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Issues and Trends in Manufacturing

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2008

Published: September 2008

Executive Summary

The increased integration of technology, operating and quality models, and integrated business models will be essential to helping the US manufacturing sector survive and remain competitive in the global economy. But which are the best methods, systems and practices to employ and how they can most effectively be implemented?

- What are the business strengths required for sustainable competitive advantage?
- What are the current business weaknesses, and how are they corrected?
- What is the value that each process and system delivers?
- What are the risks?
- Do the systems driving each process deliver the appropriate information for optimal process and business performance?
- How do these processes and systems interact and what are their interdependencies – both internally and externally?
- What processes and systems need to be improved or abandoned?
- What skills are required to support each process and system?
- Who has business ownership and accountability for each process?

The answers to these questions help to define the organization's Enterprise Business Architecture. The Enterprise Business Architecture identifies the core components of the business and their relationships to all

internal and external entities, and the events that trigger action. It is a definition of what the business must produce to satisfy its customers, compete in a market, deal with its suppliers, sustain operations and care for its employees. It is comprised of processes, workflows, technologies, resources and events.

By evaluating the risk, opportunity and value of each component of this Enterprise Business Architecture, companies can ensure that the design and capabilities of that architecture will be aligned with strategic imperatives and will be able to effectively support the business.

Background

The manufacturing sector in the US has long suffered from foreign competition and its lower production cost model. The reaction to that competition has evolved as the nature and extent of the competition has changed. The use of technology and adoption of new quality and operational models has been a key factor in the U.S. manufacturer's ability to survive the globalization trend of the past few decades.

Initially the focus was on quality, as US carmakers and other durable product manufacturers struggled to match the higher quality of products being produced in Japan and Europe. The purpose of this focus on quality was, to a great extent, intended to help protect the U.S.-made products from market erosion. These products, such as cars and defense-related products, were typically mature, in strategic industries, and manufactured using specialized equipment requiring massive capital investment and were impossible to change quickly.

Focus then turned to shop floor productivity, and technology was the key driver. The increased use of Programmable Logic Controls ("PLC") replaced outdated and limited functionality of relay logic and manual systems.

Further progress was then made using more accurate and efficient management of resources and integration to "back-office" systems with software tools such as Materials Requirements Planning ("MRP"), Master Production Scheduling ("MPS"), Advanced Planning and Scheduling ("APS") and other sub-systems within the Enterprise Resource Planning ("ERP") systems umbrella.

With the advent of Manufacturing ERP systems, focus again shifted toward the shop floor with Manufacturing Execution Systems ("MES"), Supervisory Control and Data Acquisition ("SCADA") systems, as well as other specialized shop floor-centric systems and the more pervasive utilization of manufacturing methodologies. These methodologies, such as Lean Manufacturing, Six Sigma, Just-in-Time (JIT), and Demand Process Management have been used with much success to address productivity, quality, efficiency, reduction of waste, etc.

Issues and Trends

Currently manufacturing "Leaders" are looking to more effectively integrate their shop floor control systems, production demand management and execution systems, and ERP systems.

Manufacturing "Followers" are still in the MES and production demand management system implementation level of maturity, while the "laggards" are still struggling with

implementation and effective utilization of basic Lean Manufacturing and ERP principles.

In spite of all the improvements made over the past two plus decades, some of the same issues continue to plague the manufacturing sector in the US:

- Increased global competition
- Increasing market demand for high-quality products at lower cost
- Escalating costs
- Increasingly dynamic market changes and patterns of customer demand
- Shortage of appropriately skilled resources

Some more recent dynamics that have created more pressure on U.S. manufacturers include the increased global demand for raw materials and other resources, as well as the wildly fluctuating currency markets.

All of these issues drive the need to:

- Reduce operating costs, while maximizing long-term profitability and increasing product quality
- Improve ability to quickly respond to market changes and customer demand
- Improve supply chain efficiency
- Improve demand planning scope and accuracy
- Improve availability and visibility of key information needs
- Close functional gaps and increase integration between back-office and shop floor systems

The increased use of technology and best-in-class operational and quality methodologies has resulted in a slight increase in the U.S. share of global manufacturing since 1980.¹

These are many commonly known practices used today that facilitate cost reduction, quality improvement and flexibility in the manufacturing environment. Some examples of these are:

- Lean Manufacturing
- Demand Flow Manufacturing
- Just-in-Time
- Agile Manufacturing
- Advanced Planning and Scheduling
- And many more

Each of these practices has its unique focus, strengths and inherent weaknesses. In addition, many of these practices and their supporting technologies are implemented, with limited integration between each other, ERP systems and external demand planning systems.

For example, Lean Manufacturing focuses on elimination of waste. Lean practices are inherently less flexible than Agile Manufacturing practices, performing best when there is a stable demand pattern. Conversely, Agile Manufacturing tends to create more waste. Demand Flow Management combines the best of Lean and Agile, but requires the ability to manufacture based on real demand and product delivery within customer specified timeframes. Just in Time focuses on strict management of delivery schedules, reduction of inventory, and related carrying costs, but calls for upstream suppliers to carry much of the burden of these tighter requirements.

Today's manufacturing environment is one of highly variable demand, demand for consistently high quality product, and rapid market response. Adaptive Manufacturing focuses on enabling a convergence of Lean and Six Sigma principles for early identification of exceptions and rapid response, resulting in continuous quality improvement.

All of these practices require strong operational discipline and controls, efficient processes and effective information management.

None of these manufacturing practices is ideal for every manufacturing company and none are most effective when implemented in a "purist" manner. The specific qualities of the company's customer base, demand stability, geographical location, supply chain characteristics, strategic direction, etc. must all be considered when determining the appropriate practices to implement and how they should be implemented to achieve maximum results and bring sustainable value to the company.

In order to optimize the response to global pressures, U.S. manufacturers need to use a hybrid model for implementing and integrating available systems, tools and methodologies, based on their specific market, customer, financial and regulatory pressures, as well as internal constraints and strategic imperatives.

The following table illustrates the actions, capabilities and enablers that best-in-class companies use to address these pressures:

¹ Thomas Duesterberg, Manufacturers Alliance/MAPI

Pressures	Actions	Capabilities	Enablers
Reduce Manufacturing Operating Costs and Maximize Long-term Profitability, While Increasing Product Quality	<ul style="list-style-type: none"> • Use industry and company specific approach to implement and sustain a Lean environment • Adopt and share best practices • Establish transparent risk management across the enterprise • Establish operational metrics linked to financial metrics • Optimize asset utilization 	<ul style="list-style-type: none"> • Establish clear business accountability and sustained executive support • Establish and standardized Key Performance Indicators ("KPIs") across the enterprise • Establish Knowledge Management vehicles that collect financially-related data automatically and distribute based on functional roles and responsibilities • Standardize the risk assessment process across the enterprise 	<ul style="list-style-type: none"> • Lean and Six Sigma Principles • Process Simulation • Business and Manufacturing Intelligence • Knowledge Management, KPIs, Dashboards • Advanced Planning and Scheduling • Manufacturing Execution Systems • Quality Management Systems • Statistical Process Control • Automated workflow management tools • Enterprise Risk Management systems • Asset Management systems
Improve Ability to Quickly Respond to Market Changes and Customer Demand	<ul style="list-style-type: none"> • Standardize and accelerate manufacturing and non-manufacturing processes • Synchronize external demand with manufacturing execution • Improve visibility and transparency across all business functions and departments • Leverage Lean principles 	<ul style="list-style-type: none"> • Establish an Enterprise Business Architecture model • Obtain Executive sponsorship of demand manufacturing initiatives • Measure throughput and efficiency frequently – at least daily • Measure On Time Delivery (OTD) daily or in real-time • Integrate demand and operational data to support actionable planning and intelligent response • Align operational, demand and supply chain activities to management goals, objectives and metrics 	<ul style="list-style-type: none"> • Lean manufacturing systems • Advanced Planning and Scheduling • Automatic WIP limiting • Automatic exception alerting • Automated lot sizing • Demand analytics and trending • Financial planning and budgeting • Automated workflow management tools • Knowledge Management, KPIs, Dashboards

Pressures	Actions	Capabilities	Enablers
<p>Improve Supply Chain Operational Efficiency</p>	<ul style="list-style-type: none"> • Optimize the supply chain network • Right-size capabilities and capacities of assets • Allocate demand to assets that meet service requirements for lowest cost • Improve processing operations through better use of technology, equipment layouts, material and information flow, methodologies, and labor and asset utilization • Minimize transportation spend without sacrificing OTD • Collaborate with supply chain partners • Fully integrate purchasing systems with production planning, demand and delivery systems 	<ul style="list-style-type: none"> • Build flexibility into network operations, that handles fluctuations and exceptions • Have minimum inventory investment that achieves order fulfillment objectives • Position inventory to minimize costs/handling • Fully utilize cubic space in storage and on vehicles to minimize overall cost • Forecast finished goods demand at the SKU level • Better utilize labor across functional areas and over daily/seasonal fluctuations • Use strategies like postponement and supplier collaboration to add value • Use performance metrics results to improve • Employ Supply Chain Execution Systems • Achieve complete visibility of all inventory in supply chain 	<ul style="list-style-type: none"> • Network Optimization Tools • Value-Stream Mapping • Process Flow Modeling, CAD, Simulation • Warehouse Management Systems • Demand Forecasting Tools • Transportation and Yard Management Systems • KPIs, Dashboards • Labor Standards, Planning Tools and Incentives • Advance Shipping Notices (ASNs) • Import/Export Systems • Technologies such as RFID, Voice-Direction • Unit Load and Outbound Vehicle Load Design • Inventory Slotting Tools
<p>Improve Demand Planning Scope and Accuracy</p>	<ul style="list-style-type: none"> • Evaluate desired Demand Planning capability based on costs and benefits • Refine the Demand Planning process • Manage forecasts over planning time horizon: <ul style="list-style-type: none"> • Predictive modeling • Item and Customer Hierarchies • Causal factors • Market trends • New product introductions and transitions • Simulation • Collaboration • Measure Demand Planning accuracy 	<ul style="list-style-type: none"> • Historical sales and other market forecast data are systematically integrated with Demand Planning and analytics systems • Flexible Demand Planning User Interfaces • Aggregated market and customer specific demand data is systematically interfaced with advanced planning, Lean and ERP systems 	<ul style="list-style-type: none"> • Full scope demand planning and analytics systems • Collection of relevant metrics and historical data • Financial planning and budgeting • Knowledge Management, KPIs, Dashboards • Integration between demand planning, analytics systems and demand manufacturing systems • Internal and External collaboration tools

Pressures	Actions	Capabilities	Enablers
Close Functional Gaps and Increase Integration Between Back-Office and Shop Floor Systems	<ul style="list-style-type: none"> Establish a Manufacturing Execution System (MES) platform to facilitate integration Identify and implement high value integrations between all manufacturing, business front-end and business back-end systems 	<ul style="list-style-type: none"> Product design and planning systems integrated with backend ERP via MES, APS and Lean Quality Management Systems integrated with backend ERP via MES, APS and Lean Shop floor control and statistical process control systems integrated with backend ERP via MES, APS and Lean systems Supply Chain systems integrated with backend ERP via MES, APS and Lean systems 	<ul style="list-style-type: none"> Manufacturing Execution Systems integration Supply Chain systems integration Advanced Planning systems integration Shop floor control and statistical process control integration API or custom integrations, where required

Auxis Point of View

Developing an Enterprise Business Architecture model is a critical step in determining which blend of practices, systems and processes is appropriate for the company, based on its unique characteristics. Enterprise Business Architecture is a formal way of describing the key components of your business and their relationships.

This framework creates visibility into the integrated nature of the enterprise, its processes, technology platforms, capabilities, external dependencies, organization, and strategic initiatives and imperatives.

This visibility allows a company to understand and obtain agreement on:

- What you do and what you no longer need to do, end-to-end, for all functions, at all locations

- How these processes and systems interact and their interdependencies
- What each process and system delivers and how it produces those deliverables
- What skills are required to support each process and system
- Which business strengths are required for sustainable competitive advantage
- Which business weaknesses exist and what are the required actions for improvement
- Who in the business owns and is accountable for each process

... as well as the ability to:

- Effectively and accurately measure performance
- Visually monitor actual performance against Key Performance Indicators
- Simulate change *BEFORE* implementing change

This model also provides additional context for the PACE analysis, helping to highlight where potential value can be gained through the implementation of specific systems, practices and processes. Functional roles, responsibilities and clear accountability also gain visibility through the formalized definition of enterprise business and technology components and their relationships.

More tactical areas of focus can then be addressed effectively, based on a planning and execution methodology that addresses all relevant components of the enterprise, as well as their internal and external dependencies and relationships, within the context of strategic business objectives and priorities. These include:

- Supply Chain Optimization
- Program Portfolio Management
- Manufacturing-Business Systems Integration
- Full Life-Cycle Demand Planning and Analytics
- Knowledge Management / Dashboards
- Outsourcing of non-core, low value processes, via Managed Services

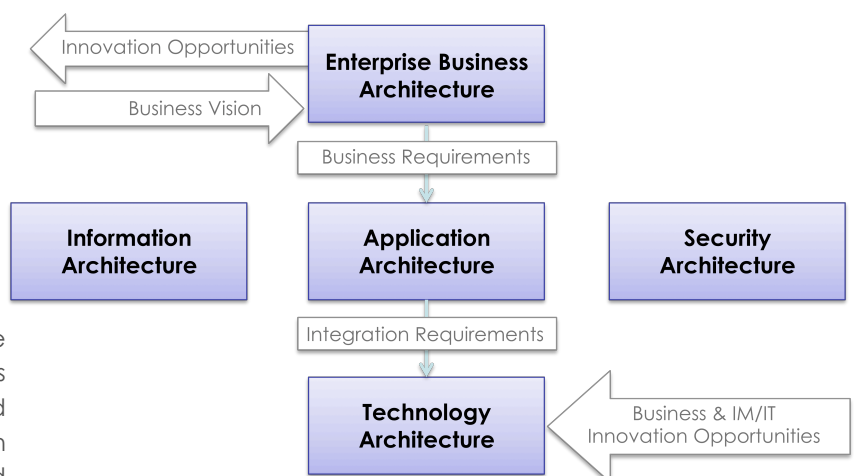
About The Author

Doug Montgomery is the Director of Management Consulting Solutions for Auxis, Inc. and has over 25 years experience in manufacturing systems and operations including FDA and NRC regulated manufacturing, ISO and CQI certification processes, manufacturing engineering and

process planning, establishing continuous quality and lean manufacturing programs for single and multi-site manufacturing operations in the U.S. and internationally.

Doug was a pioneer in the areas of Mass Customization, Cellular Manufacturing, Adaptive Demand Manufacturing and Load Balancing in multi-site manufacturing companies. Doug was also the chief architect of the Program Portfolio Management Office and Value Chain Risk Management methodologies, developed at Millennia/EMC and Deloitte & Touché. These methodologies are currently used at numerous Fortune 500 companies and government agencies.

Figure 1 Conceptual Overview – Enterprise Business Architecture





Auxis is a leading Management Consulting firm located in the Coral Gables, Florida area. Auxis' Supply Chain Excellence Practice believes in a practical, "back to basics" approach to help our clients buy, ship, and store right. Our methodology is designed to provide our clients with real-world business solutions anchored by solid financial analysis.

Auxis can help you to adapt your supply chain for the benefit of your customers, business partners, and shareholders through service offerings such as sourcing and procurement, strategic evaluation, network design, provider selection and deployment, and IT supporting infrastructure, selection, and deployment.

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