sites, and the largest outside the United States.

PLANTCockpit use case

Problem Area

The Intel use case for WP10 Energy Monitoring, Analysis and Management is an approach that will demonstrate the complexity of energy related information systems and how PLANTCockpit will deliver breakthrough solutions beyond current state of art. The concept is to tie together standalone energy management systems that are usually operated independently. There are three main themes that capture the overall operational control of energy in a manufacturing plant. These are:

• Management Support to the energy program. This is delivered through financial systems. The financial systems set the budgets, manage the actual spend and deliver the targets to be achieved against the budgets. There are usually only a small number of people that have interaction with the financial systems, yet they usually set the direction for the level of energy efficiency activity.

• Continuous Improvement delivers the method by which these energy budget reductions or energy efficiency targets can be delivered. This usually consists of some method of tracking a list of opportunities with multiple stakeholders. These opportunities deliver step change improvements in the energy efficiency of the manufacturing plant. Again a standalone activity with its own set of stakeholders usually disconnected from financial systems.

• Plant Operational Efficiency is the business control system that ensures continuous improvement is maintained. It begins with a baseline of consumption to set the parameters from which future variance or exception reporting can be delivered. This baseline can be statistically analyzed against the causes or drivers of the consumption.

The location within the Intel site which is targeted by the Intel PLANTCockpit use case is the manufacturing facility. This specific deployment area is a standalone facility within the Leixlip Semiconductor Manufacturing site. The advantage of this location is that it is a mini factory

within the main factory. Its supply chain extends from taking product from the main factory, processing them and then external delivery of the finished product to remotely located assembly sites. The mini factory has a reasonable level of energy measurement at a facility level. This has the added benefit of proving the ability to proliferate across the site and to other PLANTCockpit partner companies. This proof of concept approach can connect and integrate disparate systems and data repositories. These vary from MES (Manufacturing Execution Systems), ERP (Enterprise Resource Planning) systems, SCADA (Supervisory Control & Data Acquisition) systems and Energy Metering Systems.

Figure 13 - Use case within manufacturing site

Problem Description

The principal issue to be resolved is the integration of multiple systems and business processes to deliver a sustainable repeatable improvement in energy efficiency. The users will come from management, finance, engineering and technician groups. Each user will have a different type of system interaction depending on their ownership level of data or assets/equipment.

Table 1 - Mapping of focus areas to Factory functional area

	Operational Efficiency	**Continuous Improvement**	**Management Support through Financial Systems**
Geography	Specific Functional Area	Specific Functional Area	Factory Floor
Current State	Daily energy efficient operations is achieved through expert knowledge with access to multiple systems to understand risks and opportunities	Legacy plant and equipment not designed or oriented for energy efficiency, when tools were installed throughput was priority, energy was a utility	Management Support thru the financial system is critical to embedding the energy efficiency program into the org structure and behaviour. Currently energy

			costs are amalgamated i.e. not directly allocated to specific factory functional area usage.
Current constraints	Lack of granular data, lack of metering, current systems are disjointed Considerations including frequency of reporting (hour, shift, day, week, month, quarter, year)	We do not know what total potential savings are, risks are not fully understood.	Reporting of energy consumption is not integrated into financial systems at a sufficient level of granularity to set financial targets

Planned Solution and Innovation

The following is list of planned solutions and innovation involved in the Intel Energy monitoring use case:

- A central environment for monitoring and control that spans disparate information systems (ERP, MES, Planning and Finance, Parts, etc). This will incorporate dashboards for evaluating daily operations, continuous improvement efforts and financial outlays against goals
- Continuous improvement strategies to challenge modes of operation of equipment and drive implementation leading to step improvement in operation efficiency cost, opportunity/ strategy tracking software.
- An incentive based financial management system to drive energy efficiency

Business Benefits

PLANTCockpit deployment within the chosen use case demonstrator area will benefit Intel in the following ways:

- Provide mechanisms to be the more energy and cost efficient
- Faster response to business needs through real-time visibility extending from the shop-floor to business levels. E.g. Rapid response to changes in product priority
- Reduced cognitive workload through better integration of diverse information systems
- Seamless communication between all stakeholders
- Optimised interaction strategies for data access/manipulation
- Capability to support improvements in specific targeted use cases.