How to Maximize Lean Production in an Age of Digital Change

by Merit Solutions
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1. Introduction

While manufacturing remains a critical economic sector, both domestically and globally, during the last decades it has had its share of volatility. McKinsey spoke to this issue a few years after the turn of the decade:

The global manufacturing sector has undergone a tumultuous decade: large developing economies leaped into the first tier of manufacturing nations, a severe recession choked off demand, and manufacturing employment fell at an accelerated rate in advanced economies. Still, manufacturing remains critically important to both the developing and the advanced world. In the former, it continues to provide a pathway from subsistence agriculture to rising incomes and living standards. In the latter, it remains a vital source of innovation and competitiveness, making outsized contributions to research and development, exports, and productivity growth. But the manufacturing sector has changed—bringing both opportunities and challenges—and neither business leaders nor policy makers can rely on old responses in the new manufacturing environment.¹

Ohno would have appreciated the reference to not relying on old responses. Yet for all the public lamenting about the manufacturing sector, there can be no doubt of the progress it’s made in recent times. Consider, as one measure, this statistic: the real output of U.S. manufacturers has doubled over the last three decades. Some of this increase is due to automation and new technology. A prime example: the number of industrial robots is rising significantly. Since 2010, the demand for industrial robots has accelerated considerably due to the ongoing trend toward automation and the continued innovative technical improvements in industrial robots.

“Progress cannot be generated when we are satisfied with existing situations.” Taiichi Ohno

Digitalization or “digital transformation” is another factor. As noted in an article on planet-lean.com:

We are entering a new era in industrial production, characterized by digital integration. One by one, developed countries are waking up to this revolutionary development, as demonstrated by the growing relevance of movements like “Industry 4.0” (which originated in Germany and is now spreading to markets as far as Korea and China) and by government initiatives, such as the Digital Manufacturing and Design Innovation Institute in the United States²

This revolution is turning factories into “smart factories” characterized by:

- The omnipresence of digital devices and computers in production, which minimizes human intervention
- Real-time connection with global demand and supply
- The real-time and high-speed gathering, analysis, and sharing of data
- Last but not least: the intertwining of the virtual and real worlds.³
Perhaps the most significant change has been a foundational one with roots in the 1940s at Sakichi Toyoda’s textile factory. The original concept flowered into the Toyota Production System (TPS) under the leadership of Taiichi Ohno. It is from the TPS that lean manufacturing has developed to become the preeminent manufacturing management philosophy. Indeed, it has made the sector demonstrably more efficient and productive, progressing through a mindset that is never satisfied with the status quo. This orientation has influenced manufacturing globally, and continues to do so through the wider adoption within and across industries that are driving it forward.

2. What Is Lean?

The foundation of lean is rooted in Japan after WWII. In order to pull the country out of post-war devastation, Japan recognized the need to provide consistent employment to citizens – but companies had extremely limited resources to do so. Lean was born out of this initial idea that respect for people had to occur and that businesses had to maintain people's jobs even through downturns.

In order to support this mentality, Japanese companies believed, among others, that:

1. Flow based production would sustain level work for people.
2. A system of visual cues and maintaining an orderly workplace would reduce waste and achieve more consistent operational results.
3. With waste reduction, quality would improve while production time and cost are reduced.
4. Encouraging employees to use their heads, not just their hands, would improve real-time defect catching and enable proactive, incremental improvements.
5. If items are produced on time, delivered to the customer by the delivery date, and meet or exceed quality expectations – customer satisfaction will increase.

The term lean was first coined by John Krafcik in his 1988 article, “Triumph of the Lean Production System,” based on his master's thesis at the MIT Sloan School of Management. Krafcik had been a quality engineer in the Toyota-GM joint venture in California before joining MIT for MBA studies. Krafcik’s research was continued by the International Motor Vehicle Program (IMVP) at MIT, out of which came the international best-selling book co-authored by Jim Womack, Daniel Jones, and Daniel Roos called The Machine that Changed the World. Lean Thinking, another book co-authored by Womack, has also profoundly impacted lean development.

Many lean goals are common, including:

- **Improve quality.** To stay competitive in today's marketplace, a company must understand its customers’ wants and needs and design processes to meet their expectations and requirements.
- **Eliminate waste.** Waste is any activity that consumes time, resources, or space but does not add any value to the product or service.
- **Reduce time.** Reducing the time it takes to finish an activity from start to finish is one of the most effective ways to eliminate waste and lower costs.
- **Reduce total costs.** To minimize cost, a company must produce only to customer demand. Overproduction increases a company’s inventory costs because of storage needs.
The strategic elements of lean can be quite complex, and comprise multiple elements. Four notions of lean have been identified:  
- Lean as a fixed state or goal (being lean)  
- Lean as a continuous change process (becoming lean)  
- Lean as a set of tools or methods (doing lean/toolbox lean)  
- Lean as a philosophy (lean thinking)  

The success of lean as a philosophical orientation to manufacturing operations can be seen in its broad adoption - and in the success of those companies that have employed it vis-à-vis those that have not.

### 3. Lean and ERP

As lean manufacturing approaches began to take hold after the millennium, a conflict soon emerged with enterprise resource planning (ERP) systems, installed in tens of thousands of manufacturing companies in the ‘80s and ‘90s as their core manufacturing information system.

With traditional manufacturing resource planning - the planning engine in most ERP systems - manufacturers base production levels on a combination of independent and dependent demand, with a heavy reliance on sales forecasts. These are then pushed onto the factory floor. In lean manufacturing, however, demand is pulled by actual customer orders.

ERP emphasizes producing in “economic order quantities” and using safety stock to buffer between production runs. Lean emphasizes finding ways to match day-to-day production rates directly with customer demand rates and finding ways to reduce production lead time and buffer stocks. ERP emphasizes fixed production schedules, while lean emphasizes creating a responsive production environment for actual demand, driving continuous and dynamic adjustments in production activity throughout the production and supply chain.

Further, lean emphasizes getting the manufacturing process right and continually improving it, while with ERP the emphasis is on planning. As noted in an article on Industry Week:

*The former has the goal of eliminating all wasted time, movement, and materials; the latter seeks to track every activity and every piece of material on the plant floor. Lean is action-oriented. ERP is data-dependent. One has workers doing only things that add value to the product; the other has them recording data and bar-coding to keep track of inventory and labor.*

Software vendors - and ERP providers in particular - had not designed their tools for lean production, and subsequently failed to do a good job in adapting their technology to lean tenets as the lean revolution in manufacturing took hold. What they hadn't done is take something like the TPS and build from the ground up around it, incorporating lean techniques like value stream mapping, line balancing, cellular production, and flow-based production adjustments as required.

In recent years, ERP software companies have positioned their new versions as working well to support lean initiatives. But many of these changes have been disingenuous, such as taking push job orders and making them look like kanban cards. They are simply putting lean names and screens on top of MRP concepts and pushing production – which leads to build-up, longer cycle times, and higher inventory – antithetical to lean aspirations.
E-kanbans can be great, especially for external and geographically dislocated replenishment points, but doing that without it being a pull signal is not lean. If it is being calculated and pushed by the system, problems start to happen and human communication and thinking stops happening - again, antithetical to lean.

As noted in Planet Lean, “Over the past three decades, lean has established itself as a superior approach to management, and it is becoming increasingly clear that the methodology also represents the best alternative to navigate the new, digitally-integrated industrial landscape we are quickly finding ourselves in.”

But for an ERP system to act as the digital backbone in the organizational landscape, it must support lean principles or it will act as a barrier to lean strategy, and to efforts of lean digital transformation.

4. Microsoft Dynamics 365 and Lean Manufacturing

Like most traditional ERP systems, the formal “lean manufacturing features” of Microsoft Dynamics 365 offer very little in the way of tools you can use to model true lean production. Microsoft Dynamics 365 certainly helps lean organizations in a lot of ways. It streamlines flow between all functions of the organization and helps with the communication and standardization of work. Once standardized, Microsoft Dynamics 365 enables kaizen improvements with version control – ensuring lean improvements are rolled out, tracked, and more easily sustained. It also provides a structure to help decision makers choose the best operational tools and policies for different types of products and materials, with insights into end-to-end cost profiles. And Microsoft Dynamics 365 helps dramatically reduce NVA activities and transactions by capturing data once and leveraging it across value streams.

So while we agree Microsoft Dynamics 365 is one of the most complete, cost-effective, and scalable business platforms for medium to global manufacturing organizations – it still gets its roots from an ERP (and CRM) system.

5. Connected Lean and the Microsoft Business Platform

Our vision for lean clients is to be able to implement, operate with, leverage, and accelerate the benefits of lean principles using the Microsoft Business Platform. We want to use the software, hardware, and data only where they add value so as not to inhibit lean principles where traditional ERP all too frequently gets in the way.

We call this Connected Lean.

Connected Lean is a collection of technology, principles, repeatable methods, and approaches to implementing the Microsoft Business Platform for lean businesses and includes a number key enablers.

5.1 Microsoft Dynamics 365

When clients use Connected Lean as the configuration approach for Microsoft Dynamics 365, it subjugates the production planning and shop floor production aspects of the ERP system while lighting up and accentuating the other capabilities of the system. With Connected Lean, companies let the ERP system take and capture the customer order and then feed those down to the plant floor as demand. Companies can then run visual based production using kanbans and production schedules that are dialed into takt time and flow to reduce ups and downs – and can adjust those regularly if desired.
Companies then capture one transaction at the end of the production process when the product becomes a finished good, and that transaction goes back into the ERP systems as the finished good inventory balance. At that point the ERP system can backflush the consumed material and labor expected to have happened in the production of the finished good. Costing is updated and raw material inventory levels are decremented to that amount.

5.2 Microsoft Azure

The Azure cloud platform allows organizations to reduce NVA IT activities and variability in the availability of technical resources and provides the entire organization broad access to the technical tools that can help them do their jobs. Microsoft Azure is more than just cloud storage. Seamless integration with the Microsoft Office 365 suite, including Word, Excel, and Outlook, enables Azure to improve productivity and build backend processes as efficient and lean as production workflows.

5.3 Internet of Things (IoT)

Azure IoT enables process improvement by using connected devices that automatically capture valuable process and transaction data without adding manual activities. It improves access to key insights into the operations of the business that can help focus and support continuous improvement efforts, both in the planning and study phases of the PDSA (Plan, Do, Study, Act) problem-solving cycle. Lean companies can reduce kanban motion, manual transactions, and lead times using IoT or mobile sensors. And they can continuously monitor flow with visual controls and alerts that provide real-time performance transparency.

5.4 Mobile Applications

Mobile apps provide employees in all departments – from the plant to the field – with a real-time connection to a wealth of enterprise data, enabling them to work as effectively as possible. Mobility minimizes manual processes with mobile data collection and consumption, eliminating the waste of writing information down and re-entering it back at a desk. It also establishes real-time workstream and performance visibility, allowing manufacturers to better manage inventory, assets, quality, labor, and operations.

5.5 Power BI & Azure Data Lakes

Reduce the amount of time spent looking for business data with a centralized location for all data across the enterprise. Provide intuitive search-like self-service capabilities that require little training and simplify reporting activities. Use visual boards to display important value and quality metrics, identified and in process improvements, and reporting on sustained improvements. And turn increasing amounts and complexity of data into actionable insights that improve decisions.
6. Key Features of Connected Lean

Organizations choosing to deploy the Microsoft Business Platform with Connected Lean will be better positioned to maintain lean operations than those who do not due to many of the key configurations or features of Connected Lean.

6.1 End-to-End Value Stream Reporting

End-to-end value stream reporting flattens cost structures and makes total “true costs” visible from beginning to end of the value stream. A key tenet of lean is the relentless pursuit of waste and cost mitigation. A clear picture of the full end-to-end value stream performance is essential to truly understanding the actual costs of a product. Connected Lean uses the global reach of the Microsoft Business Platform to allow multi-national organizations to visualize the true value stream cost components across the extended enterprise to help focus kaizen efforts and to inform management decisions around pricing, profit, and value stream performance. In many multi-national organizations, the intercompany transactions hide and obfuscate the true costs of the final product leading to sub-optimal decisions. Connected Lean leverages the value stream-based, integrated nature of the platform to provide the true, holistic picture of value stream performance (e.g., product cost, inventory, lead time) that leads to decisions that support the objectives of the global enterprise.

6.2 Continuous Improvement Tracking System

Connected Lean includes a cloud-based system for collecting and executing on Kaizen ideas or suggestions. It can be used to capture ideas during a structured Kaizen Event and/or to collect improvement ideas ad hoc. It includes a structured process of notification and categorizations to ensure each idea is considered and appropriate action plans are developed and deployed.

6.3 PFEP (Plan for Every Part) Dashboards

PFEP dashboards are provided to make certain that optimal techniques for planning and tracking each part are used, as well as tracking for continuous improvement relating to lead time, lot size, and inventory reduction. “Planning for Every Part” is a foundation principle of lean thinking. In fact, it’s the first step in creating a lean material-handling system. Essentially an electronic spreadsheet or database, the PFEP fosters precise, accurate, and controlled inventory reduction while serving as the foundation for the continuous improvement of a plant’s material-handling system. It contains all the critical information about parts. This information, in turn, can be used to manage the material handling system, size markets and storage racks containing purchased parts, and design timed delivery routes and kanbans.\textsuperscript{12}
6.4 ERP/MRP for Long Lead Time Planning

Many manufacturers haven’t yet achieved pure single piece flow tied directly to each discrete external customer demand trigger. The Connected Lean approach includes a limited deployment of ERP/MRP planning engines for parts and production areas requiring longer-range planning. These are best used in concert with discrete pull-based shop floor execution methods (like bin-based Kanbans). ERP/MRP can also provide useful inputs for planners looking to build level-loaded production plans/schedules. By exploding projected customer demand (forecast) through the supply chain, MRP/ERP can help establish expected takt times for each stage of the production process. This can’t (and shouldn’t) replace a true customer-pull-based execution system, but it is necessary for many situations where long lead times or excessively high setup times prevent the optimal customer-pull-based build processes.

6.5 ERP/WMS for Simplifying Tracking of Interfaces Between the Shop Floor and Buffer Stocks—Only When Necessary

Understanding that most organizations will need to maintain some buffer stocks before or after key production processes, Connected Lean includes use of simplified, handheld scanners that can help workers respond efficiently to pull triggers to replenish supermarkets or point-of-use stocks. These handheld scanners can also be used to remove NVA activities throughout the purchasing and accounts payables processes by triggering “pay-on-receipt” or “evaluated settlement” programs with trusted vendors. These types of programs paired with a receiving/material handling system that is optimized for single touch operations can remove a significant percentage of the MATI scores for typical receiving/payables processes.

6.6 Visual Management and Manual Kanbans

Connected Lean includes visual management and manual kanbans for shop floor management. While MRP/ERP can provide valuable long-range recommendations and valuable data to support planners in maintaining optimal “plans for every part,” it can never provide the benefits of a Kanban pull-based shop floor execution system based on real-time visual management. One of Connected Lean’s principles is to encourage real-time pull-based production management wherever possible.

6.7 IoT-Automated Shop-Floor Reporting

Connected Lean provides IoT-automated shop-floor reporting for key resources. With the advent of IoT, it is much easier and less expensive to deploy automated sensors to help track material and equipment. This is extremely useful for providing data for failure-mode analysis, critical for lean because the low buffer stocks and short lead time means the effects of equipment downtime are magnified. Further, IoT automation is useful for capturing data on product quality and production rates that can be easily displayed on visual boards or provide real-time alerting via andon lights or similar tools as a visual cue to problems or potential problems.
9. Eight Benefits of Connected Lean

Develop a Robust, Data-Driven Current State

Bring together teams, customers, or stakeholders to develop “current state” process maps that document how work actually gets done – including areas of problems, delays, or rework. Utilize historical data (such as lead times and complaints) to analyze how those processes are working.

“Creativity Before Capital” Future State Development

Create “future state” process maps and design technology solutions that address the root causes of waste and minimize non-value adding activities. Taking a “mind before money” approach to continuous improvement, work to identify easy and cheap gains before investing significant resources.

Encourage and Facilitate Continuous Improvement (CI)

Capture suggestion cards and digitally track continuous improvements through stages of accepted/rejected and reasoning – then through the completion and implementation life cycle. Use dashboards to depict the status of current CIs, and monitor adoption of already implemented CIs.

Implement and Sustain Kaizen Improvements

Once improvements are identified, they can be updated with revision control in the business process modeler. Processes can then be standardized across an organization globally and implemented across the business platform in a manner that ensures the improvements are sustained.

Single Platform Reduces Transactions and Processes

Utilize a common data service and work from a trusted system of record and leverage that data across work processes. Bringing together sales, procurement, accounting, production, quality, distribution, and HR – people will never waste time re-entering the same data in different systems.

Automate Data Capture to Reduce Waste and Errors

Use connected devices to automatically capture valuable process and transaction data without adding manual activities. Replace paper forms with electronic versions that prepopulate data and error check. Provide mobile data collection rather than writing information down and re-entering it at the office.
Graphical Dashboards Monitor Quality and Performance Data

Centralized, automated, real-time dashboards are used to visually depict business performance goals and metrics that are critical to client value delivery. These dashboards enable an at-a-glance understanding of current activity status and trends for better decisions daily.

Attract, Train, and Retain Lean People

Utilize improved and integrated people development tools in order to streamline and speed talent recruitment. Better train employees and monitor certifications. Encourage transparent communication and information sharing using portals, mobile and social capabilities, and other tools.

10. Conclusion

Lean mindset companies define their work as driving value to customers. They implement cultures and thinking that embrace continuous improvement and the pursuit of perfection while stimulating problem solving and asking people to use their minds, not just their hands, to improve value to customers. Work in Lean environments is pulled through using visual cues based on customer demand, with a driving principle to smooth out throughput volumes and reduce lead times.

Yet many ERP implementations push work to people with the software dictating what to do and when to do it – restricting problem solving to the system instead of the people. Traditional ERP is designed to start and stop work repeatedly while reducing inventory within a longer time to produce. When it is put onto lean businesses, continuous improvement slows, ownership and accountability flattens, sustained improvements regress to prior states, and value stream increases end.

Connected Lean from Merit Solutions combines lean principles adopted by the Lean Enterprise Institute with the Microsoft Azure Business Platform to drive purpose, process, and people improvements across an entire global organization. Connected Lean includes software, implementation methodology, perspectives and guidance to enable your lean transformation to happen more successfully using digital information and technologies – while protecting you from the damaging effects of traditional push planning that resides in the design of parts of these systems.

If you think Connected Lean might help you on your lean journey or path to digital transformation, we’d love to speak to you.
Notes


3. Ibid, Planet Lean.


11. Ibid, Planet Lean.

About Merit Solutions

Merit Solutions is a global business process consultant and systems integrator with offices in North America and Europe. We are a focused-strategy company with the goal of being the very best at helping clients automate, grow, and transform their business through process mapping and optimization, change management, and innovative IT consulting and development services.

Merit Solutions works with clients to understand and triangulate their exact business needs in terms of people, workstreams, and enabling systems. From future state business process mapping to systems analysis, fit-gap process definition and scoping, sourcing, design and deployment, integration with other systems, and ongoing support - we provide end-to-end global services that help clients successfully transform their business and build a foundation that continuously flows value to their customers.

Our clients are typically medium to large, global enterprises who are challenged by inefficient workstreams that cost money, waste time, and reduce quality; information flows and systems that no longer support the goals of the company; and lack of visibility into business data which impedes effective decision making.

Additional Resources

Related resources to this white paper include:

- Achieving Supply Chain Visibility with Globally Adopted Systems and Processes
- Lean-Enterprise
- Decisions, Visibility, and Customer Service: The Value of ERP

Information on Merit Solutions or other publications can be found on www.meritsolutions.com