HIGHLIGHTS

of the Fifty Second

Advanced Manufacturing Forum

November 14-15, 2002

Center for the Management of Technological

and Organizational Change

(CMTOC)

The Pennsylvania State University

The Smeal College of Business Administration

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University Park, PA 16802

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Continuing Innovation in Lean Practices at Toyota

Phil Duncan,
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Toyota pioneered the quality movement in manufacturing and introduced many path-breaking innovative concepts in the automobile industry. The West Virginia plant of Toyota Motor (TMMWV) that manufactures engines for the Lexus, Avalon, Siena and other models is one of Toyota's exemplary second generation plants. This plant was ranked as North America's most productive plant in the Harbour Report (North America) 2002. The report identified lean manufacturing and the Toyota Production System (TPS) as the major factors contributing to the high levels of efficiency at the plant. Phil Duncan discussed the innovative practices introduced at the plant that show clearly why the Toyota Production System produces such exceptional gains in productivity and quality.

TPS stands for high quality and cost reduction and is supported by the twin pillars of JIT and *Jidoka*. The major advantage of Just in Time (JIT) is not just that it minimizes inventory investment but that it allows management to identify problems that lay hidden under the cushion of excess inventory. *Jidoka* is the ability of production lines to be stopped by the operator or supervisor in the event of quality problems. It ensures that defective parts are not passed on to the next process or to the customer. Jidoka is implemented through "Andons", which are electronic boards or manual signals installed on the shop floor to signal abnormalities.

Duncan also discussed additional TPS tools such as *muda*, *kaizen*, 5S and *kamishibai. Muda* means waste and TPS specifies 7 types of waste to be avoided viz. over-production, motion, waiting, conveyance, processing inventory and correction. Standardization of work is a central tenet of TPS as it promotes efficiency and eliminates *muda*. Typically, a kaizen is carried out to improve a process or activity and is followed by standardization of the new process. Without standardization, the benefits of the kaizen process are likely to be lost as employees tend to revert to the previous, inefficient ways over time.

5S is a way to organize the workplace setup so as to promote operating efficiency. It affects safety, quality, and productivity and inculcates a sense of pride in the facility. TMMWV sets specific standards to which each work space is expected to conform and encourages compliance. Kamishibai is a card describing the specifications and requirements of a particular process or equipment. It is basically a tool that enables shop floor workers carry out quality checks after predetermined production volumes.

Visual Control and Flexibility are the keys to managing a lean plant. At TMMWV, Visual Control Boards exhibiting specific conditions prevailing in work areas allows managers to monitor a large area at a glance. These boards are so designed as to draw attention to abnormal conditions and ensure that supervisors do not waste time checking processes that are under control. For instance, Andons are installed in the supervisor's office so that in case the assembly line stops for a few minutes, the light starts flashing and alerts the person in charge. Visual Control Boards are also used for monitoring various other things like quality, safety stock status, operational availability, repairs, maintenance and so on. Kanban cards are another form of visual control used at the plant.

TMMWV follows a lot of flexibility in its human resources policies that promote lean manufacturing. For instance, each team member can perform at least 4 jobs within the group and

1 job in 2 other groups. Team members are regularly rotated among groups to expose them to cross training. The number of members in a team varies depending on requirements. This flexibility allows Toyota to produce to takt time i.e., maintain production at the level demanded by the customer. Given the additional responsibilities assigned to employees, TMMWV consciously uses overtime to promote flexibility. As a matter of policy, lay offs are not resorted to. During downturns, redundant team members are reassigned to a kaizen or a different project so as to utilize their services effectively. This policy establishes a climate of trust and encourages efficiency and excellence.

Lean Barriers and How to Overcome Them

Ed Kemmerling,
Performance Consulting Manager,
Ford Production System
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Ford Motor Company initiated the process of transforming its facilities to lean manufacturing in the year 1996. As Performance Consulting Manager for the Ford Production System (FPS), Edward Kemmerling is responsible for support activities for FPS implementation in more than 40 Ford facilities worldwide. He has been closely involved in lean manufacturing implementation since the very beginning.

Much of the problem with the traditional batch layout at a mass manufacturing plant is due to the fact that it is operations-driven and not value-stream driven. This creates a complex set of flows resulting in inefficiency or waste in the system. To get the waste out of the system and deliver the product to the customer on time, these processes need to be managed efficiently.

At Ford, lean is defined as a manufacturing philosophy that shortens the time line between the customer order and the shipment by eliminating waste. Transformation to lean requires focus on system, infrastructure and results (SIR). Ed defines lean as a system with supporting infrastructure that drives results. Though Ford initiated the transformation in 1996, the process took nearly two years to really take off. Before starting the process, the Implementation Team conducted an Integrated Systems Review of Ford plants on a scale of 1-10 to measure where they were placed in terms of lean. Not surprisingly, most of Ford's plants were located at the lower end of the scale.

Ford faced a number of challenges in transforming its manufacturing environment from mass manufacturing to lean manufacturing. These barriers can be grouped under three major heads- cultural, attitudes of management and physical.

Ford identified change in organizational culture as the major factor driving the transformation to lean. It determined that the key to implementing lean manufacturing is to develop ownership and passion among plant personnel. As a Performance Consulting Manager, Ed Kemmerling spent considerable time with plant managers to bring about this change in mind set. He identified a few key people at each location and secured their commitment to facilitate the transformation process.

The reward/ incentive system played a vital role in the transformation. As the superintendent on the shop floor was rewarded for making more and more pieces, he wouldn't care less about inventory piling up. A strong message was needed to be sent out that overproduction is as bad as underproduction. The clear solution was to connect lean tools to the measurement/ reward-recognition system that existed on the floor. Ford was able to get effective support from unions by

working with them and by demonstrating the benefits of lean tools. Empowerment of employees also played a critical role in motivating them to embrace lean manufacturing practices.

The second most important factor in the transformation process is Management - specifically their attitude and involvement. As stated earlier, the fundamental difference between the two systems is that in mass manufacturing, the goal is not growth but simply to produce more. The reward structure is specifically designed to promote such an attitude. To facilitate a change in these attitudes, the Implementation Team took around senior management to various lean sites to expose them to the new culture and secure their buy in. Another important attitudinal shift needed was for management to move away from asking 'who is to be blamed for this problem?' to 'Why do we have this problem?' In short, a lean culture demanded a proactive attitude of problem prevention rather than mere problem solving.

The third major barrier to lean implementation at Ford was its physical infrastructure. Its existing plants were designed for a mass manufacturing environment. And transforming these plants proved to be more of a challenge than designing a greenfield plant. Ford determined that the key to effective design of facilities from the lean perspective is to understand what customers want (in terms of speed of delivery, customization etc.). This perspective helped Ford substantially in redesigning its facilities.

Ed summed up the discussion by focusing on the fact that a company needs to become lean not just to make money but to stay competitive. Even Wall Street with its narrow focus on the next quarter's results has recognized the long term benefits of lean over the short term costs of its implementation.

Kaizen Blitz at Dana: Philosophy, Practice and Results

Craig Browne,
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Dana University—Technical School
Dana Corporation

Craig R. Browne is an instructor in Dana University- Technical School and teaches several courses relating to Lean Manufacturing, Ergonomics, Process Management, Kaizen Blitz etc. With over three decades of experience in the manufacturing environment, he is an active and leading practitioner of six sigma and other quality enhancement tools.

Craig discussed how Dana Corporation conducts a Kaizen Blitz and some of the results that were obtained. As the name implies, a kaizen blitz is a concentrated, short duration event aimed at bringing about significant improvement in a process or activity. Much like a rifle shot, it goes after a defined, small target. Fundamentally, it aims to remove one or more of the 8 types of waste as defined by the Toyota Production system (Overproduction, Waiting, Transportation, Processing, Inventories, Motion, Defective Products and/ or service and finally, the loss of people's creativity).

A typical kaizen blitz conducted by Dana Corporation lasts 3 ½ days. Using cross functional teams, it deals with real problems both in production as well as support areas. The types of blitzes Dana generally gets involved in are set-up reduction, quality, maintenance, productivity, safety and ergonomics.

A blitz is idea driven. All team members are required to submit ideas, generally a minimum of 10 with a goal of 50% implementation by the end of the blitz. Accepted ideas that cannot be implemented in 3 ½ days are assigned to a homework sheet for subsequent implementation.

Substantial planning and pre-work is required to make the blitz a success. 4-6 weeks before the blitz, Dana sends a detailed check list to the target plant. Once the focus area is selected, a cross functional team comprising 5-10 people from different departments such as operations, purchasing, maintenance and sales at different levels is constituted.

Initially Craig acts as leader and covers theory and concepts for a short while. Then, the local team leader takes over and leads the brainstorming discussions. Infrastructure in the form of equipments, outside help (contractors/ riggers to move machinery), funds, overtime pay etc needs to be provided to the team. The Plant Manager must be available to kick off the blitz so that a clear signal is sent across to the employees that management is committed to the project.

Several structural and cultural issues are critical to the success of a kaizen blitz. The goal of the blitz needs to be clearly defined at the very beginning and sufficient resources should be committed to make the process a success. Selection of the leader is vital. Ideally, the leader should be a self starter, knowledgeable and be able to command respect. A truly cross functional team of open minded people should be constituted to provide effective support to the leader.

The process requires buy- in from the employees involved as well as the plant management. Management needs to be open to criticism. Often, problems can be traced to poor management decisions of the past and unless management accepts the ideas of the team with an open mind, the kaizen process can end in failure.

Given the extremely short time frame in which the blitz is conducted, some ideas are bound to fail. Hence, the plant should have a culture of acceptance of failure. To ensure active employee support/ involvement, Management must also actively dispel any fears of lay offs following improvements brought about as a result of the blitz. Finally, Management must be committed to implementing the suggested changes.

Dana Corporation has had several successes with its kaizen blitzes in facilities worldwide. For instance, an Italian machining plant making large axle components could cut down the number of employees in its Deburring and Washing Department by 50%. An axle gear manufacturing plant in MO was able to cut down the cooling time for a heat treated pinion gear from 45 minutes to 15 minutes thus substantially reducing Work in Process inventory and consequently freeing up much needed storage space.

Continuous Improvement with the Danaher Business System

Andrew Dordal, DBS Manager

Jeff Adams Vice President of Operations

Veeder-Root

Veeder-Root is an associate of the Danaher Corporation which manufactures/ markets industrial and consumer products. A Fortune 500 company, Danaher Corporation had 26,000 associates located in over 20 countries as of August 2002 and annual revenues exceeding $4 billion. Veeder- Root manufactures submersible pumps, dispensers and related monitoring software used in gas stations. It also provides environmental monitoring services centered around fuelling operations.

Veeder-Root started implementing the Danaher Business System (DBS) at its facility in the year 1989. DBS stresses continuous improvement to achieve excellence in customer satisfaction. It is a variation of the Toyota Production System expanded to include concepts from Six Sigma. DBS focuses on improving quality, cost, delivery and growth and can be applied at every stage of the business cycle. Kaizen is central to the DBS concept. DBS defines kaizen in two ways (a) over the long term, as the development of a continuous improvement mindset and (b) over the short term, as a formal team-based process focusing on a specific issue.

DBS encompasses three major areas viz. Business Processes, Lean Tools and Variation Reduction.

To improve Business Processes, management needs to have a strategic plan or a vision as to the firm's future and how it can be made to win on a sustainable basis. Typically, the vision covers a 3-5 year time horizon. Policy Deployment converts the firm's strategy for world-class performance into reality. It is a way of aligning targets and means throughout the organization. It is the process that facilitates the creation of business processes that result in a sustained competitive advantage for the firm. Policy Deployment involves breaking up the long-term vision into short term (annual/ bi-annual) annual action plans that clearly specify the who, what, how, how much and when of the improvement priorities.

In terms of lean tools, DBS utilizes waste reduction, Visual Management, 5S, Standard Work, Kanbans and value stream mapping. The basic thrust of waste reduction is to minimize the non-value added activities in any process. Visual Management draws attention to process abnormalities, and thereby ensures that these are attended to quickly. 5S (Simplify, Straighten, Scrub, Stabilize and Sustain) goes beyond mere housekeeping. It aims to identify and attack the underlying cause of workplace disorderliness. Standard Work enables consistent quality of output by orchestrating the various work components to perform together optimally. Value Stream mapping is the process of developing a current and future map of both value added and non-value added activities in a process. This helps in identifying specific areas that need improvement.

The third major area covered by DBS is Variation Reduction. This is basically a simplified version of Six Sigma and comprises tools and techniques for improving quality, delivery and cost in all areas of the business. The objective of Variation Reduction is to reduce the unpredictability involved in any process. Some of the tools used are Flow charts, Run Charts, Pareto Charts, 5 Whys (a way of peeling off layers to get to the core of a problem). As a first step to reducing the variation in any process, the entire workflow needs to be mapped, followed by a cause and effect analysis of the observed variations. Using this information, a Standard Operating Procedure for the process is designed and implemented to reduce variation.

DBS has been in use at Veeder-Root for over ten years and has resulted in annual double-digit productivity improvements. Veeder-Root has been able to bring down headcount by 10% while at the same time increasing volume by 75%. Lead times have come down to 3 days (from 12 days) and on-time delivery statistics improved to 99%. Thus, the company gained a significant competitive advantage in the marketplace.