

LEAN MANUFACTURING TRAINING
As Designed and Implemented by Minnesota Technology, Inc
With Support from West Central Initiative

BACKGROUND

For more than ten years Minnesota Technology, Inc. (MTI) and West Central Initiative (WCI) have been teaming up to retrain incumbent workers in manufacturing companies in west central Minnesota. Since the inception of the partnership between WCI and MTI, more than 5800 of the region's 10,500 manufacturing workers have been retrained.

A majority of the training provided has been focused on Lean Manufacturing concepts. Lean Manufacturing training is modeled on the manufacturing efficiency process developed by Toyota built on the concepts originally promoted by innovators such as W. Edwards Demming. The purpose of Lean training is to improve industrial efficiency and productivity by driving wasted time, effort, and materials out of the manufacturing environment. As a result, companies typically see substantial gains in productivity and improved profitability and cash flow.

Prior to WCI's investment in incumbent worker training and Lean Manufacturing, the manufacturing economy in West Central Minnesota was significantly more volatile than the nation as a whole. When the rest of the economy was suffering a mild recession, the region would be hemorrhaging jobs. WCI analysis suggested that a major cause of this was the strategy of most rural manufacturers to rely on low wage labor as their primary competitive advantage. With increased globalization, WCI postulated that companies that relied on low wage labor to compete would always be particularly vulnerable to economic cycles. By helping them retrain workers to boost productivity, WCI predicted that the region's economy would eventually become less vulnerable.

The economic downturn that began in 1999 gave the opportunity to test this hypothesis, and the results exceeded expectations. The effects of this recession on west central Minnesota have been very light. While Minnesota and the nation have experienced substantial declines in the overall number of employed workers, employment in west central Minnesota has increased by approximately 2.5%, leading all other regions in Minnesota in 2001 and 2002. The unemployment rate in the region also compares favorably to that of the state and the nation. While the region has historically had rates about 2% above the statewide average in most years, the 2002 annual rate was actually lower than the state as a whole at 3.9%. In addition, the region has largely avoided mass layoffs among manufacturing companies during this period of economic weakness.

While cause and effect are never possible to prove in instances such as this, there seems to be no other explanation for the improved economic performance of the region, and the results are consistent with the original hypothesis.

IMPLEMENTING LEAN MANUFACTURING TRAINING

Lean Concepts

Lean manufacturing training is based on five core concepts:

- Implementing a systems technology that eliminates non-value added activity, which is usually found outside of process activity.
- Focusing more on improving material flow than on labor elimination.
- In the efficiency ratio of Material/Labor, focusing on the numerator rather than the denominator.
- Transforming industry culture so all workers recognize waste, and providing the environment for eliminating it on a regular, on-going basis.
- Harnessing the minds of the employees as well as their physical capacities.

In addition, in implementing Lean Manufacturing concepts in west central Minnesota, Minnesota Technology has borrowed a concept from learning theory. Most students, especially adults, learn theoretical material best if their instruction includes significant opportunities for putting the theory into practice through experiential learning. All of the Lean training provided through the partnership between MTI and WCI is organized in segments specifically designed to teach a theory, put it into practice, and debrief afterwards to reinforce the learning.

The Lean Path

Over time, MTI and WCI have developed a “Lean Path” that includes six elements:

1. Lean 101
2. Visual Workplace Organization
3. Value Stream Mapping
4. Kaizen Events
5. Training Within Industry
6. Performance Management System

These elements are designed for companies operating in a medium to large-run environment, where many identical items are being produced. (An alternative curriculum is available for companies that produce items in short runs, or produce one-of-a-kind items. Please contact WCI for details if interested.)

Taken together, the elements of the Lean Path can completely transform the production environment and organizational culture of a company. Even the introductory elements have been proven to have substantial impact on participating companies. Most of the participating manufacturing companies in west central Minnesota have taken only the first two or three steps on the Lean path, yet the widespread implementation of the first few steps is already having noticeable effect on the regional economy and the health of its manufacturing sector.

Each step in the Lean process is summarized below:

STEP ONE: Lean 101

Lean 101 is a one day training class that teaches the principles of Lean manufacturing. It is typically undertaken in two stages:

- Stage one: Participation of five to ten key management personnel in a multi-company Lean 101 session to introduce the concepts and solicit organizational buy-in.
- Stage two: Implementation of Lean 101 training with the entire workforce of the company.

Lean 101 training combines training and live simulation. The curriculum focuses on the eight wastes:

1. overproduction
2. waiting
3. transportation
4. non value-added processing
5. excess inventory
6. defects
7. excess motion
8. under utilized people

Tools are then introduced for eliminating waste including: standardized work, workplace organization, visual controls, plant layout, workforce practices, quick changeover, batch size, point of use storage, quality at the source, replenishment pull, cellular manufacturing, and total production maintenance.

The Lean 101 training curriculum used by MTI was developed by the National Institute of Standards and Technology (NIST). Utilization of the curriculum requires use of a certified trainer. Train the trainer sessions are offered periodically by NIST or can be specially arranged to train a cohort of trainers. Purchase of a training kit is also required. The kit contains all of the materials necessary to set up a tabletop manufacturing simulation that is incorporated into the training process.

Because of limitations inherent in the simulation, training cohorts should be as close to 20 persons as possible. Training a single cohort involves one full day of the time of a trainer and an aide. Larger cohorts are not supported; however the use of trainer time can be maximized by training two cohorts simultaneously, although this requires the use of two aides and purchase of a second kit. Using the two-cohort method, a trainer and two aides can train all the personnel in a company with up to 200 employees in one week's time.

Purchase of the kits costs approximately \$5,000 apiece. Training a trainer can cost \$10,000 to \$15,000 depending on travel. Consumable supplies run \$25.00 per person trained. A Lean 101 training program set up to work with two cohorts can therefore be started with an initial investment of \$20,000 to \$25,000.

STEP TWO: Visual Workplace Organization

Visual Workplace Organization (VWO), sometimes also referred to as 5-S, is a five step process for creating an organized and safe work environment by eliminating everything from the workplace that is not needed and organizing what remains. No portion of the Lean Path has as dramatic an impact on the physical operations within a participating company. VWO transforms the physical environment within the manufacturing facility. As a result the manufacturing area is cleaner, neater, better organized, and in many cases production requires far less physical space to produce more product. With minor modification, VWO can also be applied to the front office, transforming the working environment of clerical and managerial employees as well.

The five steps of VWO include

Step 1: Organization/Sorting (an activity)

- Sorting the needed from the unneeded and disposing the unneeded through a process
- Key tools: red tagging and kanban cards

Step 2: Cleanliness/Sweeping (an activity)

- Cleaning floors, equipment, work areas
- Key Tools: cleaning, inspection, and maintenance procedures.

Step 3: Orderliness/Simplifying (an activity)

- Organizing and labeling needed items
- Striping aisles and work areas
- Key Tools: signs/labels, color codes, paint/tape, outline/shadow boxes.

Step 4: Adherence/Standardizing (a state)

- Maintaining the first 3-S's
- Key tool: rules

Step 5: Self Discipline (a culture)

- The habit of doing things correctly and as specified
- Key tool: 5-S audit

The curriculum used by MTI for VWO is adapted from the 5-S curriculum developed by NIST. While the NIST curriculum is exclusively classroom based, MTI's adaptation involves actually implementing VWO on the factory floor as a part of the training process.

The training is broken up by functional areas on the factory floor. Teams of three to seven workers are assigned to each functional area. The VWO process takes three days and one facilitator can work with up to five teams. Since the amount of facilitator time required declines from day to day, ten teams can be trained in a typical five-day

work week with two active teams working on Wednesday. An aide is helpful but not essential except in larger factories or when two teams are being trained over five days.

Since this training was customized by Minnesota Technology there is currently no set structure or fee for training a facilitator or for purchasing the curriculum. Arrangements could be negotiated with MTI, if desired.

STEP THREE: Value Stream Mapping

Value Stream Mapping (VSM) builds Lean 101 by helping the company create a plan for implementing Lean Manufacturing concepts in the company's own production environment. VSM provides a company with a tool for creating an improvement plan through the development of a current state map (how things are now) and a future state map (how we would like things to be at some future point in time). The gaps between the two states are then identified and become the basis for the improvement plan or the projects the company implements. Maps are done on product families, rather than the more traditional focus on a production process or department.

The VSM process utilized by MTI was developed by the Lean Enterprise Institute, and use of a certified facilitator is required. Training a company to use VSM typically involves a two-day event in which two teams of about 5 people each assigned to map a product family. At the end of the two days, company personnel should be skilled enough in the model to apply it to the rest of the company's product families.

Training a facilitator to teach companies to use VSM typically costs around \$5,000 including travel. Purchasing necessary documentation will cost each participating company around \$150. Two days of facilitator time is required per company. Consumable materials cost \$20.00 per participant.

STEP FOUR: Kaizen events

Kaizen involves using regularly scheduled events for implementing improvement projects identified in the Value Stream Mapping exercise. Each Kaizen event is a three to five day event involving a team of about five people assigned to resolve a specific problem. In many cases the event involves using the waste elimination tools taught in Lean 101 and VWO training.

Models for performing Kaizen events abound. MTI utilizes a generic hybrid of several models when training companies to implement Kaizen. A facilitator will work with the Kaizen team throughout the three to five day event. Events are scheduled monthly and the facilitator will typically work with the company for the first three events. The company is then responsible for conducting monthly events on its own for three or more months, with the facilitator returning for one month to reinforce the skills. Once Kaizen is implemented in a company, events are usually scheduled monthly forever thereafter.

Kaizen training is widely available from a variety of sources. There is currently no set structure or fee for training a trainer to use the customized version adopted by Minnesota Technology or for purchasing the related curriculum. Arrangements could be negotiated with MTI, if desired.

STEP FIVE: Training Within Industry

Training Within Industry (TWI) is a three-part human development program that is designed to teach production level supervisors and team leaders how to appropriately supervise in a Lean environment. Because production level supervisors and team leaders are usually promoted from the ranks of production workers, they seldom have any formal training in effective supervision. As companies progress through the Lean Path, this can become a significant barrier to maximizing productivity gains.

TWI has three main components:

1. JR/Job Relations
 - A structured method for treating people as individuals and for handling problems
2. JI/Job Instruction
 - A structured method for assimilating people into the organization, culture, and work environment
3. JM/Job Methods
 - A structured method for breaking down a job task into specific elements

TWI is conducted over a five day period with a maximum of 10 people in a training cohort. Each day involves two hours of classroom instruction and six hours of implementation on the factory floor. To conserve human resources it is possible for one instructor to train two cohorts in a day.

The TWI process is just being extracted from the practices of Toyota, and no one offers a commercially packaged curriculum. MTI has not determined a fee structure for training a facilitator or for using the customized curriculum they have developed. Arrangements could be negotiated with MTI, if desired.

STEP SIX: Performance Management System

The final step in the Lean Path utilized in west central Minnesota will be the Performance Measurement System. The development of this system is being finalized by Minnesota Technology out of realization that maintenance of Lean principles and practices requires a "Lean-based" measurement system that ties back to company, group, & individual expectations and performance, and provides for incentive based compensation. Development of a process for training companies in implementing a Lean-based performance management should be completed and tested by the end of 2003. No information on cost or personnel requirements is available at this time.

CONTACT INFORMATION

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