Manufacturing Enterprise Collaboration

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About the Author

Michael McClellan has over 30 years of experience serving and managing manufacturing enterprises. He has held a number of positions in general management, marketing and engineering, including President and CEO for a multi-division equipment systems supplier. In 1984 he and a group of associates founded Integrated Production Systems, a company that pioneered the use of computer systems to manage and track production events on the plant floor. His first book, Applying Manufacturing Execution Systems, defines manufacturing execution systems and explains the reasoning and history behind them. He is a frequent speaker at companies and manufacturing conferences, has presented a number of papers on plant information systems, and holds one patent. He has recently completed a new book, Collaborative Manufacturing: Using Real-time Information to Support the Supply Chain.

He currently lives in Washington state and is President of Collaboration Synergies Inc., an advisory company providing consulting services in the area of collaborative manufacturing system development and implementation, plant floor information systems and manufacturing execution systems.
Manufacturing Enterprise Collaboration

In Manufacturing Enterprise Collaboration the specific objective is to link information from disparate business system applications to better support business processes. Visibility is a key word. Synchronizing information is a key process. The perspective is holistic information empowerment to better support manufacturing related business processes within a plant, within a company, or across the extended enterprise.

There are a number of similar ideas being advocated by industry analysts. Some focus on closer ties and coordination with suppliers. Others point at internal opportunities to provide information visibility to departments or plants within an enterprise. In each case the message is very similar—improve your business by linking data from the many business process sources. This is a strategic view that sees information as a resource that is largely underused due to lack of visibility.

Manufacturing enterprise collaboration is based on two ideas:

1. Computer system applications have been developed around specific business processes such as accounts payable or quality assurance or production scheduling or warehouse systems. This has provided silos of information that should be linked to fill gaps that exist within or between business management processes. Significant gaps can exist through company or facility acquisitions leaving companies with sometimes hundreds of very useful system applications that are isolated from each other, unable to provide any transfer of information. There are also changes that take place in organizations and processes that can create information gaps or change the information required to best perform a business function. Linking these disparate sources to improve operational information visibility can enhance business operation.

2. The linking mechanisms between business processes are usually people using their ability to bridge gaps by providing judgment and experience to complex business issues. There is a significant opportunity to improve company performance by better supporting these people linked business processes. The support mechanism can be very simple such as an email to confirm an event has taken place, or rather complex such as integrated systems sharing inventory or schedule information across the supply chain.

Companies have been implementing systems that address specific business issues for many years. These applications have tended to be somewhat inward looking providing a service that is focused on a particular business area. That has left an assortment of acronym soup systems that probably serve their original constituency reasonably well but service outside of that constituency can be very obscure or abruptly nonexistent. An obvious example is to consider the functionality of a typical Manufacturing Execution System and a simple Customer Relationship Management System. There are many possible links but it is a rare system that has any connection.

Evolution to Collaboration

Disparate Data Sources
Serial Information Transfer

Aligned and Linked Data Sources
Collaboration Linkage Environment

Figure 5-1
One more example of narrow use is a quality assurance point solution that was implemented to meet the requirements of the quality assurance department. The application may have included all the bells and whistles that fit the needs of the department but the information typically was (and usually still is) very difficult for others to see or use. Another example is the advanced planning and scheduling system that is not receiving information feedback from the plant floor that identifies available resources or production yields.

These systems typically provide excellent information depth for the original users but little or no visibility or access for others. The departments of a manufacturing plant floor might include scheduling, order tracking, quality assurance, process control, resource planning, genealogy, and maintenance, each with its own software system specifically chosen or designed to meet the needs of that department. Planning systems range from modern fully functional corporate-wide systems to non-integrated manufacturing resource planning modules. The result is a collage of applications across the plant, across the company, and across the enterprise each doing its own specific job very well but meeting the requirements of the wider entity very poorly. Successful companies are made up of an interdependent linked set of business processes. Building the various software system components into improved business process support is the impetus behind manufacturing enterprise collaboration.

Industries will always be consolidating and many companies will continue to grow and change through acquisition, providing opportunities and requirements to link business processes more closely. As companies or plants have been acquired, the difficulty of systems integration has proven to be a substantial obstacle to information sharing. A very weak process information system can result when combining acquisitions with the globalization of firms, the expansion of their supply chains, and worldwide markets.

![Figure 5-3](image-url)

The need to inform and to be informed with real-time business process information is heightened with miles of separation, multiple facilities, and global supply chains. Manufacturing enterprise collaboration is the tool to help ensure business process support.

Manufacturing Enterprise Collaboration will automate, link, complement, or support business processes across departmental, plant, enterprise, or supply chain boundaries.

Connections and synergism between business processes has been accomplished through expensive software system integration or, more effectively, through people. As we near the top of the systems pyramid with ever higher-level business processes, the need to apply the judgment skills of people with integrated information from across the extended enterprise is ever more obvious. Instead of better informed people we see business processes in one area not linked to processes in another, forming larger silos of information. The business process gaps are connected through swivel chair or sneaker-net technology or in many cases the link is simply not made.
These typical examples give more insight to what manufacturing enterprise collaboration can do.

- Provide real-time production run yield information to the Planning and Scheduling system so schedule regeneration can be based on actual production system results.
- Provide warehouse inventory information to the customer relationship management (CRM) system for view by a sales person. Give the sales person the ability to commit inventory to a customer order.
- Provide corporate production planning with real-time enterprise individual plant capacity information to facilitate where-to-build decisions.
- Provide production planning with the latest demand information from the customer on a daily basis to optimize the production schedule and reduce build-to-forecast inventories.
- Give a customer the on-line ability to track the logistical progress of their order.
- Share product design information with internal or external supply chain partners on-line.
- Provide design engineering with a vendor’s tool capacity information.
- A broader example is linking quality assurance data from within the manufacturing execution system with a supply chain event management system to monitor yield information and broadcast results to recipients internally and/or externally. An additional step might be to provide that information to the planning and scheduling system for an automatic response to the actual yield quantity, and to revise the schedule accordingly. This can be extended further to inform downstream partners of the quality assurance data, the resulting yield, the revised schedule, and current shipment information as developed in the logistics management system. One more step might be to advise the supply chain event management system of the new priority enhanced schedule using system logic that requires notification by the production management system if the revised schedule for the order does not begin on the date specified.

Informal collaboration has been a part of business since the first customer was found and when the first employee was hired. In today’s view collaboration is a strategic business tool that sees information as an underused corporate resource that could be better deployed. These are a few ideas to begin a strategic use of collaboration and to set some objectives.

- View information and collaboration in the broadest sense across departmental, company, and extended enterprise boundaries.
- Examine business process gaps where decisions are based on poor or lacking information, assumptions, or information that is not current.
- View information as a corporate resource, not as departmental property. There is extensive information generated and accumulated each day that could enhance business processes if it were visible.
- Examine collaborative opportunities from the view of each group of users and information sources.
- Internal users across the enterprise.
- External suppliers and partners.
- External customers
- Collaboration is not an all or nothing process. There should be incremental progress based on defining places of need and acceptance by the users.
- There is no one best answer. Collaboration is about filling gaps in existing business processes by providing linkage between applications. Your applications and your business processes will define the path.
- Collaboration is not about technology. Technology requirements, if too great, will deter partners from willingly supporting projects.
- Collaboration should not force a dramatic change from existing business methods and practices. Collaboration should be the enabler that brings incremental improvement.
- Aim to use tools that can be revised without information technology management resources wherever possible.
- Revisit specifications for all control systems and information technology applications to ensure adaptability to collaborative use by providing information visibility. Internet access should be a standard requirement.
• Linking the various points and communicating in real time can provide an organization with one mind acting on real time information.
• Consider the broadest span of business processes from the plant floor systems to the customer and the most upstream supplier.
• Certain collaborative situations are meant to be temporary and some relationships that seem so solid now may change. For these reasons coupling and decoupling should be part of collaboration considerations.

In the paper *Putting People Back Into Collaborative E-Commerce*, author Michael Mikurak further argues the case for collaboration as a people-centric process. He suggests two requirements for collaborative processes. First, technology must deliver the right information to the right people in the right context at the right time to make a decision. Second, the information must be in the right form for people to use it effectively. People-centric systems
• Break down data and process barriers and allow relevant information to flow to whomever needs it.
• Provide capabilities for users to adjust processes that need to be changed without requiring IT support.
• Provide a process-centric environment that spans tasks, applications and departments.
• Support both behind the screen processes and collaborative processes that involve people.
• Provide workflows that can be granular or high level, depending on the user’s experience and knowledge about a process or issue.
• Co-exist and leverage the existing infrastructure of applications, systems and communications.

Formal collaboration mechanisms are being applied in some industries at the product design level and some areas of the supply chain. But there has been little or no formal process that addresses the internal requirements between the front office and production functions. While there may be some integration between applications within a particular business function, there is little integration across them. Business processes are typically lined up in these categories. An examination of the sublevels of each category will find smaller silos of information that have not been integrated into the other systems in their category or even less, those outside of their category.
Enterprise collaboration requires integration of production information across these silos to better support people-centric business processes. Figure 5.6 is an example of what this plan might look like.

Once synergy has been achieved across these silos a whole new world of collaborative possibilities with the supply chain opens up, including optimizing market-facing business processes between the internal supply chain and external supply chain network.

Manufacturing enterprise collaboration has many of the same inherent inhibitors as might be seen in external supply chain partners. The two primary issues are culture and trust and their impact can be just as profound within an enterprise as might be seen between competitors. Culture can extend to inter-departmental relationships that should be constructive but quite often are anything but that. Trust and commitment are also as important but sometimes more elusive within organizations. Does your production organization work precisely to the marketing forecast or is there a fudge factor? Have manufacturing and/or purchasing had an opportunity to collaborate on new product design or are they expected to do as they have been told? Can a sales person or a customer determine the current status of an order or is information provided only on a need-to-know basis—and when provided, is it trustworthy?
Similar to other forms of collaboration, the first step in enterprise collaboration initiatives is a general assessment of the current condition.

**Step 1.** Review the current condition. Begin by establishing the review boundaries along with the breadth of the review and the perspective. The view of the Chief Information Officer will be different from the supply chain manager of the same corporate unit. Is the view to be a corporate-wide perspective, from the information technology view, from the managerial perspective, plant manager, supply chain manager, or manufacturing support? What is the breadth and depth of the analysis?

**Step 2.** Examine the current environment to see if there are collaborative processes in use today that follow any of those outlined in this book? What is the level of informal collaboration and could a different approach with real-time information provide better support? If there are systems in-place what is the scope and the impact? What was the origin of these systems? What problems arose as they were getting to full operation?

**Step 3.** Examine the culture of the company regarding information systems. Is information seen as a proactive strategic tool either internally or externally? Do people interact with the information systems only as a data entry point or is there a flow of information both ways? Is information locally owned or is it available for broader business use? How are systems accessed? Is technology in place for technology reasons or is it truly based on business process support? Are we disadvantaged where the information is too stale to be of value? Does culture inhibit modern business systems or embrace them as tools? What is the culture response to ideas other than information technology such as sharing customer information with suppliers or product development with suppliers—or market demand information? Can we be open enough to expose vulnerabilities? Are suppliers and/or customers adversaries or partners? If trust is lacking can this situation be changed? Does the outside world see us as trustworthy? Two issues are basic to manufacturing collaboration. One is openness and vulnerability and the other is factual information. Do those correspond with our culture?

**Step 4.** Develop a preliminary supply chain map using a few threads based on either products or market sectors. Map the internal supply chain. Identify how demand is determined and where that information is used. Define all the sources of internal supply within the company. Define and map the external sources. Examine and layout the supply chain indicating the relationship, sales history, physical proximity, financial issues and likely future. Categorize high volume vendors as collaborative prospects, keeping in mind that not all vendors are equal. Outline the information transfer methods—computer, mail, personal, etc. Indicate information systems capabilities at the planning and plant floor level and the willingness to use electronic methods to send and receive information. Look at issues such as material management, scheduling, capacity planning, order tracking, and engineering change order tracking.

**Step 5.** Examine the current business processes to determine the time deficit of information sources. Are you in a time deficit where the available information is always old? If so, how old? Are promises made with data that is not current? Trust is a critical point of collaboration, internally as well as externally, and late information may not be reliable enough to maintain trust. It is not safe to make predictions based on yesterday’s data. Real-time information from the point of activity will provide a better basis for judgment and decision-making.

**Step 6.** Identify decision points. Where and how are business processes affected by individual decisions? Pick two processes and map the decision points as an example of how this can affect the operation. Identify how the decision process works and what the inputs are, and determine whether they can be affected by collaboration. Examine some exceptions and the method of reaction at the decision points.

**Step 7.** Collaboration, regardless of its form, requires a commitment, and needs a company vision statement to identify that commitment. Effective initiatives must have the backing and support from the highest level and a champion to drive and implement them.
ARC Advisory Group as a provider of analysis guidance for collaborative manufacturing has identified seven requirements that manufacturers should be considering:

1. Synchronize Business Processes with Manufacturing Processes. A key step is to surface more information for sharing with other audiences and make production systems more responsive and flexible.

2. Optimize the Supply Side Value Chain. There are tools and methods available to manufacturers that provide actual demand information in real-time throughout the production network, and a competitive edge.

3. Automate Business Processes Across Departmental and Business Boundaries. First movers can expect to realize significant competitive advantage by capitalizing on the agility and responsiveness of adaptive business process control.

4. Generate Value by Empowering People and Measuring Results. Web-based tools such as portals can provide information from a variety of systems throughout the enterprise.

5. Implement Collaborative Design and Engineering. This includes the management and collaboration of specification and product development information, as well as the design and collaboration on manufacturing processes across multiple specialized nodal manufacturers.

6. Link Operations with Customers. In this new environment, close collaboration among nodal manufacturers raises cooperation to a new level. It is now possible and necessary to transmit real-time information in two directions among these nodes. Production information on quality, materials availability, and production status must flow to customers while information on orders, inventory levels, specifications, and change orders flows to the supply chain.

7. Enable Collaborative Maintenance and Manufacturing Support. As delivery promises must be met it will be necessary to avoid equipment failures and downtime through effective Plant Asset Management Systems.

The software systems industry has developed many products that are applied in various places in the enterprise and supply chain hierarchy. Manufacturing enterprise collaboration does not have a specific collaboration software product that addresses the needs outlined in this chapter but there are two applications that seem particularly appropriate for use in manufacturing enterprise collaboration activities. Plant portal solutions and the closely related category of enterprise manufacturing intelligence applications are gaining acceptance as tools that can be used to aggregate, analyze, and present information generated by disparate plant-level systems and process control solutions.
Portals are websites that allow a specific group of users to access, view, and interact with specific data items and software applications. The idea is to gather and integrate data and applications needed by a user into a virtual single repository. Although they are relatively new to most businesses, portal development has gone through three stages, beginning as simple websites that allowed employees to view company news or employee benefits. The next generation brought information from outside the company to include such things as stock quotes, maps, and other extraneous information. The next generation provided access to structured information for analysis and began to build extensions to a broader environment. Newer systems are being developed that fit the requirements of the user organizations and provide access to a full range of data sources including existing applications such as the enterprise resource planning systems.

Newer portal applications are referred to as enterprise information portals (EIP) and should meet these characteristics:

**Single Point of Access**—The portal can provide a single point of access for all corporate data. The enterprise information portal should be designed to collect information from a wide variety of heterogeneous data sources into a single repository. Users can search the repository, or the portal can be configured to alert users when new, pertinent information is added.

**Knowledge Management**—By providing a single point of access an enterprise information portal establishes the infrastructure necessary for knowledge capture and sharing. A key to sharing data is the ability of users to publish documents to the portal, and to subscribe to information they require or are interested in. The publish-and-subscribe model allows workers in different departments, locations, or companies, to easily share business-critical knowledge.

**Corporate Customization**—Companies can customize the portal to provide access to a range of applications and data sources. Roles can be defined by the system administrator and applied to categories of users, such as marketing, sales, engineering, manufacturing, accounting/finance, human resources, customer support, or senior managers. Corporate customization also includes defining security policies and procedures, and defining how data will be categorized in the portal.

**End User Personalization**—Corporate users can personalize their portal interface by selecting from the catalog of data sources and applications they have access to according to the parameters of their assigned roles. The personalization process allows users to quickly locate information they require and filter out information that is extraneous.

This increases productivity by reducing the amount of time wasted locating and consolidating information situated in a variety of heterogeneous sources.

The Extended Enterprise—An enterprise information portal addresses the challenge of streamlining supply chains, by providing to business partners secure, controlled access to corporate data and application. These business partners include suppliers, distributors, OEM/VARs, and customers. The enterprise information portal allows companies to increase competitiveness by accelerating the flow of corporate information.

Another software tool called a Manufacturing Intelligence System is being applied in many industries. This off-the-shelf package is designed to collect data from the many plant focused devices and systems and to bring appropriate information into context for presentation and analysis.
The application processes include:

- Extract real-time process and production information from all plant focused systems, leaving each source unchanged.
- Aggregate the information providing context to data from dissimilar sources and correlating it as if it came from the same system.
- Transform the information into actionable manufacturing intelligence through customizable analytics.
- Personalize the information for each user.
- Deliver the information to browsers, wireless devices and enterprise business applications.

The tie between these systems and collaboration efforts is straightforward and direct. Both are about sharing information across a broader range of people for the purpose of making better decisions.

After even a simple review of the existing condition in your manufacturing enterprise it is very likely a number of opportunities will be obvious. Collaboration opportunities in this category are much like choosing little improvement tasks around your house. If you cannot find them you are not looking very hard.
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