



Improving Manufacturing Excellence
Managing Production Processes Across
the Value Chain



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Executive Overview

Production Process Management is a new way to view, build and evolve the information systems infrastructure and do away with the expensive and overly complex software application silos found in many of today's global manufacturing enterprises. For many years department-oriented applications were installed and then forced together with systems integration techniques with results that often were outdated before the project went live. Too often, chasing the need to be agile only led to being boxed in whenever the business or technology changed. The result is a data-centric world made up of islands of information instead of strong, vibrant systems of production.

Today, we should view the production process as the basic unit for improvement and automation within an organization and its value chain – a transformation in thinking and IT governance from being data- and application-centric toward being process-centric. The process-centric perspective looks at how the business is managed and how production is accomplished. This is a far cry from discussing ERP (Enterprise Resource Management), MES (manufacturing execution systems), QAS (quality assurance systems), WMS (warehouse management systems) or any of the other acronyms that have come along. Eliminate the hierarchical ideas behind information systems and use all the tools in the information systems network to most effectively accomplish your business objectives and build your competitive advantage.

Production Process Management is **not** a technology. Instead it is a framework consisting of process-centric best practices, a model for proper governance, implementation and full life cycle management in a process-centric business, and an IT architecture based on model-driven composition technologies such as those found in Business Process Management. Production Process Management is applied to solve production issues and realize opportunities using the existing legacy application infrastructure to manage and support processes across the enterprise and its value chain. Once you view your business as a set of processes you will wonder why this has taken so long.



What is Driving Us Toward Production Process Management

An earlier paper titled Manufacturing Enterprise 3.0 describes the holistic convergence of information systems and ubiquitous information usage across the extended enterprise, obliterating the line between the administrative view and the operations view. This follow-on paper will provide substantial form and function to the ideas presented in that paper and show how and why one should rethink IT strategies targeting custom or off-the-shelf applications to meet the needs of the business, without looking at the information silos they create. This paper will describe and focus on the inclusive view of company processes (how things get done) and view information and its use by systems and people, in a business process context. Additionally, there will be an argument that enterprise-level systems, including Enterprise Resource Planning (ERP), Product Life-cycle Management (PLM), Supply Chain Management (SCM) and legacy manufacturing plant systems should all be seen as elements of the same unit, not a universe of different worlds. One must think not of systems of record but of the processes and process layers those systems support, and move from a data-centric view to an enterprise-wide holistic process-centric view.

Note these corporate objectives taken from a major international multi-plant food products producer as it began an overhaul of its enterprise information technology systems:

"Improve and redesign the key business processes we use to run and manage our business and make them common across the company."

"Improve how we capture and maintain our critical business information. Connectivity is about sharing information, and sharing requires a common 'language'."

"Standardize key company data and implement the data standards so that we can have a single business language that makes it easier to share information across the company."

"Simplify and consolidate our portfolio of software applications and upgrade the technology that supports them."

Analyst firms have taken some strong views on how and what must be done within manufacturing companies to realign information systems. The following is taken from a Gartner paper written in 2010. The comments still apply today.

"Manufacturing organizations seek a manufacturing architecture that remains consistent with broader enterprise architecture for global visibility, collaboration and control, while still being flexible enough to support individual site goals. This is a challenge — especially for those who have inherited multiple divisions, sites and manufacturing styles and models (i.e., in-house, virtual or contracted)."



KEY THOUGHT

The business process is where the IT department and operations meet.

“The need to link detailed — and diverse — manufacturing operations with supply chain requires product supply architecture that supports both global orchestration and local execution. Bringing manufacturing and supply chain together requires a set of multi-plant and extended business process capabilities that aren’t being addressed by current manufacturing standards efforts.”

“No domain is riper for applications overhaul than manufacturing operations. Clients are continually challenged by the dearth of widely distributed and available skills and technical knowledge for deployment, re-configuration and maintenance of manufacturing software. The software itself is aged and cannot cope with constant reconfigure and requirements to support lean and Six Sigma initiatives — let alone produce timely access to data for key stakeholders or demonstrate compliance.”

Typical manufacturing company information systems are dauntingly complex networks made up of hundreds to thousands of applications in addition to the standard central Enterprise Resource Planning (ERP) system. This broad range of user interest is only one of many things that make manufacturing information management complex. There are additional factors driving manufacturing including these:

Manufacturing enterprises are unique The information technology management within manufacturing companies is unique from most other businesses. Foremost is the large number of disparate applications in use. Added to this base are the wide-ranging applications within our value chain of customers and suppliers.

Inaction is not an option Manufacturing enterprises are aggressively pursuing their ongoing effort to improve and compete, and it is unlikely this will change anytime soon.

User role-based information Looking at reports is no longer a valid approach, nor is interpreting information to make an informed decision. Information must support decisions, be specific to the user, and be built on trust. Again, this is not about data or behind-the-scenes, monolithic computer systems, but a focus on content, workflow and the process that suits the user at any position within the extended value chain.

Coherence There are many sources of facts to deal with in a manufacturing enterprise, among them ERP, PLM, MES, Data Library, CRM, maintenance, logistics, warehouse management, APS, SPC, quality assurance and more. This world of data chaos ends when companies focus on their processes instead of applications. Managing the cross-departmental, horizontal nature of processes, and supporting those processes with exact information at the right place and time, will replace the din of data with usable and actionable information.



Agile This is the capacity to react to changes in your business and business environment. Some changes require immediate responses, and others require strategic reactions. Information systems must, and will be, the leading response mechanism, but they will operate within well-defined and supported processes.

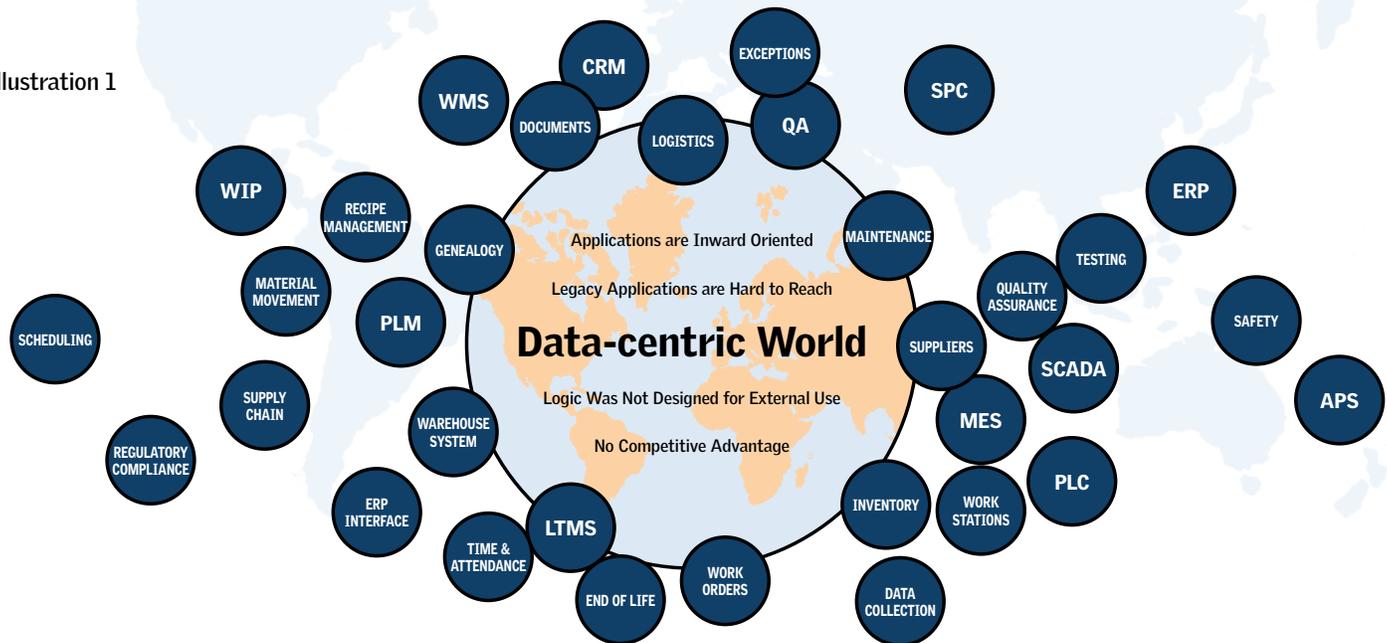
Competitive advantage Building competitive advantage through better information use is quicker and usually less expensive than nearly any other initiative.

There are many more drivers that could be mentioned here but these certainly form a solid base that few people will question. In this paper we will focus on two significant areas of the manufacturing enterprise — the plant operations information infrastructure and the area of production operations across the enterprise and its value chain.

The "As Is" Manufacturing Enterprise

It is difficult to easily identify or define the full range of applications used to accomplish production because industries are different and vendors have added to the confusion by using labeling to suggest differences. The broad definition begins with a holistic view that includes the complete production system infrastructure and the collection of business processes that provide the event-by-event, real-time management and execution of the planned production requirements. But even that is not an adequate definition until we include each enterprise in the value chain on both the supplier side and on the demand side.

Illustration 1



Life would be easy if the plant processes were as simple as this illustration suggests. Unfortunately, reality is a bit messier with plants typically running 60 to 100 different applications that have been installed over the past 10 or more years. Within a multi-plant company, or within a supply chain, the number of applications can grow to hundreds of disparate data generators and information sources. The value of these applications has been typically based on each system as a stand-alone answer to a particular set of operational conditions.



KEY THOUGHT
DEFINING COLLABORATION
 The simultaneous use of
 real-time information across the
 value chain.

Stovepipes, silos, islands of information, islands of automation etc. are all metaphors fitting both plant and enterprise applications. The plant information legacy has long been based on narrow departmental requirements that usually differ between plants in the same company. These applications can range in cost from a few thousand dollars to many hundreds of thousands. However, in most cases they are all individual islands of information that are significantly opaque. The real cost and difficulty comes when there is a need to access the information to support the broader corporate community and when that need spans application domains within the IT landscape.

Data Centric Versus Process Centric

Viewing information management through the lens of an application builds a data-centric view that is narrow and focused on the original requirement to support a specific set of objectives with an inward sense. As an example, consider an application designed to support the quality assurance department. Although important quality management issues, including statistical process control, non-conformance measurement and statistics, corrective action support, in-process testing and more are usually included, rarely will the package address or have any connection to equally important issues such as WIP tracking, cost variance or scheduling. Early material requirements planning (MRP) systems were often described as closed loop systems. The operator entered data, the software did the calculation and clear truth emerged. Indeed it was a closed loop that focused on internal mechanisms (pure logic unadulterated by outside forces) to deliver an answer. This inward focus toward a narrowly identified list of departmental functions drove the frequent reference to many plant systems as islands of information or silos. A much greater value can be envisioned when we alter thinking away from the data-centric view to a process-centric view.

In previous writings on manufacturing, there has been a lot of attention devoted to Manufacturing 2.0. Many of the obvious business issues were identified as well as how they were being addressed within the daily activities of manufacturing and how to improve multi-site operations excellence, global visibility, integration etc. across the entire value chain network.

Production Process Management complements the 2.0 discussion by providing a framework for layering in process and process management techniques. This process-centric approach is different and promises to have an impact on manufacturing and supply chain agility as great as the Internet has had over the past 15 years.

The challenge is to focus neither on data nor the application, but the **process** as the basic unit of computer-based automation. The idea of systems-of-record must be revisited to view systems-of-process and layers-of-process, to achieve the required goal of becoming more process centric.

For manufacturing, the formal concept of process has been around since Frederick Taylor's workplace analysis nearly 100 years ago. Manufacturing has long used processes to outline the order in which tasks are to be accomplished. Imagine the chaos if each mechanic at Boeing determined how to assemble an airplane. Or consider if Oreo cookies were made in any way different from the basic recipe (see Illustration 2). In manufacturing, following the designated process is the way of life.



Illustration 2



Is there any similarity in making a Boeing 747 and making Oreo cookies?

Yes! Each has a defined set of processes with a beginning and an end. Those processes follow the hierarchy outline and fall into identifiable clusters.



Today, every manufacturing company has deployed some number of software applications within their manufacturing facilities. These applications have ranged from simple programmable logic controllers (PLC) to, among the others, Statistical Process Control (SPC), manufacturing execution systems (MES), quality assurance, maintenance management, scheduling, inventory management, material movement, manufacturing process management, receiving systems, time and attendance, etc. It is not unusual for a moderate-sized facility to have as many as 60 different software application systems. In most instances these applications do not communicate with each other, require re-entry of data, are substantially redundant with overlapping functionality, built on varying and frequently outdated technology, and exceedingly difficult to fully understand or revise. The installed base is frequently referred to as legacy systems.

By transforming the company to a process centric approach, one eliminates or mitigates the problems associated with data-centric systems and allows the organization to apply holistic, proactive management across the extended enterprise/value chain using precisely defined and supported business processes. Easily coupled and decoupled information resources will provide real-time information between any and all sources, and the focus is on the processes with people addressing exceptions and improvements. This new vision is forward-looking yet makes best use of the assets in which investments have been made over the years. It is robust enough to take companies where they want to go over the next 20-plus years. Historically, applications have been implemented with a heavy tilt toward vendor standards, whereas the new vision is easiest to implement when based on a business process platform and self-reliance, using in-house knowledge resources to make the changes needed. The future is unhinged from central IT systems and focused on how to run the business.



Introducing Production Process Management

The assortment of legacy applications becomes painfully obvious when multi-plant companies set out to deploy a new ERP system that requires communication to and from the plant floor infrastructure. As an example we will consider a global food products producer with 20 facilities located around the world. The new ERP system requires that a wide range of data be transmitted to the plants (recipes, schedules, customer orders etc.) as well as significant data (production results, scrap, schedule variances etc.) be sent from the plant to the corporate office. The company wants to operate the information network at or near real time.

Since the company was largely built through acquisition there is a wide range of legacy applications currently in place. The historical approach to this discordant set of systems usually follows one of two avenues:

1. Replace all of the existing plant systems with a new set of common applications. An identical set of applications including MES, QA, testing, labeling, weighing etc. are deployed across the landscape in every plant. This allows the software integration tasks from ERP to the plants to be somewhat similar. The uniqueness of each plant is handled by customizing the standard common applications, usually in a form acceptable to the ERP committee.

2. Recognize the unique requirements of the plants and develop a wide range of integration software code to satisfy the corporate requirements in both form and function. This allows the plant to operate as usual based on their installed base but fully supports the corporate ERP bi-directional information needs.



Illustration 3

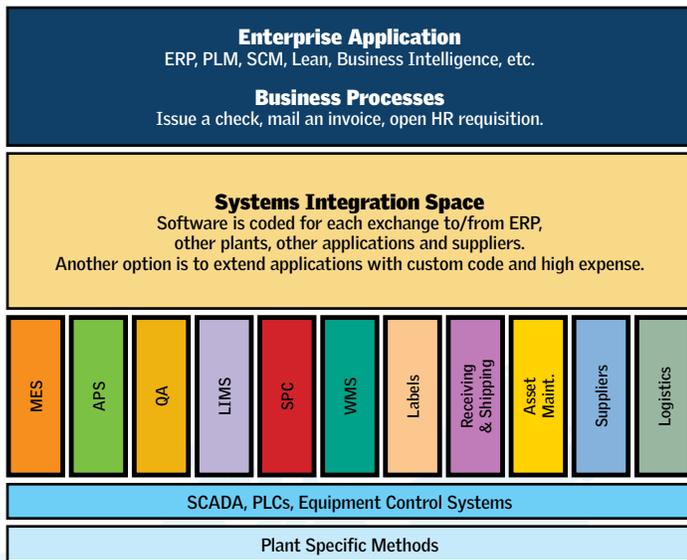
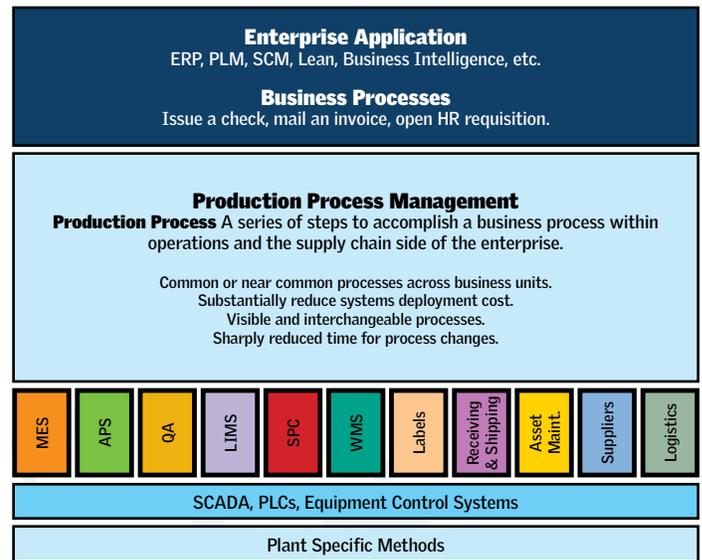


Illustration 4



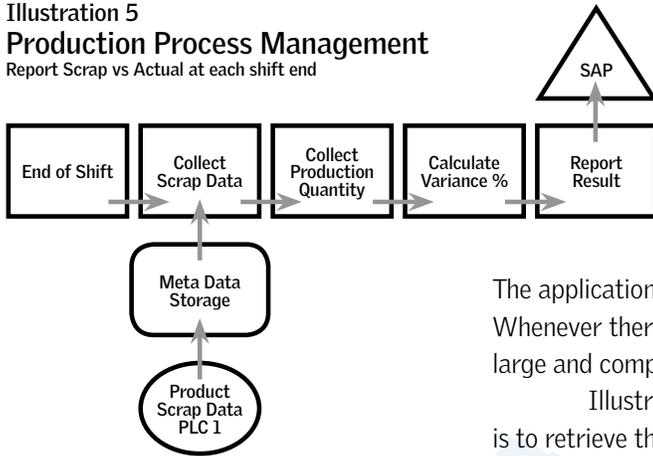
There is now another way to obtain the information management result that is less costly, less time consuming, less risky and also offers a wide range of additional benefits. This method is called Production Process Management (PPM). Production Process Management describes a concept of applying business process management design and tools to the areas of manufacturing plant and supply chain activity management within the extended enterprise. The primary idea behind PPM is to center thinking on business functions and activities versus what software package or combination of software packages might be applied. Processes are designed to follow chronological steps of how you want to run the business by connecting and supporting predefined, sequenced events with the correct information in a role-based form for the intended user. A process may be fully electronic, fully or partially manual, or combinations of either. One key thought is that the process is specific to and alterable to fit the given business requirement.

These illustrations above provide an overview of the typical application hierarchy in most manufacturing companies today. Illustration 3 shows the usual ERP system with a focus on business administrative applications. Beneath that is the integration layer made up of mostly custom software intended to bridge the gap between the plant application activities and the needs of the ERP. The next lower level is a symbolic display of plant applications used in manufacturing. These are typically stand-alone, departmental data-centric systems. Beneath that are the machine level programmable controllers, other control systems and sensors. The bottom layer suggests the specific operational requirements of the local plant, which could be based on things like product, tradition or labor agreement.

Illustration 4 shows the same hierarchy except the integration layer has been replaced with a **Process Layer**. Instead of using software development tools to create and deploy new functions, process development modeling tools such as Visio, ARIS or Provision are used to collaboratively develop the process using standard modeling language (not C++). The modeled processes will be supported by data retrieved from the existing applications as part of the process execution functions.



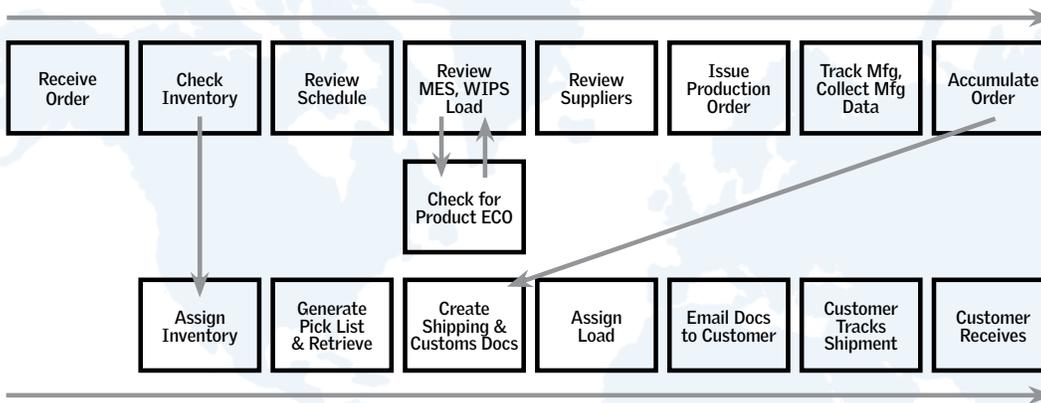
Illustration 5
Production Process Management
 Report Scrap vs Actual at each shift end



The application of processes, of course, is not limited to grand global roll out plans. Whenever there is a need to extract and link information into a new process, whether large and complex or small and simple, PPM concepts can apply.

Illustration 5 shows an example of a simple production process where the task is to retrieve the amount of scrap produced from each plant at the end of each shift and calculate the scrap percentage of the finished product produced on that shift. The plant

Illustration 6
Production Process Management
 Typical order fulfillment process



is required to weigh each item of scrap and collect the shift total in a scale-mounted PLC. The PPM platform will initiate this process automatically at shift end by collecting the scrap and finished goods data and making the calculation. The information is then sent to the ERP system as part of the financial and metrics measurement administrative processes.

The next example shown in Illustration 6 is an order fulfillment process. This

begins by outlining the steps in the proposed process. Once the process steps have been identified it is determined what information is required and where it is located. At this point a process model can be developed using swim lanes and other Business Process Modeling Notation (BPMN) techniques and tools.

Production processes can come in any shape and form and, in a large company, might run into thousands. They may be enterprise-wide, connecting applications across plants. They may be within a plant either as a new process added to an existing application, or a composite application developed to bridge existing applications. The process execution may be located at an offsite location, at the local plant or in a cloud where process execution can be provided as a service.

The key steps for defining and implementing a new process will usually follow along these lines:

- Describe what to do in sequential steps.
- Identify the necessary data elements.
- Choose the preferred data element location and usability, or create the data source.
- Model the process and revise as necessary.
- Deploy the process through the production process platform.
- Review, edit, revise and manage the process as you would a Microsoft Word document, maintaining a process life cycle history.



KEY THOUGHT**COMPETITIVE ADVANTAGE**

A firm possesses a sustainable competitive advantage when its value-creating processes are superior to competitors and they have not been able to be duplicated or imitated.

As we grow the process layer to include hundreds to thousands of processes, some structure for indexing and reusing processes will be required. The PPM Hierarchy is one scheme that will bring real organizational benefits as processes are visualized and deployed across the enterprise.

Business Process Hierarchy Processes should fit the company process hierarchy, which closely follows the financial reporting hierarchy. Strive for a data rollup similar to the financial reporting system.

Enterprise Strategies

Management Initiatives to support strategies

Business Processes to support the initiatives

Support Processes (**Production Processes**)

Process Applications (MES, PLM, LIMS, ERP etc.)

Data Elements

Earlier this paper described the traditional approach to applying information technology in manufacturing as the deployment of narrow purpose software applications such as MES, warehouse management or maintenance management to meet specific operational requirements and then modifying (custom programming) those applications to fit the way the company actually operates. This has proven to be costly, time consuming and difficult to revise once in place. Focusing instead on how to operate the business (the processes) as the starting point, using PPM provides many advantages:

- A less costly method to accomplish information exchange without direct systems integration.
- Dramatically reduced implementation time for system connections.
- Applied business processes that are enterprise global standards with granular changes at the business unit and/or plant level.
- Easier global visibility to business information and production processes.
- Production process layer will be proprietary to the user company, not driven or seen by any vendor.
- This proprietary intellectual property forms the basis for building competitive advantage.
- New generic operations information systems such as MES, maintenance, LIMs, quality, SPC, scheduling etc. can be purchased at lower cost.
- Systems layer customization cost and time will be reduced immediately.
- Ability to manipulate live business practices and make changes quickly.
- Optimization of business processes within and between entities.
- Path to zero latency and a full real-time enterprise.
- Easy couple/decouple information sharing with external and internal entities.
- System management through a process layer environment that is less disruptive for system users.



Illustration 7

BUSINESS ROLES	
 PROCESS OWNER	<ul style="list-style-type: none"> • A senior business person • Leads process governance for initiative-specific improvements • Responsible for end-to-end process performance • Defines the business objectives for the metrics continuum
  EXECUTIVE SPONSOR	<ul style="list-style-type: none"> • The process owner's day-to-day delegate on the BPM Project Team • Facilitates construction of the "Metrics Continuum" for the target process • Escalates process governance and project decisions to process owner when necessary
 SUBJECT MATTER EXPERT	<ul style="list-style-type: none"> • Provides business and domain expertise • Identifies formal and informal processes affecting the "Metrics Continuum" • Participates in workshops, counseling, "to be" activities

This graphic is based on a slide created by Gartner. See Cited Material on page 20.

Beginning the Journey

By now many readers are likely convinced they have found the answer to a number of problematic issues. Consider that existing processes have probably been in place for a long time and people are most comfortable with old habits. Most users usually do not understand or see the full existing process and process elements. Some headwind should be expected.

The best place to start after the initial top management charter is to build a governance capability that

might include a steering committee and/or a process center of excellence, or COE. Illustration 7 on this page and illustration 8 on page 14 offer suggestions on broadened skills and responsibilities that should be considered when building the team. Some companies even have a Manager of Process to lead the effort and address territorial conflicts. In any case, applying PPM will change the broadest outlines of the company and governance is part of the equation. Enforcing business process standardization according to internal corporate policies, both within a particular location and across the extended product supply network, will be part of the process management and definition tasks of the COE.

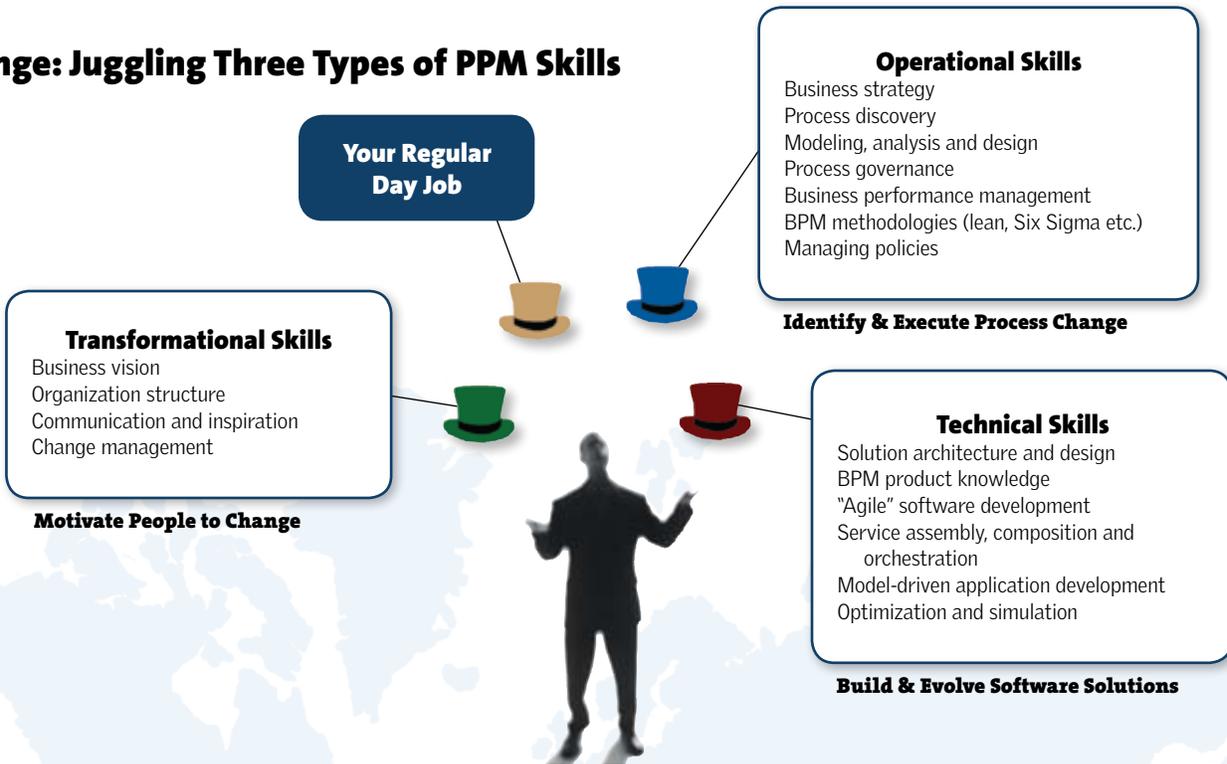
When establishing and staffing a COE, here are several key recommendations and best practices:

- Keep the size of the teams small and manageable in order to remain effective; if the team gets too big it should be divided into smaller, separate teams focused on a smaller scope of processes, led by a lead or manager.
- Staffing should include both IT and business users, each with knowledge of the processes in scope for the PPM-based COE, and each should have sufficient tenure within your organization; a minimum of five years, perhaps as a business analyst, is a minimum threshold for project success.
- Corporate IT should be fully engaged, providing strong architectural oversight of your PPM program, if not directly involved with the COE team or governance committee.
- A process usually spans multiple organizational boundaries; process owners need to be familiar with a broad range of inter-departmental routines. This is usually someone with a diverse background.
- The best process owners link process improvements to business goals; the sustainability of the governance organization itself depends on its ability to demonstrate measurable and compelling business benefits to management and staff alike.
- Manager- or director-level personnel from the various process areas are usually your best choice; they typically have a hands-on role in overseeing process improvements. In addition, they are usually skilled in arbitrating disagreements while handling company politics.



Illustration 8

Challenge: Juggling Three Types of PPM Skills



This graphic is based on a slide created by Gartner. See Cited Material on page 20.

Once a governance committee has been established and staffing for the COE is underway, you must agree on, document and effectively communicate the program's charter and its initial goals and strategy. When forming these, here are some things to consider:

- Clearly document and communicate roles and responsibilities of the team members that are consistent with the team's goals.
- Document and implement any additional policies and procedures needed specifically for PPM, obviously building on and remaining consistent with those already in existence at other corporate and IT programs.
- Analyse and document the efforts required to improve both the business culture and the IT infrastructure in terms of their process maturity and agility.
- Map your PPM strategy to one of the BPM process maturity models now commonly available.
- Define the requirements for and select a BPM platform and technology; BPM technologies play an important role in the success of a process-centric ecosystem.
- Look at enhancing and evolving processes versus replacing them.
- Staff more than one process improvement project at a time.
- Do roll outs in parallel and globally once value and benefits are proven during pilots or first implementations.



Nearly every aspect of process management deviates from the small boxes on the organization chart and crosses departmental boundaries. In many ways it is the white space on the organization chart that creates the most concern.

Illustration 9

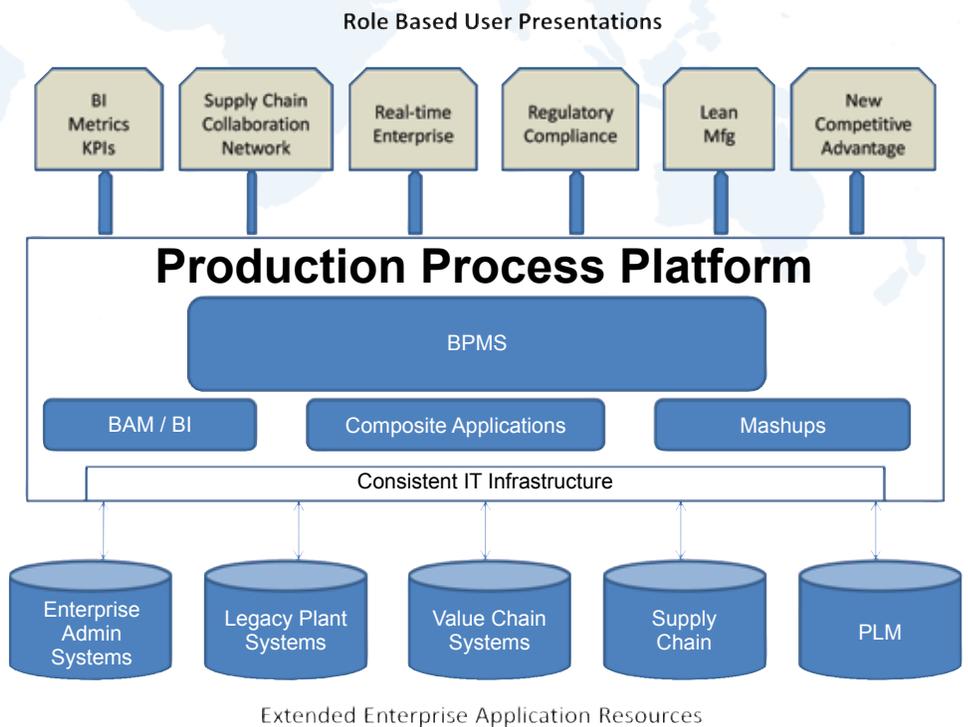
Process Initiatives can vary in size and type

	QUICK & SIMPLE	MAJOR PROCESS REDESIGN	TRANSFORMATION INITIATIVE
LEVEL OF CHANGE	Simple application to application process	Rationalize existing plant application base to reduce redundancy	Replace all systems integration with processes
SCOPE	Revise the current operation	Apply process analysis to certain plant systems	Complete reevaluation of multi-platform systems
PROJECT TIME	Weeks	Months	Years
GOVERNANCE	Sponsor plus Analyst	Process Owner	Steering Committee

The Production Process Platform

Applying process management ideas across many industries, including manufacturing, has become quite popular. In most companies this has meant studiously modeling and reengineering each process and then storing those models in notebooks until the next review. There is another dimension to PPM that actually executes the modeled processes via the Production Process Platform (PPP).

Illustration 10



The Production Process Platform (PPP) is an integrated set of tools that serves as the hub for developing and executing production processes. This hub centers on a Business Process Management Suite (BPMS) that is a set of technologies that manages activities and entities surrounding the complete process cycle, including developing the process model, through process execution and measurement. The PPP is obviously an important part of the process network as this is where all aspects of the production process management system are designed, stored and run. Management through processes allows non-IT personnel greater managerial access and the opportunity to make changes; however, this is still a highly technical set of tools and IT expertise should not be far away.

The key functions of the Production Process Platform include:

Process Modeling, Design, Simulation and Management The production process is designed and visualized by the process designer using graphical icons and collaborative interaction. This is not software development but instead easy to understand human readable models of the process, typically using Business Process Modeling Notation (BPMN). Earlier modeling tools, including ARIS, Provision and others, can usually be imported into newer process management systems. The modeling visualization provides insight for all users who want to understand the full breadth and functions within the process. The modeled processes are managed similar to a Microsoft Word document in that a record of the original process development as well as a history of all revisions and contributors provides a process life-cycle tracking document. The transparency afforded to everyone from user to manager is an important aspect of Production Process Management.

Process Implementation and Execution Modeled production processes can be implemented with the execution side of PPM. In simple terms, the platform converts the process into a workflow that operates step-by-step to accomplish the tasks or logic as modeled. An event starts the instance of the process model (frequently called a process launch) that follows the model through to conclusion. Processes launched but not ended are usually referred to as in-flight. Important to note is that in a production environment in-flight processes may remain open for long periods that include days or weeks. The model designer/process manager should also consider the circumstance of propagated version control to in-flight processes and how this is supported in multiple plant companies. These are some issues that separate PPM from the usual business process management environment.

In today's connected world, where users demand access to information and want quick insight into today's production performance, or the latest trend in a vendor's perfect order performance, or details about a process or product issue that just surfaced, the PPM platform itself must be based on a solid technology infrastructure that is consistently implemented across the enterprise IT landscape and its value chain.



Conclusion

There are many themes that could describe this paper. One might be the "Anyway You Want It" approach that suggests using data to build your process as you see it. Another is to view the entire IT toolset as a data resource to be reused in new process-driven ways.

Yet another theme is that process definition and process management are a team affair. Process is sometimes described as the convergence point of IT and operations personnel. This is true if convergence means of the same mind. Discussion around a process must be done in plain company language describing business events and the expected outcomes, avoiding "geek talk" and departmental insulation. Add to this the process transparency for users to see and the ability for revision by non-technical managers and this approach appears to be win-win for everyone when we view the process as the basic unit of computer based automation.

Some Definitions

- **Business Process** a series of steps to accomplish a business action, such as issue a check, mail an invoice, open an HR requisition etc.
- **Business Process Management (BPM)** a management discipline focused on business activities/ functions related to the processes to get things done.
- **Business Process Management Suite (BPMS)** a collection of software tools assembled to design and execute business processes.
- **Business Process Modeling Notation (BPMN)** a high-level business process modeling language.
- **Manufacturing Process** a series of steps to manufacture a product.
- **Operations Rules** the set of managerial rules that form the basis for production process definition and execution.
- **Process Model** a collection of related, structured activities or functions that produce a specific service or product (serve a particular goal).
- **Process** a series of steps or tasks (manual or automatic) aimed at accomplishing a defined business objective.
- **Process Element** an element of data, an operation on an element, a result of an operation or a process within the process.
- **Production Process** a series of steps to accomplish a business process within the production and supply chain side of the enterprise.
- **Production Process Management (PPM)** the design, implementation and management of processes relating to the operations/production aspects of a manufacturing enterprise and its value chain.
- **Production Process Platform** the arrangement of technology tools to manage and orchestrate the production processes.
- **Operations Rules** the set of managerial rules that form the basis for production process definition and execution.



Cited Material

Manufacturing 2.0: A Fresh Approach to Integrating Manufacturing Operations with DDVN, Simon F Jacobson, Leif Eriksen, Phannee Kim, Gartner Inc., 2010. (The data should be viewed historically and doesn't necessarily represent Gartner's current view.)

Operational, Transformational and Technical Roles for Successful BPM Projects and Programs, Michele Cantara, Gartner Inc., BPM Presentation, Baltimore, Maryland, 2012.

Reference Material and Suggested Reading

Business Process Management: The Third Wave, Peter Fingar and Howard Smith, Meghan-Kieffer Press, 2001.

Collaborative Manufacturing: Using Real-time information to Support the Supply Chain, Michael McClellan, St Lucie Press, 2003.

Manufacturing Enterprise 3.0, Michael McClellan, Collaboration Synergies Inc., 2009 Whitepaper.

Manufacturing Business Process Management, Apriso Corporation, 2009 Whitepaper.

Using BPM for Success with Manufacturing IT System Deployments, Chris Will, CTO, Apriso Corporation, Whitepaper, 2010.

Discrete Manufacturing Reference Architecture (DIRA), Microsoft Corporation, 2011 Whitepaper

Other Suggested Reading

The Agenda, Michael Hammer, Crown Business, 2001.

Business Process Management: Profiting From Process, Roger Burlton, Sams Publishing, 2001.

BPMN Modeling and Reference Guide, Stephen A White and Derek Miers, Future Strategies Inc., 2008.

Business Process Mapping, J. Mike Jacka and Paulette J. Keller, John Wiley & Sons, 2002.

The Networked Supply Chain, Charles Poirier, Lynette Ferrara, Francis Hayden, Douglas Neal and J. Ross Publishing, 2004.

Process Based Management, Dennis C. Daly, Patrick L. Dowdle, et al, Bookman Publishing, 2004.





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