Work Process Management

Make Every Operator an Expert
Agenda

9:00 – 9:30   Welcome and Breakfast Refreshments
9:30 – 10:30  Work Process Definition and Context
              Industrial Strength Work Process Management
10:30 – 10:45 Break
10:45 – 11:45 Production Work Processes Examples
11:45 – 12:00 Who we are and our solutions
12:00 – 1:30  Lunch
The Age of Turbulence

Reset Assumptions
Risk, Asset Values, Commodity Prices, Exchange Rates, Supply Networks

Financial Discipline
Projects That Deliver Positive Cash Flow < 6 months

Visibility
The Only Weapon Against Volatility

Adaptability
Masters of Change Will Win

Opportunity

“I guess I should warn you, if I turn out to be particularly clear, you've probably misunderstood what I've said”

-Alan Greenspan
Former US Federal Reserve Chairman
Agile To Learn and Drive Change
Drive Sustainable Business Value Through Work Process

What might happen?
What is happening?
Why did it happen?

Reporting
Controllership
Operations Excellence

Analysis
Monitoring
Schedule Optimization

Predictive Analytics
Dashboard
History

Material Optimization
Process Optimization

Alerts
Process Optimization

High
Low

Complexity
Business Value

Proficy
Performance and Agility for the Real-Time Enterprise

imagination at work
Work Process Definition and Context
Challenges our businesses face...

Peanut industry: Recall price tag $1 billion
And that could just be the beginning, producers set to testify

Mars Recalls Some Dry Pet Foods
Potential Salmonella Contamination Affects Pedigree, Pet Pride, Other Brands

Pet food recall to cost Menu Foods $45M

Honda adds 440,000 cars to recall over airbags

Glass particles force Sam Adams beer recall

Failure to Follow Procedures, Improper Training Cited as Factors in El Paso Contract Mechanic Fatality

Today the National Transportation Safety Board (NTSB) released the Probable Cause of the Continental Airlines ground accident which claimed the life of a contract

The requirement for an emergency response plan

The operations and maintenance section of the state rule, Chapter 246-290-415 (2)(d) WAC, requires public water systems in Washington to have an emergency response plan as
Process Definition

A Process is...
A method of dealing with in a routine way; "I'll handle that one"; "process a loan"; "process the applicants"; “I will clean the equipment”

Procedure: a particular course of action intended to achieve a result; "the procedure of obtaining a driver's license"; “submitting my expense report”...

A Business Process is...
A business process is a set of coordinated tasks and activities, conducted by both people and equipment, that will lead to accomplishing a specific organizational goal.

Business Process Management is...
Business Process Management (BPM) is a systematic approach to managing and improving business processes.
A Business Process
Expense Reimbursement

Submit Expense Report

Expense Report

1.0 TRAVEL ARRANGEMENTS
1.1 All arrangements required for business travel are to be made through the Travel Coordinator. The coordinator can solicit better corporate discounts and rates for hotel, airlines, car rental agencies and travel agencies. Employees benefit because they do not have to spend their own time comparing rates and making their own arrangements.

1.2 To arrange the travel, complete the travel arrangements form with all pertinent information and receive departmental approval. The form should then be forwarded to the staff responsible for coordinating travel (Travel Coordinator). For maximum savings on airlines, this form should always be completed at least 15 days in advance unless an emergency trip is required.

1.3 It is possible that all employees travel during non-working hours or maximize efficiency. The Travel Coordinator will make arrangements for the trip as required and will return a travel itinerary and any tickets or reservation forms to the employee.
Traditional Business Process Management

Level 4

Business Planning & Logistics
Plant Production Scheduling, Operational Management, etc

Time Frame
Months, weeks, days, shifts

Level 3

Manufacturing Operations Management
Dispatching Production, Detailed Production Scheduling, Quality Assurance, ...

Time Frame
Shifts, hours,

Process Customer Order
- Create an Invoice
- Submit an Expense Report
- Returned Product
- Ship Order

Level 2

2 - Monitoring, supervisory control and automated control of the production process

- Discrete Control
- Continuous Control
- Batch Control

Level 1

1 - Sensing the production process, manipulating the production process

- Sensing the production process, manipulating the production process
- Monitoring, supervisory control and automated control of the production process

- Establishing the basic plant schedule, production, material use, delivery, and shipping
- Determining inventory levels

- Workflow / recipe control, stepping the process through states to produce the desired end products. Maintaining records and optimizing the production process.

- Sensing the production process, manipulating the production process

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Business Process Management
Rapid Adoption Happening Now

Significant Results from BPM

“We reduced processing time from 6 weeks to 48 hours and the associated labor by 70%.”

“We increased transaction capacity by 50% and reduced staff and processing time by 30% each.”

- Improve conformance
- Ensure compliance
- Increase throughput
- Reduce rework
- Reduce resources

- Reduce work in progress
- Improve understanding
- Reduce training requirements
- Reduce progress chasing
- Improve ability to meet dates
A Work Process
Manual Quality Check

6.2.2 Each manufacturer unit sampled is labeled indicating a sample was removed from the container, with the initials of the person who removed the sample, the date the sample was taken, and a container ID number for whom multiple sample containers are collected. For example, 1, 2, 3, etc. (Attachment IV).

6.2.3 The number of containers sampled is recorded on the Raw Material Test Report (Attachment II) and the amount removed is documented on the Inventory Card per BDP 20303 – CGMP Product Accountability.

6.2.4 Sample Quantities

6.2.4.1 Sampling for Release Testing: The sample quantities taken from each unit sampled must be adequate for specific tests to be performed. Reference the raw material specification sheet for the specific sample volume.

6.2.4.2 Sampling for Retention: From the first container sampled, in addition to collecting a volume sufficient to perform all required release testing, collect a separate retention sample at a volume sufficient to perform all required release testing in duplicate, except the volume required for testing of sterility or release gages need not be retained. Reference the raw material specification sheet for the specific retention sample volume. Retention samples will not be taken for media plates, stoppers, vials, crimpers, and any other components will be retained at a sample size of 20.

6.2.5 Each sample taken for release testing will be identified with a label indicating it is a test sample. The label will have the following information: Name, BDP Part Number, BDP Lot Number, QC Test Request Form Number, Manufacturer’s Lot Number, Container ID Number, the initials of the person sampling the material, and the date the sample was taken. The samples will be taken in appropriate containers.

6.2.6 Each sample taken for retention will be identified with a label indicating it is a retention sample. The label will have the following information: Name, BDP Part Number, BDP Lot Number, QC Test Request Form Number, Manufacturer’s Lot Number, Container ID Number, Retain On Date, initials of the person sampling the material, and the date the sample was taken. The retention sample must be placed and stored in a container comparable in construct to the received raw
We have 1000s of Work Processes People are involved in many

- Quality Check
- Raw Material
- Check Adhesive
- Levels
- Receive Materials
- Quarantine Product
- Corrective Action
- Setup Machine
- Correct Alarm
- Metal Detector Check
- Dispatch Production Order
- Scrap Product
- Package Finish Goods
- Store Product
- Rework Product
- Product Deviation
- Package Finish Goods
- Scrap Product

imagination at work

GE
Other Types of Work Processes People are not involved

- Send Order from ERP to Production System
- Send production results to ERP
- Monitor production metrics
- Notify supplier of low inventory levels
- Correct Alarm
- Coordinate equipment operation
- Condition data for a spreadsheet
- Prevent downtime
- Escalate expired work requirements

GE imagination at work

13 / GE /
Work Process Management
In the Production Environment

Level 4
1. Sensing the production process, manipulating the production process
2. Monitoring, supervisory control and automated control of the production process
3. Workflow/recipe control, stepping the process through states to produce the desired end products. Maintaining records and optimizing the production process.
4. Establishing the basic plant schedule - production, material use, delivery, and shipping. Determining inventory levels.

Level 3
ERP <-> Production System
Production Order Completed
Backflush Inventory
Maintenance Execution
Actual Production Order Status

Level 2
Production Order Dispatching
Engineering and Spec Changes
Corrective Action
Maintenance
Task Management

Level 1
Digitized Work Instructions
Task Execution
Station-Level Control
Manual Data Entry

Discrete Control
Continuous Control
Batch Control

Alarm Analysis and Action
Mfg Intelligence Data
Condition Monitoring

Real-Time Brickwall
Time Frame
Shifts, hours
Months, weeks, days
Time Frame
Shifts, hours
Shifts, hours

Business Planning & Logistics
Plant Production Scheduling, Operational Management, etc.

Manufacturing Operations Management
Dispatching Production, Detailed Production Scheduling, Quality Assurance
Roadblocks to Effective Work Process Management

- Maintaining and updating written SOPs is very time consuming and expensive
- Roll out and training people to use SOPs is very time consuming and expensive
- Monitoring conformance and compliance to SOPs is very time consuming and expensive
- Execution performance feedback lags and is subjective and inaccurate
- People that know the process best typically do not create the process
Overcoming Roadblocks

An Industrial Strength Work Process Management System
Key elements of an effective Work Process Management System

- Work Processes must be able to be developed by the people who know the process best
- Work Processes must be able to be created and deployed quickly to solve problems and get control of a process immediately
- Work Processes must be able to be executed with very little training
- Work Processes must be able to be managed throughout the plant with little effort
- Execution performance feedback must be real-time and accurate so that process improvements can be implemented immediately
- Work Processes must be able to be implemented on top of existing systems
A Work Process Management System

Workflow Design and Definition

Workflow Authoring Environment

Workflow Authoring

Workflow Definition

Workflow Execution Engine

Workflow Execution

Workflow Monitoring and Control

Real-Time SOA

Task Inbox

Hosted Applications

Interaction with People, Equipment and Applications

ERP <-> Production System
Production Order Completed
Backflush Inventory
Maintenance Execution
Actual Production Order Status

Production Order Dispatching
Engineering and Spec Changes
Corrective Action
Maintenance
Task Management

Digitized Work Instructions
Task Execution
Station-Level Control
Manual Data Entry

Alarm Analysis and Action
Mfg Intelligence Data Condition Monitoring

Digitized Work Instructions
Task Execution
Station-Level Control
Manual Data Entry

Alarm Analysis and Action
Mfg Intelligence Data Condition Monitoring
Task Inbox

My Tasks

The Task Steps that must be worked on

Detailed instructions and input
Graphically define a Work Process
Managing Tasks

Task: Test city water pH level
Expires: (none)  Priority: (none)

- Test city water pH level
- Test city water mineral levels
- Test city water hardness level
- Test city water fluoride level

Task Steps:
- Scan water sample into system
- Perform pH test
- Record pH level into system

Documents:
- CDC pH Info
- CDC Public Water Systems
Process Feedback and Reporting

### Workflow Task Execution

<table>
<thead>
<tr>
<th>Workflow Name</th>
<th>Task Step Name</th>
<th>Start Time</th>
<th>End Time</th>
<th>Duration</th>
<th>State</th>
<th>Step Person</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Get Quality Sample details in s95 Material</td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td></td>
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<td>7/5/2009 9:00:00 PM</td>
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</tbody>
</table>

### Workflow Statistics - Detailed Report

<table>
<thead>
<tr>
<th>Workflow Name</th>
<th>Subprocess Name</th>
<th>Count</th>
<th>Avg Minutes</th>
<th>Min Minutes</th>
<th>Max Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>UC-Quality Sampling &amp; PA</td>
<td>Mixer #1 Sample Required</td>
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<tr>
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<tr>
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<tr>
<td></td>
<td>Get Quality Sample details in s95 Material</td>
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<td>0.65</td>
<td>0</td>
<td>3</td>
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<tr>
<td>Workflow Totals</td>
<td></td>
<td>82</td>
<td>3.43</td>
<td>0</td>
<td>14</td>
</tr>
</tbody>
</table>
Using existing systems, layer on top
SOA – Service Oriented Architecture - The Basics

Data and Services Repository

Universal Client

Production Process

Setup Machine → Produce Product → Inspect Product → Package Product → Package & Ship

Real-Time Services Bus

Core Services

Security, Alarm, OPC, Users, Events, S95 Data Models, Reporting, Object Relational, Licensing, SQL Database, Web Services

Service Providers

HMI, ERP, PLM, Legacy Apps
iSOA – Core and Service Providers

Get Alarms
Ack Alarms

Data Items
Add Item
Remove Item

Production Events
Downtime Events
Waste Events

Equip Model
Process Segments
Operations Mgmt
Quality Mgmt

Production Order
Material Consumed
Materials
Order Status

Tags
Displays
Ack Alarms

Real-Time Services Bus

Security
Alarm
OPC
Users
Events
S95 Data Models
Reporting
Object Relational
Licensing
SQL Database
Web Services

HMI
ERP
PLM
Legacy Apps
Processes Enabled by iSOA

Alarm Corrective Action Example

Workflow

Corrective Action Process

- Quarantine
- Manually Inspect
- Disposition
- Create Deviation
- Clear for Production

Real-Time Services Bus

Core Services
- Security
- Alarm
- OPC
- Users
- Events
- S95 Models
- Reporting
- Object Relational
- Licensing
- SQL Database
- Web Services

Service Providers
- HMI
- ERP
- PLM
- Legacy Apps
Example Production Work Processes
Most Common Work Processes

Work Instructions
- **Electronic Work Instructions / SOPs**
- "Standard Work" for Lean Initiatives – “Error proofing”
- Production Set Up
- Virtual Trainer

Quality
- **Quality Hold: Non Conformance, Rework and Quarantine**
- QA Plan & Sampling

Corrective Action
- **Alarm Management and Corrective Action**
- Exception Management
- HACCP Monitoring Procedures
- Troubleshooting Trees: Equipment Repair & In-Process Product Repair

Middleware
- Production Specification & Recipe Management
- Industrial Middleware
Simple Work Process

One User, One Location
Pressing the Button triggers a Workflow
Get operator input to confirm actions.

Provide details for completing the step.

Manual BackWash Verification Process Instructions:

1. On the HMI screen, click the Manual BackWash button.
2. Checking to ensure ‘no filters’ are in automatic or manual backwash currently.
3. Respond to verification above when prompted.
Task: Manual Filter Backwash

Manual Filter Backwash

Task Steps

Eligible for manual mode? [ ]

WFTraining [ ] proficy

Manual Backwash Setup

Walking through the steps for manual backwash of filter #1

Initiate Manual Backwash

WFTraining

Finishing Backwash

WFTraining

Reset Filter Switch

WFTraining

Preliminary Setup Process steps

Enter in each step as completed:

☑ 1) Close Influent Valve
☑ 2) Close Effluent Valve
☐ 3) Set Draw Down set point at 8.6 gpm in HMI. Click on linked documents to view HMI screen until flow is greater than 1.560 gpm.
☐ 4) Turn On Blowers
☐ 5) Open Backwash water valve

Automatic Access to HMI

Tank Level

Use HMI Displays for Operator interaction

Filter DrawDown Flow SetPoint

CMP0902

F I L

Auto Setpoint

0.00

Man Setpoint

0.00

Flow Rate

1,318
The target flowrate has been reached.

Automatic Access to HMI

HMI display is providing real-time feedback.
The step will not continue until all manual checks have been validated.
New input requirements for this step

Keeping track of how long the workflow has taken so far

Each step can deliver unique instructions

We moved to the next step
Many types of media can help complete steps.
Final validation and comments

Electronic signature of the person performing the work
Control is returned to the HMI.
Electronic Work Instructions
Covers a lot of level 2

Level 4
Business Planning & Logistics
Plant Production Scheduling, Operational Management, etc

4 - Establishing the basic plant schedule
   production, material use, delivery, and shipping.
   Determining inventory levels.

   Time Frame
   Months, weeks, days, shifts

Level 3
Manufacturing Operations Management
Dispatching Production, Detailed Production Scheduling, Quality Assurance, ...

3 - Workflow / recipe control, stepping the process
   through states to produce
   products. Maintaining records and optimizing the production process.

   Time Frame
   Shifts, hours, minutes, seconds

Level 2
Discrete Control
Continuous Control
Batch Control

2 - Monitoring, supervisory control and automated
   control of the production process

Level 1

1 - Sensing the production process, manipulating
   the production process

Digitized Work Instructions
Task Execution
Station-Level Control
Manual Data Entry
Moderate Complexity Work Process

Many Users, Many Locations
Product Quarantine
Based on real customer quarantine process

Work Process
1. Operational staff identify quality suspect product
2. Product put into quarantine
3. QA staff requested to review and decide action
4. Operational staff process action (Release, Rework or Scrap)
5. Finance notified if scrap amount significant

Current manual process
- Creates huge paperwork processing burden
- Costs the company as delays/losses in process causing the product to get too near to it’s expiry date:
  - Rejected/low sell price/fine from supermarkets
  - Unnecessary scrap
# People involved in the Work Process

<table>
<thead>
<tr>
<th>Username</th>
<th>Job role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paul Wynne</td>
<td>Finance Manager</td>
</tr>
<tr>
<td>Sue Smith</td>
<td>Product Stream Shift Manager: Shift 1</td>
</tr>
<tr>
<td>James Hall</td>
<td>Product Stream Shift Manager: Shift 2</td>
</tr>
<tr>
<td>Tom Caesar</td>
<td>Product Quality Co-ordinator</td>
</tr>
</tbody>
</table>
Sue Smith – Product Stream Shift Manager (Shift 1) Logs in
At Log in there are currently no Workflows pending for Sue.

Person logged in identified at top of screen.

Controls for display options and manually starting new Tasks at bottom.
Sue observes product issue on bottling line and decides to initiate the Quarantine workflow.
New Quarantine initiated – No unique identifier until confirmed with “Submit” button.

Steps of Quarantine Workflow associated with this user.

Time since Workflow started. Warning mails/messages can be generated if runs too long.

Form to be Completed by PSSM i.e. Sue.

Work instructions, Standard Operating Procedures (SOPs) and other documents can be linked and displayed at each step in Workflow.
### Standard Operating Procedure for Initialization of Quarantine

<table>
<thead>
<tr>
<th>Step</th>
<th>Step Description</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>On identification of potential quality issue initialize workflow</td>
<td>PSSM</td>
</tr>
<tr>
<td>2</td>
<td>Select the production line affected by the quality issue</td>
<td>PSSM</td>
</tr>
<tr>
<td>3</td>
<td>Select the top-level reason for the suspected quality issue. If not covered by standard values then select &quot;Other&quot;</td>
<td>PSSM</td>
</tr>
<tr>
<td>4</td>
<td>Set the Quarantine status to &quot;Open&quot;. (&quot;Closed&quot; should only be selected in the eventuality of accidentally creating a Quarantine event – please explain reason in comment field)</td>
<td>PSSM</td>
</tr>
<tr>
<td>5</td>
<td>Set due date by which Quality Control must review the Quarantined stock. (After this period, the status will be escalated to)</td>
<td>PSSM</td>
</tr>
</tbody>
</table>
Top level details entered through pull-downs as better for later analysis

Current step highlighted in turquoise and by progress bar

All fields must be completed before possible to move on – including free comment fields

PSSM selects period of manufacture for which product must be Quarantined
Completion of previous step highlighted with tick mark, and current step highlighted for execution.
Stop / Start, User and other step details stored to database for later reporting. (Hover mouse over step to see details)

After submit of previous step, Workflow is confirmed and given unique identifier.

List of pallets manufactured during selection Quarantine period. PSSM asked to confirm quarantine of these pallets.
Next step completed and system informs that an e-mail has been sent to Tom Caesar (Product Quality Coordinator PQC) for further processing.

No current task actions for Sue Smith (hence blank form)
Product Quality Coordinator (Tom Caesar) receives e-mail that Workflow is waiting for him and logs in ...
Tom Caesar – Product Quality Coordinator Logs in
Pending activity for Tom Caesar immediately highlighted at login:

- Person logged in

Steps of Quarantine Workflow associated with this user:

- PQC Quality Review of Quarantine
- PQC Quarantine Allocation - Release
- PQC Quarantine Allocation - Scrap
- Notification of Quarantine

Form recalls quarantine details entered by PSSM.

PQC examines quarantined pallets and can review, edit, comment and verifies details for quarantine.
Following examination of quarantined product PQC selects those pallets for release to distribution.
PQC selects those pallets from remaining quarantined product (considering previous step) to be written off or scrapped. Another option could be Rework.
Next step completed and system informs that an e-mail has been sent to PSSMs. (Note: message sent to the PSSM role rather than a specific individual at this time)
No pending tasks for Tom Caesar (hence empty task list)
Product Stream Shift Manager (Sue Smith) receives e-mail that a Workflow is waiting for her and logs in ...
Previously when Sue was logged in, she had no pending actions, as the workflow was waiting for the PQC (Tom) to complete their actions.

As PQC completes actions Status of Quarantine task updates for Sue to pending
Sue is instructed to Scrap those pallets identified by Quality Coordinator for write-off, and then confirm (with the Submit button) that it is done.

Note: Pallets released to distribution have their statuses updated automatically and have no manual action.
No pending tasks for Sue Smith. Workflow for Quarantine is completed!
Finance Director is notified by e-mail that product over a threshold has been written off. Logs in to check status ....
Paul Wynne (Finance Director) is presented with historic report of all Quarantines (including the recent issue). Report filterable (using SQL reporting).
Report filtered on specific pallet

Details of Quarantine recorded
<table>
<thead>
<tr>
<th>Start Time</th>
<th>Line</th>
<th>Reason</th>
<th>Released Pallets Count</th>
<th>Scrapped Pallets Count</th>
<th>Start Time</th>
<th>Status</th>
<th>Total Pallet Count</th>
</tr>
</thead>
</table>

- **Total Pallets Quarantined**
- **Pallets released to distribution**
- **Total Pallets written-off**
Product Quarantine
Covers many levels

Level 4
Business Planning & Logistics
Plant Production Scheduling, Operational Management, etc

Level 3
Manufacturing Operations Management
Dispatching Production, Detailed Production Scheduling, Quality Assurance, ...

Level 2
1. Discrete Control
2. Continuous Control
3. Batch Control

Level 1
1. Sensing the production process, manipulating the production process
2. Monitoring, supervisory control and automated control of the production process
3. Workflow / recipe control, stepping the process through states to produce the desired end products.
4. Establishing the basic plant schedule - production, material use, delivery, and shipping. Determining inventory levels.

Time Frame
- Shifts, hours, minutes, seconds
- Months, weeks, days, shifts

ERP <-> Production System
- Inventory
- Financial Records
- Actual Production Order Status
- Quality Quarantine
- Corrective Action
- Dispatch Product Orders
High Complexity Work Process

Many Users, Many Locations
Many Systems
Process Production Order
Mixing automated and manual tasks

Task 1
Set Up Machine, Download Recipe

Task 2
Visually Inspect Product

Task 3
Package Product

Task 4
Pallet and Ship
Setup Machine
Take the next production order, begin the setup

Task 1
Setup for Production

ERP releases Production Order
Create Task
Setup Production Line
Production Starts
Setup Started
Inspect First Run Product
First Run Approved
Production Corrective Action
Actions Taken
First Run Rejected
Deliver Packing Material
Visual Inspection
Inspect and correct production issues

Task 2
Visually Inspect Product
Package Product
Package, Inspect, and Stage

Task 3
Package Product

Random Inspection
Defects Found
Production Corrective Action
Product Scrapped

Send Notifications
Quarantine Product

Finished Product
Stage for Shipping

Deliver Packing Material

Send Notifications
Product Scrapped
Process Production Order
Mixing automated and manual tasks

Task 4
Pallet and Ship
Process Production Order
Covers many levels and systems

Level 4
Business Planning & Logistics
Plant Production Scheduling, Operational Management, etc

Level 3
Manufacturing Operations Management
Dispatching Production, Detailed Production Scheduling, Quality Assurance, ...

Level 2
Discrete Control
Continuous Control
Batch Control

Level 1
1 - Sensing the production process, manipulating the production process
2 - Monitoring and control of the production, production, product, product, product
3 - Workflow / recipe control, stepping the process through states, producing products, maintaining the production process
4 - Establishing the basic plant schedule - production, material use, delivery, shipping. Determining inventory levels.

Time Frame
- Shifts, hours, minutes, seconds
- Months, weeks, days, shifts

ERP <-> Production System
Actual Production Order Status
Inventory Movement
Customer Shipping

Quality Sampling
Corrective Action
Material Delivery

Production Setup
Quality Sampling Trigger
Inspection Instructions
Packaging Instructions
Label Printing
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Batch Execution
Plant Applications
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