GE Digital

Work Process Management

Achieving Operational Excellence through Consistent and Repeatable Plant Operations

With Work Process Management, organizations can drive the right actions at the right time, every day – from common tasks to corrective action on out-of-spec events and critical emergencies. Work Process Management can close the loop on industrial operations to minimize errors and risk, reduce waste, and ensure compliance. By digitizing procedures, companies guide operators, track actions and events for reporting, and empower workers to do more with less.

INTRODUCTION

Every operations environment contains a mix of automated and manual interactions between equipment and personnel. Often, these processes are not fully documented and include extra steps and resources. As such, they are difficult to adapt to changing business needs. Additionally, as workforces age and retire, organizations are losing the knowledge that is gained from years of experience on the plant floor – as the information has not been captured electronically and put into formal processes.

Digitizing work processes offers a way to drive consistent and repeatable operations – adapting the proven methods that Business Process Management (BPM) brought to the enterprise and leveraging industrial standards-based, real-time Work Process Management technology. By documenting, leaning and digitizing production work processes or workflows, companies can achieve greater agility and long-term sustainability.

Driving Toward Digitization

Operations Management solutions have been evolving over many years as very broad or very specific solutions to manage production operations. In most cases, companies had to significantly customize production systems which meant they could not be easily upgraded or improved and often remained static. Changes to the systems have required large commitments from Manufacturing IT resources, leading even farther into customization and making the systems even more difficult to maintain.

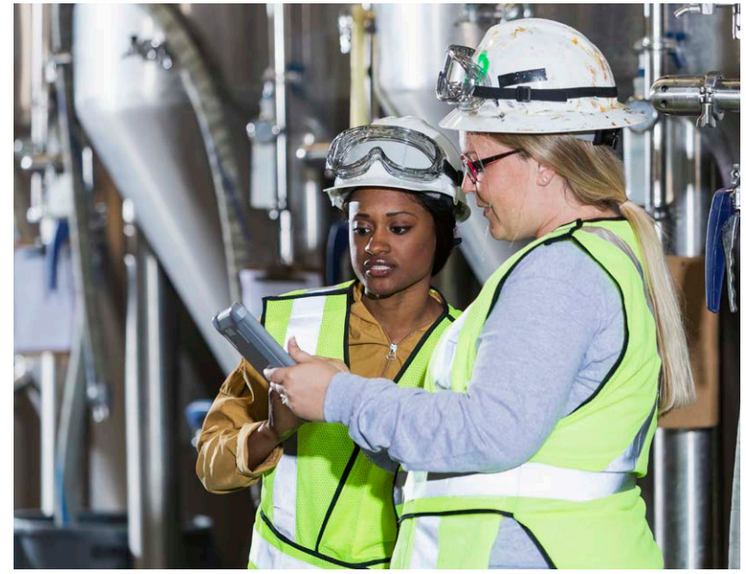
While MES has been solving scheduling, execution, and data collection challenges for years, it still remains mostly a static solution when it comes to the processes these systems execute. Due to the limitations of these systems, companies have hundreds of workflows or processes within every production facility that are executed manually.

Today, a manufacturing composition environment is evolving that supports process orchestration, workflow and alerting. MES solutions are moving into the realm of operations process management, and Enterprise Manufacturing Intelligence (EMI) solutions can now include workflow capabilities in their dashboards, making systems more actionable and capable of simple execution.

With these advancements in technology – and the availability of low cost computing resources – the ability to digitize work processes has become a reality. A Work Process Management software solution can sit on top of existing plant systems and fill the gaps in most MES, production and control systems. Work Process Management software allows domain experts, not just programmers, to create workflows that orchestrate services and communicate to real-time equipment. Work Process Management can also make existing systems more flexible and adaptable to change – which brings the power of digitization to production teams.

The Power of Work Process Management

- Document processes and transfer knowledge – for consistent, repeatable operations
- Minimize the effects of a shrinking and aging workforce
- Enforce and track work processes for compliance
- Lean your processes – improve, eliminate and automate steps
- Manage by Exception
- Automate information flow from Plant2Enterprise and Enterprise2Enterprise
- Integrate people and their roles/functions
- Customize to individuals' work styles and decision making
- Manage and audit your production processes more effectively and consistently
- Share production best practices and collaborate on processes



Grow with the Flow

By definition, a workflow is the automation of a process during which information or tasks move from one participant to another for action, according to a set of rules. As an enabling tool, Work Process Management software provides a system for improving and optimizing industrial and manufacturing practices – combining automated and manual processes through authoring, execution and analysis capabilities. This software takes a production “flowchart” and digitizes it, connecting people, equipment and systems. Unlike BPM in the enterprise – which operates in hours and days – Work Process Management operates in a time window of seconds and subseconds.

Just as production has a broad range of work processes, Work Process Management software can solve a broad spectrum of challenges. Workflows can involve basic tasks such as asking an operator to check tank levels every hour, to managing an entire production process, to orchestrating data transformations between ERP and MES. The workflow system – and its reporting – can touch almost all production personnel, including quality managers and quality technicians, maintenance, operations supervisors, industrial engineers and more.

Additionally, digitization of a process can involve one or many steps. It can take place in one station with one user or spread across the plant and move from person to person, following a set of rules. The workflows follow the execution path logic developed by the power user through easy-to-use graphical authoring tools.

Documenting Processes

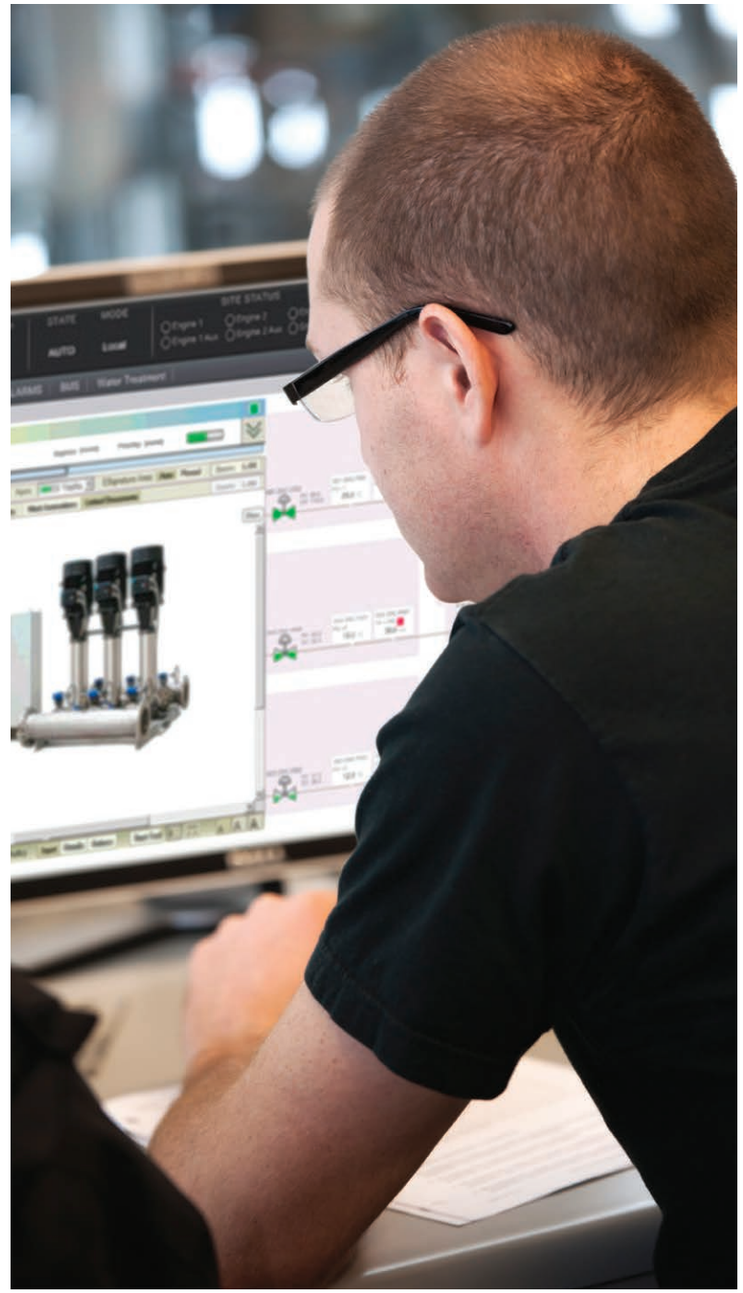
Work Process Management typically does not require IT resources, and process experts are able to make changes to the system to immediately improve production. The graphical authoring environment permits drag-and-drop construction of workflow diagrams or the execution process. A Standard Operating Procedure (SOP) configuration tool allows anyone, including clerical support, to assist with documenting process steps.

Following definition, the workflow moves to the execution engine. A typical plant could have 60-100 workflows executing at the same time, depending on the industry. In the case of an interactive workflow, the workflow then gets pushed to the next functional area, which is the task client. The task client shows a backlog of tasks for a role and location. In the case of a system workflow, the workflow does not have interaction with end users and runs behind the scenes. For example, a company could have several system workflows that are communicating with the ERP regarding material consumption or other information.

The steps for digitizing a procedure include:

1. **Document your new or existing process.**
2. **Identify, eliminate or reduce non-value-added activities.**
   Lean out the process. By using Work Process Management, companies can look at their processes, often for the first time at this level, evaluate them, and make significant improvements.
3. **Describe the event, or combination of events, that will trigger the workflow to execute.**
   Triggers can range from particular data coming from a PLC to a production event in an MES system to information from an HMI node. Users can combine several with one conditional statement to trigger a workflow. Or, users could trigger a workflow with time-based events.
4. **Define the conditional process logic that will dictate the appropriate types of actions.**
   Dictate the execution path – which specifies the specific tasks to be completed within the workflow.
5. **Identify recipients – and what data they require to make the correct decisions and complete their tasks.**

For every step within a workflow, users can attach documents and work instructions to assist and speed with execution.



Each step could include linked documents such as work instructions – or any information that pertains to how the user should complete the process.

Unlike traditional systems, Work Process Management allows production teams to mix automated and manual tasks. Figure 1 shows a simple workflow to process a production order, as follows:

1. Set up machine and download recipe.

The ERP triggers an event that a work order is passing down to the MES system, and a workflow begins and pushes out steps to different places or stations within the plant for execution. In this example, Task 1 is pushed out to a particular production machine and provides set up instructions to the operator in the form of attached documents.

Once the machine is successfully set up, the workflow system could communicate to a SCADA or HMI system – or it could download the recipe directly. The workflow system has access to real-time data sources such as PLCs, OPC servers, custom process equipment, and more. With completion of these first two steps, the operator finished set up, downloaded the recipe, and put the machine into production.

2. Visually inspect product.

As the product moves down the production line or from cell to cell, the operator receives a task to do visual inspection for that particular production order. The system provides work instruction for how to perform the visual inspection. Within that task step, the system requires Manual Data Entry, as the operator inspects the product. The operator enters the information into an easy-to-use form, which is set up specifically for that task. The system pushes the inspection data into other systems – such as MES, LIMS and HMI.

3. Package product.

With the visual inspection completed, the product moves to packaging. At that station, the packaging operator receives instructions on how to package the product and moves through a workflow that even includes printing the package labels.

4. Pallet and ship.

Once packaging is completed, the product moves to pallet and ship. The operator receives more instructions on what packages to use as well as materials and other information. The workflow system automatically pushes information back up into the ERP, so the ERP now contains the completed order information – including which pallets, which exact products and other details.

Task 1
Set Up Machine, Download Recipe

Task 2
Visually Inspect Product

Task 3
Package Product

Task 4
Pallet and Ship

Figure 1 Mix Automated and Manual Tasks
Unlike traditional systems, Work Process Management allows production teams to mix automated and manual tasks.

Work Process Management Across Operations

Use cases for Work Process Management vary from company to company and industry to industry. However, many organizations face common production challenges. Common use cases for Work Process Management include:

Orchestrate high-level processes and manage the data between systems – Many companies do not have visibility into their high-level processes and do not have them documented – and even fewer are orchestrating systems and managing the data between them. The example in **Figure 2** shows the high-level workflow for a brewery that needed to achieve process visibility and management. Located in Europe, this leading brewer had no way at a high level to prepare a batch for execution. In the illustration, the high-level workflow consists of the blue boxes. The first step, "define the brewery setup," goes to an engineer – whose actions trigger another workflow, or a nested workflow, as shown with the flowchart to the right. The engineer executes that workflow and defines the setup. Once completed, the workflow moves to the next engineer, who then looks at the site recipe, checks if it requires changes, makes any modifications to the master recipe, and creates the batch. Next, the production team examines the control recipe and, finally, starts processing the batch. This new digitization gives the brewer visibility across the business into all of the batches that production is processing. From one place, the brewer can look at all of the batches that are currently under dispatching and scheduling and see where they are at without personnel having to leave their desk. People, systems and processes are all interconnected.

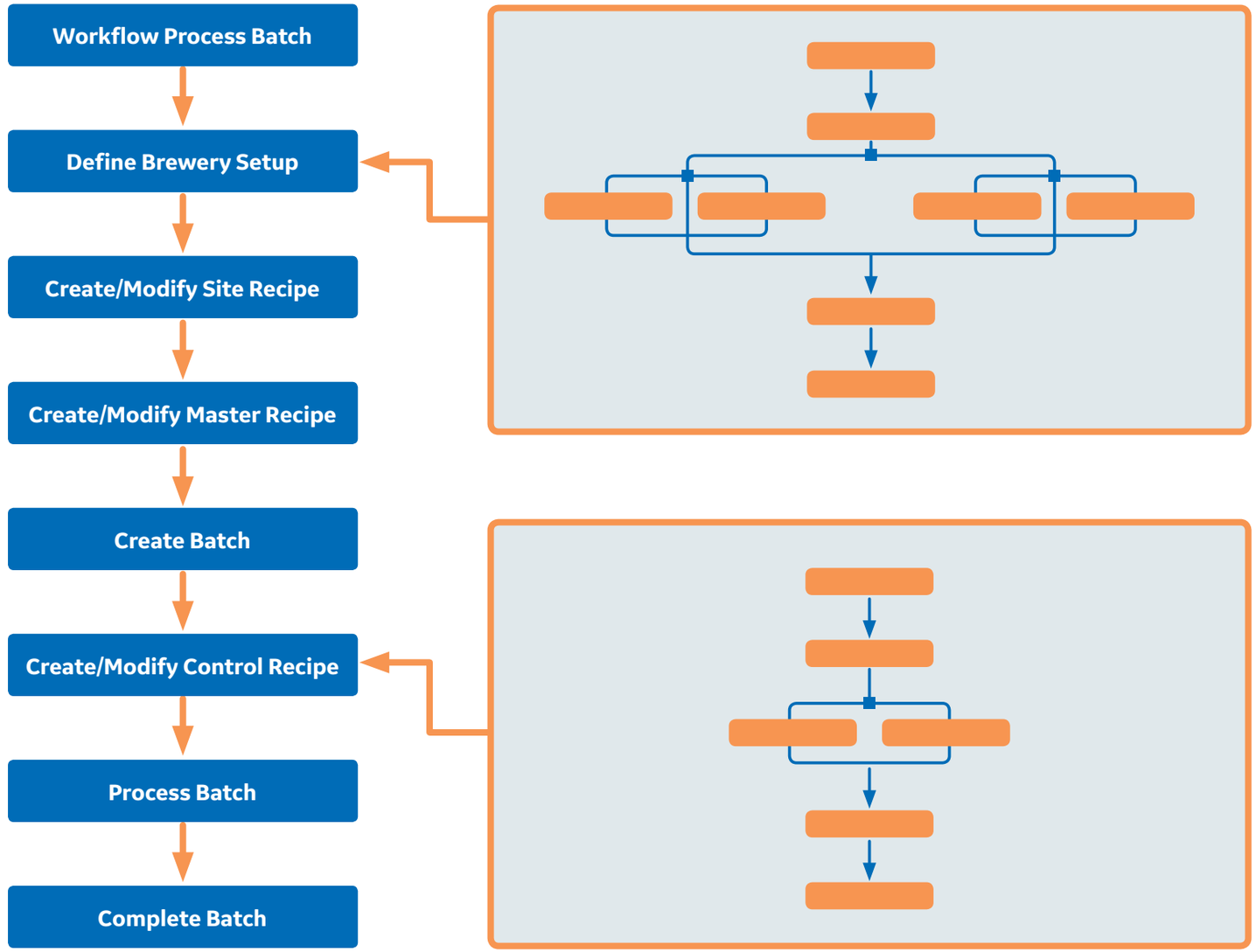


Figure 2 Orchestrate Entire Production Processes
A major brewer used Work Process Management to achieve process visibility and management. This new digitization gives the brewer visibility across the business into all of the batches that production is processing. People, systems and processes are all interconnected.

Digitize Good Manufacturing Practices (GMP) Tasks – Because GMP tasks can become part of the digitized workflow, companies can push the tasks out to personnel and equipment. The system sends instructions to operators at their stations and requires them to complete the tasks. The system records the details regarding task completion. For example, if a machine is constantly in production, the system may require the operator to check it, as the individual process requires. With a packaging machine that is applying labels, the operator may need to check adhesive levels every hour and confirm completion of the task.

*Digitize Standard Operating Procedures and Work Instructions –*Instead of using a static piece of paper or a binder at their station, operators follow SOPs and work instructions through Work Process Management. They accomplish their work with fewer errors – and the system records the information.

HACCP Monitoring Procedures and Corrective Action – Now, production teams can use Work Process Management to create HACCP procedures – and build the corrective actions that are necessary if there is a negative response to one of those procedures. As companies execute on a HACCP check, teams need to collect the data on corrective actions – when they are taken, how, and what the response to the corrective action was. Work Process Management provides a full closed loop for HACCP.

Alarm and Event Response, Corrective Action – While Work Process Management monitors alarms, companies can also layer it on top of HMI – and monitor alarms through the SOA platform. Workflow can filter out nuisance alarms, so teams only need to take action on certain alarms. Additionally, Work Process Management can eliminate the scripting, traditionally VBA coding, in many HMI applications. As shown in Figure 3, Work Process Management provides a better way – one that is 30-50% faster than HMI scripting and easier to maintain.

Manual Assembly Error-Proofing – Work Process Management provides station level control for assembly and error proofing – while also fully documenting products, people and resources for traceability.

Plant Task Management, Decision Wizard – In addition to extensive plant task management, Work Process Management also offers a basis for decision wizards. At a major consumer products company, teams have now documented troubleshooting trees for the first time. These trees capture the knowledge of workers due to retire before employee attrition affects the plant. Work Process Management digitizes the trees into decision wizards that walk newer employees through processes. The digitized decision trees help guide the newer workers on what corrective actions to take under certain circumstances. The system may ask the operator for input – or may require input from many people. Work Process Management helps to manage the process, connecting knowledge, teams and equipment.

Line, Workcell, Machine Setup – To speed production and increase accuracy, Work Process Management facilitates machine setup. The system walks users through the setup of a machine, provides machine documentation and records the time it takes for operators to move through each step. In reviewing the use cases, Work Process Management spans production challenges from machine setup to managing entire production processes and communicating between many different systems. As the complexity of the workflows increase, industry standards become more and more important to ensure successful execution.

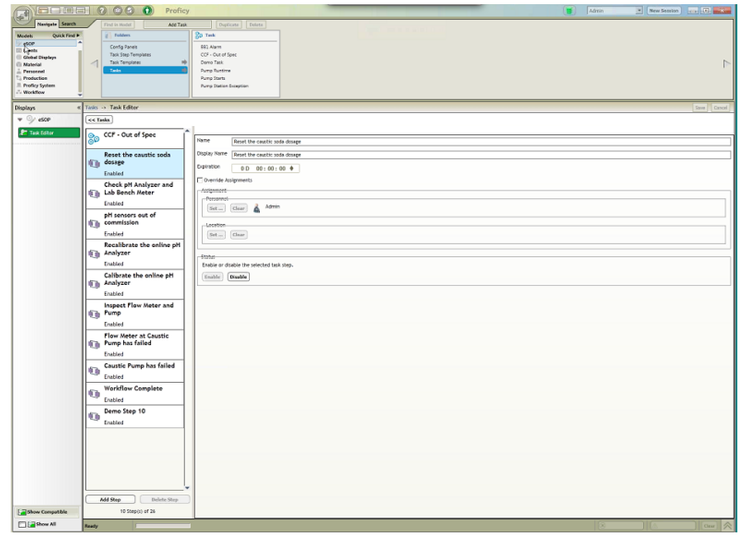


Figure 3 Easy Process Configuration
With an easy-to-use interface and template strategy, you can speed documentation and digitization of work processes. Templates can allow the creation of hundreds of workflows in a short amount of time – minimizing the effort to document even the most complex work processes. The easy interface allows clerical support to enter and modify workflows – without technical assistance.

Enabling Work Process Management with Industry Standards

To create common ground between systems, companies need a common definition of data. Even at the simple end of the spectrum – such as a workflow that performs basic tasks – companies must exchange and store data.

The S95 standards provide a common framework and data model in which different systems can communicate and give context to data found in static and real-time systems. Once standard data models are in place, workflows can use the data within the models to carry out their execution and have a place to store results of execution.

Workflows are a key element to connecting and managing flexible work processes that can be very dynamic. By leveraging a common reference model and workflow engine layered on with transformational innovation specifically to improve production operations, companies can enable workflows to execute across many systems – and know that they have achieved a foundation for sustainable advantage.

For more information on Work Process Management, visit: www.ge.com/digital/products/workflow

ABOUT GE

GE (NYSE: GE) is the world's Digital Industrial Company, transforming industry with software-defined machines and solutions that are connected, responsive and predictive. GE is organized around a global exchange of knowledge, the "GE Store," through which each business shares and accesses the same technology, markets, structure and intellect. Each invention further fuels innovation and application across our industrial sectors. With people, services, technology and scale, GE delivers better outcomes for customers by speaking the language of industry.

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