synchrono®
manufacturing software

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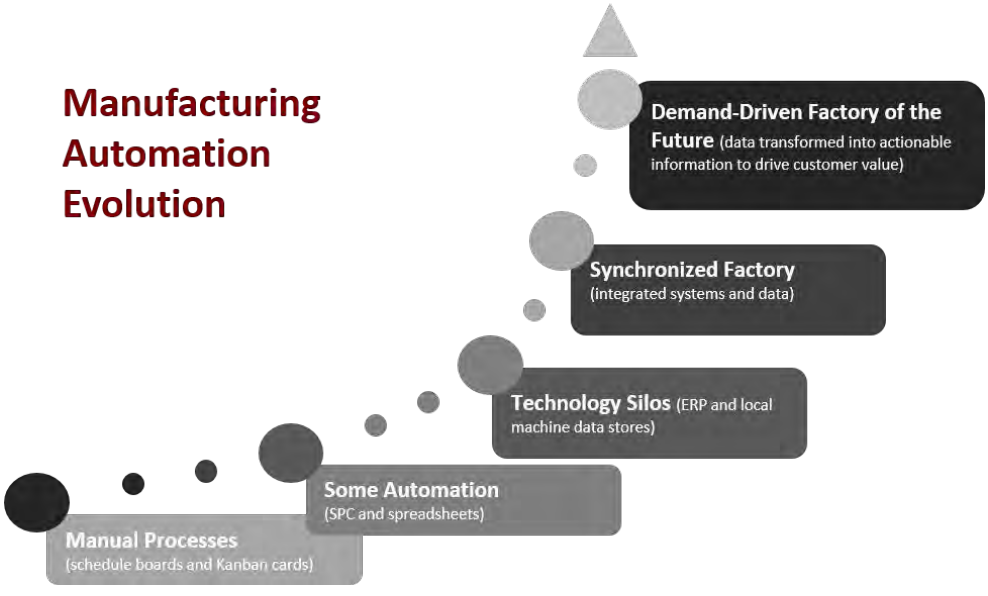
Introduction | The Demand-Driven Manufacturing Evolution

Production has stopped and* no one *is scurrying around to take care of the flashing red lights. An event that at one time would have caused serious downtime is now only a blip, thanks to the evolution of manufacturing technology. Today, the appropriate employees would be instantly notified of the outage and the problem quickly fixed because the factory is digitized and connected in real-time. Everyone - management, maintenance, production, planning, scheduling and more – have visibility into the production process because they are all on a single, synchronized platform.

In an afternoon continuous improvement (CI) meeting, some team members are clustered around a large flat screen —while others are accessing the same information on their smart phones miles away. The entire team comes to an agreement quickly because all of the facts are visualized. Enabling this is technology based on proven, demand-driven methodologies that encompasses the best of Lean, Six Sigma, and Theory of Constraints (TOC) principles. Enterprise, system and machine-level data is transformed into actionable information — making this CI meeting more collaborative and effective.

Using demand-driven principles and synchronized systems, manufacturers have learned to reach new levels of communication, growth and customer responsiveness. Every forward-thinking manufacturing environment is somewhere on the path toward becoming more synchronized and demand-driven. Where are you?



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Demand-Driven Concepts

Lean - In Lean manufacturing, the flow of production is accomplished by eliminating *mura* (unevenness), also known as production leveling. Pull is accomplished by the use of Kanban and Heijunka (sequencing or smoothing). Lean philosophy believes that using resources for anything but creating value for the end customer is wasteful, and should be eliminated.

The *gemba* walk, much like Management By Walking Around (MBWA), is an activity that takes management to the front lines to look for waste and opportunities to practice *gemba kaizen,* or practical shop floor improvement.

Theory of Constraints (TOC) - A holistic management philosophy developed by Dr. Eliyahu M. Goldratt that is based on the principle that complex systems exhibit inherent simplicity, i.e., even a very complex system made up of thousands of people and pieces of equipment can have at any given time only a very, very small number of variables – perhaps only one (known as a constraint) – that actually limit the system's ability to generate more goal units.*

Five Focusing Steps - These describe how the TOC works to 1) Identify the constraint; 2) Exploit the constraint; 3) Subordinate everything to the constraint; 4) Elevate the constraint; and 5. WARNING!!!! If in the previous steps a constraint has been broken, go back to step 1, but do not allow INERTIA to cause a system's constraint.*

Six Sigma is an improvement methodology used to reduce errors, waste and variations, and increase quality and efficiency in manufacturing. Six Sigma-driven companies use data to examine, manage, and enhance operational performance by eliminating and preventing flaws in goods and related processes, such as design, management, production, consumer satisfaction and service delivery.

*TOCICO Dictionary 2nd Edition

During this series of papers, we will examine the evolution towards becoming demand-driven—why more manufacturers are adopting this approach and how it changes the metrics you measure and the way you manage your processes and teams to be successful. This paper sets the foundation for the series, by providing an overview of some of the conditions and technologies that are driving the demand-driven manufacturing movement.

The Era of Digital Connectivity

We define demand-driven manufacturing as a process that incorporates the best of Lean, TOC and Six Sigma principles. (See sidebar for definitions.) It describes production that is based on actual customer demand with the aim to synchronize everything (workforce, method, materials, machines, and information) in order to drive flow. This process is accelerated by technology that automates, digitizes data and connects every function within the demand-driven organization and to every layer of the supply chain.

The Industrial Internet of Things

The Internet of Things refers to connectivity between products and systems across nearly every aspect of life. This concept within the manufacturing industry is referred to as "The Industrial Internet of Things" (IIoT). For manufacturers, this is the ability to collect, analyze and share data about materials, machines and processes in the production environment, in real-time. The power of this level of information is unquestionable. As such, the IIoT will bring exponential value to those companies who know how to use it. According to a recent McKinsey Global Institute Report:

"The Internet of Things has the potential to unleash as much as $6.2 trillion in new global economic value annually by 2025. McKinsey also projects that 80 to 100 percent of all manufacturers will be using IoT applications by then, leading to a potential economic impact of as much as $2.3 trillion for the global manufacturing industry alone."[i]

Manufacturing equipment, products and planning and execution systems are more connected, allowing the people that use them to see what is really going on *as it happens.* The synchronized factory enabled by the IIoT is able to

Industrial Internet of Things

- 80-100% of manufacturers projected to be using IoT applications by 2025.
- $2.3 trillion potential economic impact

McKinsey Global Institute

visualize and effectively overcome obstacles and bottlenecks that once prevented them from responding to their true priorities.

"The *Industrial Internet of Things* has been heralded as a way to improve operational efficiency [effectiveness]. But in today's environment, companies can also use it as a tool for finding new - and unexpected – growth opportunities. Successful companies will use the Industrial Internet of Things to capture new growth through three approaches: boost revenues by increasing production and creating new hybrid business models, exploit intelligent technologies to fuel innovation, and transform their workforce."[ii]

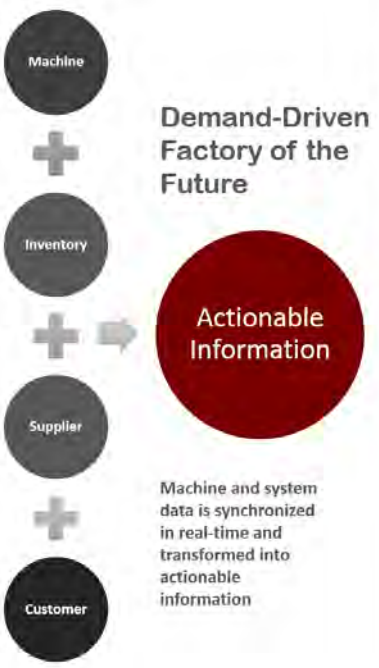
Connect, Collaborate, Compete

Research has shown that connected factories use this new intelligence to become more demand driven, and thus increase their competitive advantage. They pull together machine-level, inventory management, supplier and customer data – and transform it into actionable information. This information provides a big-picture view that identifies disruptions in real-time, coordinates a fast and effective response, and logs the cause and impact to direct your continuous improvement efforts.

In manufacturing environments, this level of synchronization and integration allows teams to see information as it happens. They can:

•Collect tag and sensor data from machines, conveyor belts, HMI screens and Environment Management Systems (EMS);
•Collect transactions from RFID tags and capture business application information in a contextualized historian;
•Analyze this granular data to pinpoint causes of production variability, quality problems or wasted opportunities;
•Use the data to support operator and resource metrics;
•Create a work-cell information board to support gemba walks, plant-wide KPIs, and plant, business unit, and corporate gold standards.

The key is that this core data is automatically collected and used to evaluate and support decisions at all levels of the organization. No more working from different data sets or pulling data from disparate business applications, spreadsheets and databases. Everyone is working from the same real-time



information which, depending on their system, they can visualize in a number of different ways.

According to Aberdeen Research, "one of the keys to a successful Lean operation is getting the baseline data and then tracking improvements. A good … strategy can accelerate Lean's impact through:

•Improved access to data
•Self-service analytical tools
•Alerting to out-of-control conditions
•Management tracking tools for prioritization of projects"[iii]

Demand-driven factories can deliver on-time orders more reliably and gain capacity to meet future customer needs. As information is gathered by the software and placed in front of the people who need to act—they become more empowered and informed to improve the way things are done. The intelligent environment gives employees clarity about what is the number one thing they could be doing right now to improve overall company performance and the information to determine how to approach it. By shortening reaction time to disruptions and bottlenecks, and by focusing on the true driver of sustained growth—improved flow – they can exceed customer expectations. World-class effectiveness in the service of the customer order (and becoming more productive when looking for ways to meet customer needs in advance by continuously improving) is how manufacturers unleash growth in a synchronized environment.

Reactive vs. Proactive: Predictive Analysis

When manufacturing systems link to every node on the supply chain and resource and transaction in the plant, in real-time, manufacturing intelligence amplifies.

A reactive environment is replaced with proactive thinking when technology enables industrial predictive analytics, the gathering of information from data and using it to predict trends and behavior patterns. When data links all of the moving parts in a manufacturing process, it can be used to create predictive intelligence to prevent flow disruptions and bottlenecks from occurring before they impact production.

For example, process engineers in such environments are now using predictive analysis triggered by machine-level "warning states" to do

preventative maintenance and repairs before the line goes down and compromises throughput. What's more, they can identify the metrics for demand-driven success with more confidence and direct these new activities with more visibility. The entire organization can align behind these metrics and experience a transformation in the way they work. This improvement in process effectiveness allows real-time demand-driven flow.

Demand-Driven Metrics

The demand-driven factory performs to flow-based metrics that are (ideally) visible to everyone on a shared technology platform in a connected enterprise. Production leaders predict and plan using three primary demand-driven metrics from Dr. Eliyahu Goldratt's seminal book, *The Goal*, to ensure that their goals - to make money now and in the future - are met:

1. **Throughput.** Throughput is calculated as the selling price of the product minus totally variable costs per unit.
2. **Investment** (I) (inventory). All the money currently tied up in the system, which the company intends to sell. As used in TOC, investment refers to the equipment, fixtures, buildings, etc. that the system owns as well as inventory in the forms of raw materials, work-in-process and finished goods.
3. **Operating expense** (OE). All the money the organization spends in turning Investment into Throughput.

There is also a critical change in mindset from traditional, unit-costing measures utilized today to measure local *efficiencies* to global *effectiveness* (see sidebar).

While data silos are still commonplace, those manufacturers who are synchronizing systems have more comprehensive, actionable knowledge about their production cycle. They gain transparency in managing customer orders, expenses and investment across the enterprise and drive for continuous improvement—improvement that leads directly to profitability and a competitive advantage.

"Efficiency" too often describes unit-costing measures which show cost savings or waste reduction on a local level. The risk is that myopic focus on these elements prevents the company from seeing what needs to change to impact the big picture.

"Effectiveness" encompasses much more than efficiency or local measurements. It describes a holistic view of a production system and philosophy that allows proactive action to improve all elements of an enterprise's supply chain. Effectiveness powered by technology benefits the business on a global scale.

"...manufacturing data can help companies grow and support the vision for a more knowledgeable, effective organization."

Real World Results

Wenger® Manufacturing, who now uses a synchronized, demand-driven production planning, scheduling and execution platform that connects to their ERP system,

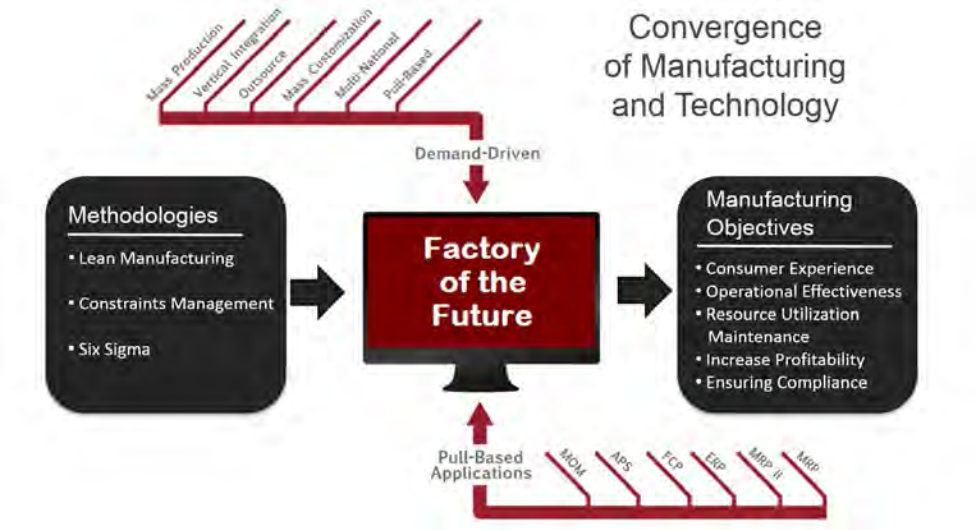
- Increased on-time delivery from 40% to 95%+;
- Experienced a WIP reduction of 15% in the first few months, and;
- Reduced stock outs of stocked parts by 25%.

This capital equipment manufacturer for extrusion processing applications returned to profitability for the first time in three years by gaining visibility to their flow and acting on these signals to meet customer demand. They also achieved the "grand prize" of sustainable manufacturing success—user buy-in: "Organizations that can centralize and consolidate their systems are more equipped to unlock the value of their data and, as a result, get buy-in from their users. When approached effectively, manufacturing data can help companies grow and support the vision for a more knowledgeable, effective organization."[iv]

Another manufacturer used their improved connectivity to achieve record capacity and improve customer lead time from three weeks to five days. New manufacturing software delivered clarity about constraints to improve flow. The connectivity that drove those changes on the floor also helped them accelerate throughput and improve delivery time. They achieved additional workforce utilization as well, effectively creating new ways for their employees to contribute to positive, profitable change and continuous improvement.

Summary | Manufacturing Intelligence for the Demand-Driven Factory

Demand-driven manufacturers succeed when they use technology to gain capacity and solve customers' most pressing business issues. The graphic on the top of the next page shows the convergence of manufacturing and technology, which we've defined as the demand-driven factory of the future.



With clear objectives monitored by KPIs, everyone - from managers to shop floor personnel - becomes empowered to improve not only their individual performance, but the entire plant. After gaining real-time visibility into what is actually happening out on the floor and the extended supply chain, they know which metrics lead to improving these objectives–and can act on them. In many cases, their compensation also becomes tied to these objectives.

This level of Manufacturing Intelligence (MI) is the driver to enhancing value. As Aberdeen Research reported in January 2014, "manufacturers that effectively harness their MI achieve meaningful results." They used four key performance criteria to distinguish the Best-in-Class (top 20% of aggregate performers) from All Others (bottom 80%). The Best-in- Class achieved the following performance metrics:

•96% Successful new product introduction, versus 82% for All Others
•+26% Increase in operating margin, versus corporate plan, versus +6% for All Others
•94% Operating Equipment Efficiency (OEE), versus 81% for All Others
•99% on-time complete shipping, versus 90% for All Others"[v]

In today's complex manufacturing environments, the physical processes of manufacturing encompass so many moving parts that only digitizing their respective components will yield demand-driven results. In our next paper, we will help you build a business case for your demand-driven manufacturing transformation. We will help you identify the value of synchronizing your production processes to your demand-driven actions in different manufacturing environments, and explain how gaining control of flow, throughput and variability benefits your value proposition. Finally, we will explore how these activities help you remain more customer-centric, meeting their business needs--and your own--for profitable growth -now and in the future.

For additional commentary on various aspects of demand-driven manufacturing, visit the blog, Demand-DrivenMatters.com.

About Synchrono

Synchrono® LLC is a leading provider of demand-driven manufacturing software and services that simplify complex manufacturing environments and transform business results. The company's planning, scheduling and execution and eKanban inventory replenishment software are powerful on their own, and when combined with its operations systems under the Synchrono Demand-Driven Manufacturing Platform, clients synchronize their workforce, methods, machines, resources and more to enable flow from order inception through production and delivery. Aggregating information from its own applications as well as from both machine-level and disparate enterprise systems, the Synchrono Demand-Driven Manufacturing Platform provides a real-time visual factory information system that empowers everyone - from the top floor to the shop floor - with actionable information.

Synchrono helps clients manage constraints, improve flow, drive on-time delivery and maintain a competitive edge. Look to Synchrono for software that meets your demand. Sync with us at www.synchrono.com.

About the Author.

John Maher

John Maher has more than twenty years of experience working in manufacturing environments and has been with Synchrono since the company's inception. John's subject matter expertise in ERP, MRP, APS, supply chain, manufacturing planning and scheduling systems and constraints management drives continuous refinement of the company's Lean and constraints management-based software and services. John is responsible for providing strategic direction for the Synchrono product roadmap and oversees the technology and delivery functions within the organization.

John earned his BBA in production/operations management from University of Wisconsin, Whitewater, and an MBA from the University of Minnesota, Carlson School of Management. He has APICS CPIM certification in production and inventory management and Jonah certification in Theory of Constraints from the Goldratt Institute.

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i Heppelman, James. ***The Internet of Things*** pg. 1

ii Daugherty, Banerjee, Negm and Alter, ***Driving Unconventional Growth through the Industrial Internet of Things,*** Accenture Technology white paper, page 2.

iii Aberdeen Research, January 2014. ***Three Steps to Make Your Manufacturing Systems Intelligent and to Distribute that Knowledge with the Greatest Efficiency***. Page 3

iv Ibid. Page 2.

v Ibid. Page 1.