COLLABORATIVE MANUFACTURING EXPLAINED

A MESA International White Paper

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1.0 Purpose

This paper explains a strategy that MESA refers to as “Collaborative Manufacturing.” In Collaborative Manufacturing, designated individuals and organizations – both internal to a manufacturing enterprise and extended to its suppliers, customers, and partners – work together for mutual gain. The objectives of Collaborative Manufacturing are to streamline end-to-end business and supply chain processes and provide a more comprehensive and accurate information base from which to make decisions. MESA’s Analyst Partners cover such concepts with specific models.

Collaborative Manufacturing allows multiple groups to act together as they set plans and policy, agree to actions, and execute operations. Collaborative Manufacturing can boost responsiveness, agility, and customer-centricity. It also fosters the most cost-effective methods to design, source, make, deliver, and service standard, mass-customized or to-order products.

An effective Collaborative Manufacturing strategy requires business processes to include more inputs and interactions than most traditional processes. To support Collaborative Manufacturing, information systems must integrate and aggregate information from across the manufacturing business and from its suppliers, trading partners, and customers. It must also provide the means to intelligently distribute that information across various business entities.

This paper explains the market trends and drivers for Collaborative Manufacturing, its impact on business processes, and solutions that support the evolving needs. Other MESA white papers will address the benefits and implementation considerations for Collaborative Manufacturing solutions. Understanding how to leverage such solutions to support critical business processes and corporate strategy is one of the key offerings that MESA provides to the manufacturing community.

2.0 Background & Market Drivers

2.1 Background

Manufacturing companies have increased their productivity and efficiency over time by implementing new strategies, business processes, and IT solutions. Strategies have ranged from total quality management to lean manufacturing and Six Sigma to customer-centricity. Improved business processes and supporting software solutions have brought more accuracy, visibility, consistency and efficiency to manufacturing companies. Manufacturing productivity grew 4.5% in 2002 as reported by the US Bureau of Labor Statistics, even as the economy in general was considered at the time to be sluggish at best.
However, there is an increasing recognition that companies are competing as supply chains, not individual entities. For today’s manufacturers, business processes such as produce-to-pay and concept-to-delivery involve a number of different organizations, both within the company and across companies in a supply chain or value network.

To maintain a competitive edge, manufacturers must make a major shift in strategy to effectively synchronize activities among functionally and geographically dispersed groups. Those with whom they need to collaborate include:

• customers and, in some cases, their customer’s customers;
• distributors and channel partners;
• materials and sub-product suppliers;
• outsourced or contract manufacturers;
• logistics partners for distribution, warehousing, and transportation;
• providers of services such as legal and regulatory advice;
• multiple departments and divisions within their own company and with any of those entities described above.

A Collaborative Manufacturing strategy can help a company maximize the effectiveness of its value chain in order to better control profits and address changing market demands. MESA’s definition of Collaborative Manufacturing: A strategy by which all appropriate individuals and organizations – both internal and external to the legal enterprise – work together.

The objectives of such a strategy are to streamline end-to-end business and supply chain processes and provide a more comprehensive and accurate information base from which to make decisions.

Collaborative Manufacturing strategies will play a crucial role in helping world-class companies increase business value in the emerging global economy. To successfully meet marketplace requirements, manufacturers must create business processes that leverage shared information. Fortunately, the Internet provides a relatively low-cost and widely available communication infrastructure to support such processes.
A proper Collaborative Manufacturing application infrastructure combines real-time operational information with supply chain, enterprise planning, product lifecycle, and customer relationship investments. It further provides secure access to authorized individuals and organizations for rapid collaboration to resolve issues as they arise in design, planning, operations, and execution (Figure 1). The end result is responsive, high-velocity supply chain performance that delivers on the promise of manufacturing excellence.

![Collaboration Diagram](image)

**Figure 1:** Collaboration works with data from many different systems, and across all levels and phases of the enterprise, from planning to operations to execution.

### 2.2 Market Drivers

A variety of trends are driving manufacturers toward Collaborative Manufacturing. Producing the right product at the right-quality, right-price, and (ready for delivery at the) right-time to meet market needs is still a fundamental need. However, each of these measures of what is “right” has ever-higher benchmarks.

Customers can now demand shorter lead times, customized products, and better quality, while comparing prices freely. This is partly because mergers and acquisitions (M&A) have consolidated buying power into fewer customers’ hands in many markets. Further, the Internet empowers customers with more information for negotiation.
The impact of each partner’s performance on achieving these goals is increasingly obvious - be it supplier, outsourcing partner, or customer. The agility to accurately promise and quickly deliver increasingly customized products or new products requires synchronization across a broad scope of manufacturing activities performed by multiple organizations:

**Designing** the right product is a matter of understanding customers’ true needs and desires through marketing and sales, customers and channels. This requires collaboration between customers and internal & partner design and production groups.

**Supply** increasingly relies on outside materials suppliers and outsourced production partners for product quality, cost, and timeliness – from concept through production and innovation cycles.

**Delivery** at the right time involves not only production, but also sales and order promising, and partners in distribution, transportation, supply, and production.

The following market trends compound that complexity further, and drive greater pressure for Collaborative Manufacturing:

- Globalization of production & distribution
- Outsourcing of manufacturing & private label production
- Rapid innovation for market leadership and growth
- Customer-centered and customer-driven production enterprises
- Mass customization – flexibility for both Make-to-Order and Make-to-Demand
- Increased quality at ever-lower costs
- Meeting increasingly stringent regulatory compliance while maintaining adequate profitability
- Responding to major trading partners’ requests for collaboration and information
- Staying competitive in the face of market trends in various regions and buying groups
- Complex, global distribution networks, requiring the right stock levels of products in the right place at the right time
- Radically reduced time-to-market to capitalize on continually decreasing buying windows.
2.2 Implications

Collaborative Manufacturing will have a different emphasis for companies in different vertical industries, and even within a vertical or sub-vertical industry for companies that hold different positions in the supply chain or that choose to compete on a different basis. The processes and business partners involved can vary greatly.

Many companies are moving to mass customization, make-to-order (MTO), or make-to-demand strategies to address customer demand and increase margin. These strategies bring upstream production and supply activities closer to the actual demand, allowing for lower inventories throughout the value network. With lower inventories, it’s even more important to have instant views of orders, status, and configurations, coupled with collaboration to resolve issues as they arise.

Most manufacturers are also focusing on providing customers visibility and information. Depending on the industry, this may involve batch records, product history and materials genealogy, visibility into order status from order entry through production phases and shipment, quality metrics and Certificates of Analysis (CoA), and process and calibration information. Many companies now find that shipping this information is as important to their customers as shipping the actual products. These records require data collected from suppliers, testing labs, and plants.

Accurate maintenance and correlation of this information across a manufacturer’s plants, with further integration and correlation to the materials from suppliers and partners, is critical to analyzing the root cause of issues related to returned goods. Companies that lack this product history capability may not be able to take timely and appropriate corrective action across the supply chain. Thus, they may not be able to fulfill orders with quality product and their short-term agility will be decreased due to repair or scrap activities; that is, the need to re-produce orders will impact the existing orders and increase the potential for lost opportunity. It can also create unduly large warranty liabilities on the balance sheet, hurting profits.

Functional boundaries within a corporation are also becoming blurred, as a result of many departments’ contributions to each business process. Because of the speed of change in today’s businesses, it is critical that the information on which groups collaborate is up-to-date and timely. In summary, business processes that were once fragmented by department and function are now integrated, and must flow smoothly. They span across an enterprise, and also between an enterprise and its trading partners.
3.0 Aims of Collaborative Manufacturing

Implementing a Collaborative Manufacturing strategy can be thought of, in simple terms, as:

1. Identification of critical business processes across a manufacturing company, even as those processes extend out to its customers and its network of trading partners; and then
2. Making those business processes as efficient and flexible as possible to meet both the market demands of today and the “unknowns” of tomorrow.

For many companies, their first need is to identify those business processes – those critical to achieving the strategic goals of the company – and the people they involve and the information systems that support them.

From there, making those business processes as efficient as possible requires not only the alignment of the various organizations within a company and its partner network, but it also means:

- Implementing the appropriate configuration of the individual systems so that they can work together and can be synchronized, and
- Automating the flow of data and information between the systems and the people who use them so that the synchronization and accuracy of information shared between systems is done in a relatively real-time manner.

In order to achieve the “agility” to meet tomorrow’s yet unknown business needs, a key component of a successful Collaborative Manufacturing strategy is flexible integration to enable the flow of data and information between systems.

Although critical business processes vary from industry to industry, in almost all cases a Collaborative Manufacturing strategy that covers, for instance, the top ten business processes of a manufacturing-oriented company will touch the various functions (and the information systems used in those functions) within that company. It will also focus on areas where the company works with its suppliers, customers, and other business partners.

For example, strategy, forecasting, and planning may be collaborative; product and process design are increasingly collaborative; operations and execution also span multiple partners that can be more effective with better collaboration. Even management and metrics should extend beyond the “four walls” of a manufacturing business to suppliers and partners.

Additionally, a process cannot be judged unless there are metrics to measure its success. While a company may have metrics in place, a successful Collaborative Manufacturing strategy will re-examine those metrics to understand which processes (or portions of processes) affect those metrics and also to identify their contributing factors to pinpoint other metrics.
Companies must track performance and correlate it to business processes. The impact of improvements or changes on business metrics must be understood.

The same process improvement concepts that have been applied on the plant floor for many years are now being more effectively applied to the other business processes of a corporation. The major difference is that these measurements and business processes cross not only plant boundaries, but span departments and, in some cases, beyond the enterprise to business partners.

Creating consensus on ‘what to measure’ and ‘how to measure’ across these various groups is usually a first-time experience for companies. As a result, for many organizations developing metrics for collaborative manufacturing can require major changes. These changes may range from how individuals perform their jobs, to new ownership of inventory, to changes in HR policies, and changes in incentive systems.

4.0 Business Process Change Considerations

As with all sound business practices, Collaborative Manufacturing focuses on eliminating inefficiencies while achieving maximum effectiveness. At the time of this writing, most companies’ collaborative business processes have not been fully mapped out, and appropriate metrics usually are not in place. In many instances, a collaborative process will require different extended roles and responsibilities to accommodate participation by more individuals and groups. Agreement on updated or new business processes is the foundation for success in implementing Collaborative Manufacturing strategy.

Key considerations for business process implementation or change to execute a Collaborative Manufacturing strategy include:

- **Who:** What groups does a process impact and how? Collaborative Manufacturing processes may directly impact an individual’s or department’s ability to meet their current goals, or they may affect what information and resources are readily available to them to get their jobs done.

- **What:** How to gain agreement among various groups that will collaborate. This involves designing the process jointly, then negotiating and setting up plans and performance targets, appropriate exception limits, roles and responsibilities, and joint metrics.

- **Where:** What are all of the sources of data for each decision in this process? The people and systems involved need to prepare – and usually filter and secure – data for input into the process. Additionally, the ownership of information (designs, procurement plans, etc.) often changes in such a re-engineering process.
• **Interactions:** What other processes are interdependent with this one, and will changes in this process require changes in other processes to keep all of them effective? Mapping interdependencies up front is critical to success with a minimum of unpleasant surprises upon deployment.

• **How:** What are the key points to monitor in order to keep this process on track and all parties meeting their metrics effectively? Metrics may need to be collected by different organizations and business entities, making it tricky. But you can’t manage what you can’t measure; so developing measurement systems is a key to ongoing success.

• **When:** For which changes and exceptions does each party need to be alerted? It is critical to set alert thresholds for each player to allow management by exception – without being overwhelmed with alerts.

Success with Collaborative Manufacturing strategy rests firmly on having processes, targets, exceptions, and metrics established up front. As the parties work together more tightly, all of these elements may be refined. Participants are likely to streamline process flows, revise what constitutes an exception or change worthy of notification, and refine ways of measuring success as they learn.

A successful Collaborative Manufacturing effort requires commitment and often a change in corporate and operational mindset – but the near- and long-term benefits are considerable. To summarize: implementing a Collaborative Manufacturing strategy is an insurance policy for the efficiency and agility of a company today and into the future.

Some examples of Collaborative Manufacturing opportunities:

• Initiation of new product development efforts using a broader range of input and review from extended enterprise partners and customers

• Improving a product design for manufacturability and supply using the full range of competencies within the supply chain network

• Synchronizing the inventory across the supply chain beginning with first tier suppliers

• Providing schedule information to support production output that meets actual demand, not just forecasted or assumed demand

• Improving logistics cost across the supply chain network

• Reducing the time-to-market and time-to-volume for new products

• Reducing the manufacturing cycle time across designated suppliers and outsourced partners.
• Developing a formula to measure overall supply chain cost in order to better rank opportunities for tactical initiatives using this metric as a basis for decisions

• Improving supplier responsiveness and service by sharing quality issues with them on a more real-time basis

• Initiating a benchmarking performance review of the supply chain network

• Examining how collaboration might be used to more closely align production with distribution channels

5.0 Solutions Landscape and Supporting Technologies

Collaborative Manufacturing business processes reach across the entire manufacturing business and trading partners. As a result, the software systems infrastructure to support Collaborative Manufacturing must combine supply chain, enterprise, plant floor, design engineering, product lifecycle, and customer relationship investments.

There are many manufacturing enterprise solutions that support a Collaborative Manufacturing strategy (see Figure 2 below). These solutions can be grouped into several major categories:

• Product Information Focused Solutions – PLM/PDM, CAD/CAM/CAE, EDA, Visualization, Formulation and Recipe Management, etc.

• Supply Chain Focused Solutions – SCM, APS, Demand Management, SRM, Strategic Sourcing/Procurement & Buy-side e-Commerce, Supply Chain Control

• Production and Process Information Focused Solutions – MES, Process Optimization, EAM/CMMS, SCADA, CAPP, CAPE, PLC, DCS, OCS, Auto ID, Test, LIMS, SPC/SQC, Quality Management, DNC, Work Instructions, Labor Management, etc.

• Regulatory Compliance Focused Solutions – Document Management, ISO 9000 & variants, ISO 14000, EH&S, and Returns and Warranty management, etc.

• Distribution & Logistics Focused Solutions – Logistics Management, WMS, TMS, International Trade Logistics & Management, Wireless location tracking, etc.

• Customer Information Focused Solutions – CRM, Demand Management, Marketing Management, Configurator, Sell-side e-Commerce, Content Management, Sales & Marketing Automation, Field Service Automation, etc.

• Financial Information Focused Solutions – ERP, Accounting, Cost Management, Strategic Pricing and Profit Management, etc.
Broad-based Collaborative Solutions – SCEM, e-Commerce, XRM, Knowledge Management, e-Meeting, EAI, workflow, analytical applications, business intelligence, performance management, and etc. are not application specific, but can apply to many areas.

To fully support timely and distributed information flow for Collaborative Manufacturing, companies will need to pull information from, feed information to, or correlate information between these types of systems. These systems span the entire supply chain set of processes, from design to planning, sourcing, making, delivering, and returns. A company may already have these systems, or some form of them, in place – assessing if they can adequately support Collaborative Manufacturing is an important task for successfully implementing such a strategy.

In each functional area described in Figure 2, different enterprises and value chains will use various combinations of these solutions to support the businesses processes they require. Some of these solutions support collaboration directly with workflow mechanisms, integration means, interactive workgroup tools, etc. Others provide essential information on which collaborative processes rest, and yet others need the output of collaborative processes to operate most effectively.
The MESA Glossary spells out and briefly defines these categories of solutions. MESA aims to clarify which systems most commonly deliver various functions and how they interact through additional white papers and educational materials. The scope of any given commercial software may vary, however, and may not reflect in whole these definitions. Specific vendors’ systems may include more than one type of function listed, or may have specific sub-functions within a category or type. Solution scope and depth are some of the key ways in which manufacturing enterprise solutions differ to suit various industry, customers, and strategy needs.

6.0 Summary & Conclusion

Collaborative Manufacturing is a strategy by which supply chains can effectively compete. It is a way for a company to become more efficient and agile both internally and in the way it works with its suppliers, partners, and customers. It is a way to improve the performance of existing company metrics and to enable measurement of new ones that cover the effectiveness of many functional entities together. Implemented with the appropriate manufacturing enterprise solutions, Collaborative Manufacturing improves decision-making processes and increases the speed by which adjustments and appropriate corrective actions are made. These processes tie together demand, design, sourcing, production, and service in ways that reflect their inter-relationships and financial impacts.

Collaborative Manufacturing – that is, people and the systems they use working together to support critical business processes – is essential to the level of agility, flexibility, low cost, customer responsiveness, and financial success required in today’s markets. Collaborative Manufacturing supports the extended enterprise’s ability to innovate, execute, and operate profitably. A wide range of information system solutions must come together to support Collaborative Manufacturing. They must integrate the data and information between the various individuals, departments, and trading partners that affect the performance of critical business processes.

Manufacturing businesses are constantly looking for ways to improve efficiency and productivity – it is the manufacturer’s best way to positively impact margin and market flexibility. Collaborative Manufacturing is the next step in the progression of manufacturers looking to positively impact their business success. Implementing a Collaborative Manufacturing strategy is a question of ‘when’: will it be a pro-active initiative to achieve competitive advantage or a re-active response to market pressure?
This paper is one of many that will address key topics of Manufacturing Enterprise Solutions and the Collaborative Manufacturing strategy they support. Additional White Papers will focus on the benefits of Collaborative Manufacturing, describing the opportunities available throughout an enterprise and its supply chain trading partners. A MESA Glossary is also available to explain terminology and acronyms. Visit www.MESA.org for ongoing information and updates.

Contributors:

Paul Ashmore . . . . Teradyne
Julie Fraser . . . . . Industry Directions
Charlie Gifford . . . ASECO Integrated Systems Ltd.
Jonathan Kall . . . . Interwave Technology
Michael McClellan Collaboration Synergies Inc.
Ram Prabhakar . . . EDS
Rob Rudder . . . . . Camstar