



Becoming Lean - Vision of Demand Flow Manufacturing

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Lean manufacturing, total quality management and material flow are often used to describe improved manufacturing systems. This article defines a common vision of demand driven flow manufacturing, building on principles of total quality and lean manufacturing, using a work systems redesign framework - including elements of the social and technical system.

Work systems redesign starts with external scan and internal scrutiny. External scan uses tools of benchmarking and best practices. There are several examples of world-class companies to review. It is best to perform internal scrutiny, process analysis, prior to benchmarking. Become a more valuable benchmarking partner and more quickly apply learnings to a well-understood process.

Start with value stream / process flow mapping to describe the existing process. Map the material and information flow. Make obvious improvements without going outside. Define a clear link to the business strategy and provide management support to benchmarking and improvement.

External scan and internal scrutiny improve understanding of the business situation. These are inputs to business strategy development: participation and operating. The key is to build commitment of the organization to common purpose and direction. Build strategies on a foundation of realistic resource planning to deploy the necessary improvements to business practices.

The operating culture is made up of material and information flows, work task and technologies, capabilities, workplace design, structure, rewards and recognition. The following addresses each separately as they relate to product flow.

Material and Information Flows: Material flow should follow a simple path with highly visible process stages. Design a balanced, synchronized flow aligned to customer requirements. Use takt time to define time available based on customer demand per unit of time. Use standard work to define the best method and right combination of people and machines to produce within takt time.

Capacity should be reviewed to identify bottlenecks. Bottlenecks are protected by time buffers of materials and are a focus to improve process, capacity and input quality. Cellular manufacturing or flow lines connect separate work processes with minimal handling. Avoid the mistake of making cells too product specific. A process cell handles a family of parts with the benefit of reduced moves and queues.

Disconnected operations are connected by a pull system. Kanban squares, containers, cards connect the flow. Kanban buffer stock needs to be carefully planned based on process potential, anticipated throughput time and safety stock based on expected quality and potential delays.

Information flow is very visual. Kanban is one visualization technique. It is very easy to see flow as represented by buffers, cards or empty spaces. Other visualization techniques include lines on the floor or workspaces to indicate equipment or inventory positions, hanging signs, arrows or color codes. Andon lights on equipment or workstations indicate status. Information centers display production and quality graphs, SPC charts, process descriptions, business / team objectives and improvement projects.

Planning information is largely confined to defining requirements, rough-cut capacity planning and linearity. In a true pull system, a linearity graph showing daily end-product production rate on a continuous cumulative slope, is provided to the last operation. Actual production plotted over the target provides a measure of linearity or how well output tracks to daily rate.

Apply SMED techniques for set-up time reduction. Enable smaller batches and less work in process. Use preventive - predictive maintenance - put sensors on machine to predict a breakdown and react accordingly. Apply operator daily checklists to clean, verify and lubricate equipment.

Work Tasks and Technologies: Work tasks are defined by visual and understandable procedures. Total quality control uses quality checks done concurrently with manufacturing steps. Control the process directly through monitoring machine variables such as vibration, spindle speed or heat. Use mistake-proof / failsafe devices to make it impossible to make a mistake. Apply devices such as locating pins to allow only one possible orientation. A less desirable, but effective method is operator independent crosscheck and checklists. Use color codes on drawings - work instructions.

Videotape, analyze and document existing methods. Then develop efficient standard methods to optimize tasks. Apply technology appropriate to the task. Don't invest in all the latest and greatest machines. Instead invest in sensors to monitor tool wear, simple flow enhancements such as kanban carts, simple sequencing devices, operator handling aids and process control devices.

Capabilities: People are cross-trained and capable of performing multiple tasks. In a cellular arrangement, multi-skilled people are critical. People are certified to perform a procedure through repetition and verification. They may lose certification if they don't perform an operation over calendar interval. Education and training is encouraged and rewarded. This is not limited to job skills but expands to include interactive and personal development. People have capability to improve processes and learn through doing - applying tools to improve their operation. Kaizen events are an excellent way to impart this knowledge while rapidly improving the process.

Workplace Design: The workplace shows attention to methods, ergonomic, safety and handling issues. Everything has a place and everything in place. Lifts are minimized or eliminated, reaches are shortened, walking and searching is reduced, lighting is optimized, hazards are eliminated, the workplace is exceptionally clean, safety equipment available and noise minimized or source controlled. It is generally an attractive, nice place to work.

Structure: Leadership aligns the workforce to common goals and purpose. Management is more effective if aligned along flow lines. Avoid functional silos: separate manufacturing departments and staff departments. The flow organization reduces the number of managers in a flow chain. Resources are either dedicated to the flow or feel first allegiance to the flow. Functional groups can act as resource pools and centers of functional excellence and employee development. Everyone feels ownership of ultimate deliverable. Hand-offs and organizational barriers are minimized.

Rewards and Recognition: Responsible plans and delivery of recognition support measures and goals. Measures are flow-oriented such as first pass yield and total cycle time. Customer satisfaction is measured through a combination of quantitative (such as escaping defects) and qualitative (such as a survey to determine responsiveness and other customer satisfiers). Morale is high because people are recognized for individual supportive behavior and team results. R+ is planned, because what gets planned gets done.

There is a lot to be done to truly accomplish flow. This is intended to provide structure to the ultimate objective. The main thing is to get started. Get help from experts in addition to involving the majority of your workforce.

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