

Training Recommendations For Implementing Lean Manufacturing

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ABOUT THE AUTHOR

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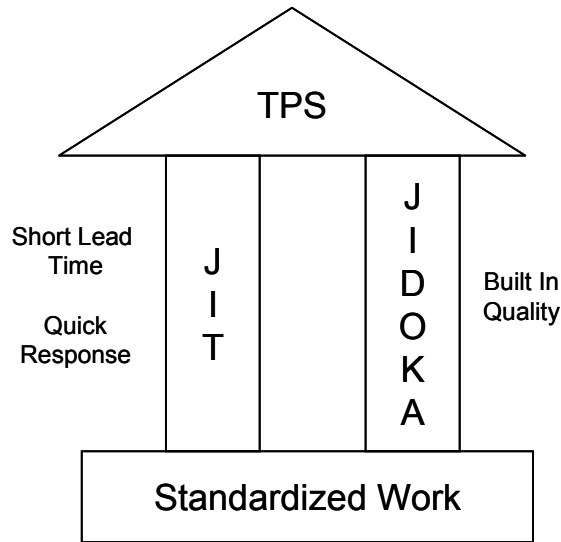
Marek's initial knowledge and expertise of Lean Manufacturing tools, methodologies and practices comes from working for Toyota Motor Manufacturing in Cambridge, Ontario. He was hired by Toyota in 1987 as the Education and Training manager. He was one of the first Canadians hired by TMMC. He was a member of the Management Team responsible for recruiting of Team Members, training, development of the Organization and start-up and ongoing operation of production activities. In 1994 Marek enter the field of consulting. Since then he has worked with numerous manufacturing plants in North America and Europe where he has a proven track record of successful implementation of the principles of Lean Manufacturing. His clients include companies specializing in automotive products, furniture, consumer packaging, personal computers, electronics and medical equipment.

In his work he has proven that Lean is not a trend or a movement. Lean is a collection of tools, methodologies, techniques and processes, that when implemented correctly and in the right sequence, will generate measurable results, help companies reduce costs and improve overall operational efficiency. Any company venturing into a Lean Journey must consider not only changes to their manufacturing and material management practices, but also a review and modifications to their organizational structure. As a part of his experience in implementing Lean Marek also emphasizes the organizational development and training process to achieve the business objectives and benefits that are requisite of the above improvement processes.

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INTRODUCTION

Those of us who studied Toyota Production System (TPS) for the last few decades have seen this graphic on many occasions:



It is a pictorial representation of principles and strength of Toyota Production System. The foundation of TPS is **Standardized Work**. The two major pillars supporting TPS are **JIT** (Just-in-Time) and **Jidoka** (Autonomation, or as I call it - "Stop the Line, fix the problem").

The first time I heard about Just-in-Time was in 1980 when NBC showed a TV documentary called "If Japanese can, why can't we?" Later on I came across two books written by Dr. Richard J. Schonberger called "Japanese Manufacturing Techniques" and "World Class Manufacturing". And finally Jim Womack, Dan Jones and Daniel Roos introduced a landmark book called "The Machine that Changed the World" and the Lean revolution was born. We found a formula on how to improve performance of our companies through the "Lean Production" approach based on TPS (Toyota Production System.)

We started to study any publication that came out of Japan that we could get our hands on. We learned about Quality Circles, Waste, 5S, Kanbans, Kaizens, SMEDs, flow, cell layout, Supermarkets and Value Stream Mapping. We learned a lot. During the last twenty years we also implemented a lot of these new Lean methodologies and processes. Unfortunately the results are limited and most of the new processes do not last long term.

We have not been able to achieve the same level of quality, performance, understanding and involvement as you can observe in any Toyota plant in Japan or in North America.

I remember a few years ago I had a conversation with a Plant Manager of a metal stamping operation. His comment was "We have run over eighty Kaizen events in the last two years, why I don't see an improvement to my bottom line?"

We have learned the Lean tools and methodologies, we appear to understand them, so why is it that there are more companies struggling with the implementation of Lean Manufacturing than those companies which have successfully completed the Lean Journey? What are we missing? What are we forgetting? Why is it so difficult? What are we doing wrong?

We attend conferences and seminars; we conduct training sessions and workshops. We keep learning more and more about different Lean processes and tools. Are we learning the right stuff? Do we have the skills and knowledge to implement Lean? Do we understand the logical connection of all TPS tools and methodologies? Do we understand the sequence of implementation? Do we have the knowledge of solving all obstacles and problems that are associated with the implementation of Lean?

What we are forgetting is that we need to have a total understanding of all Lean processes, learned through study or through experience, in order to successfully implement the program. We need to have the right people involved in the implementation and we need to follow a learning model developed by Toyota. Many companies initiate training activities and attempt to implement different aspects of Lean looking for a “quick fix” or a “quick solution”. It took Toyota over twenty years to develop what we now call Toyota Production System. You cannot expect long term results without properly investing in training and not rushing the implementation

A Lean environment requires a different style of management, different style of Leadership and performance measurements, different organizational structures, different thinking and different culture. We have done a lot of training and made organizational changes, but do we really understand how to select people to implement and run Lean Manufacturing? Do we know what skills do they need to be effective in a Lean environment or what kind of training we need to develop to be successful in implementing Lean?

In the next few pages I will try to answer these questions and give some directions and recommendations in the area of training requirements for implementing Lean. These recommendations are based on my experience from both working for Toyota Manufacturing in Cambridge, Ontario and from my consulting career.

TOYOTA'S TRAINING STYLE

When Toyota opened their first manufacturing facilities in North America in 1984 there was a lot of promotion regarding the amount of training programs that would be offered to their new employees. Training was one of the major attractions to get a job at Toyota. It all started with NUMMI (a joint venture between GM and Toyota) and later on with TMM in Georgetown, Kentucky and TMMC in Cambridge, Ontario. I joined TMMC in June of 1987 as their Training Manager. Here are some of my initial observations about Toyota's training style.

OBSERVATION #1 - TRAINING IS DONE BY MANAGERS AND LEADERS

One of my first surprising discoveries about training at Toyota was a fact that there was very little written about Toyota Production System. There were no books or operating manuals. There were some brochures and handouts, but nothing close to what we are used to, and there were no written policies defining what TPS is.

Toyota very heavily depends on the "spoken word" to train and to sustain the knowledge of TPS from one generation to another. Experienced Group Leaders, Team Leaders, senior executives, managers, engineers and specialists become mentors and trainers. Training on many occasions is conducted one-on-one with hand generated notes or pictorials. (A method we have since learned to call Value Stream mapping). There are sitting down sessions and as well as visits to the manufacturing floor or to the warehouse or to the office to observe actual processes in action.

Toyota Production System is considered a "living", dynamic and always changing entity. There have been modifications and improvements to TPS since its introduction over 50 years ago. These improvements result from contributions from individuals who were able to overcome some of the process issues or find a better way.

There are no formal certification processes to become a TPS trainer or a mentor. There is no such a thing as a "TPS Instructor". There are groups of internal consultants, in each plant or a major business unit whose primary responsibility is to help senior managers to move their organization towards the ideal state. Many of these individuals have received intensive training through Toyota's Operations Management Consulting Division. OMCD was established to develop and diffuse the system through Toyota and its suppliers. Each Leader is responsible for teaching and training his subordinates, and this is done almost daily. (In 1992, Toyota founded the Toyota Supplier Support Center (TSSC) in the United States to provide North American companies with training in Toyota Production System. TSSC is modeled on OMCD).

This training process is very similar to a trade Apprenticeship program, where an experienced Craftsman takes a student "under his wing" and teaches him knowledge and skills required to perform a job. It really does not matter if you are a new employee on a shop floor or a newly promoted manager. There always will be a senior Mentor or an Advisor waiting to teach you.

The amazing part of this teaching process is how consistent and reliable it is. Everybody gets the same point, there are no conflicting messages, there are no individual interpretations of TPS philosophies and there are no disagreements. The success of TPS is that everybody understands the principles and follows them. Their superiors immediately correct those, who attempt to do or to teach something outside the principles and philosophies of TPS. This is where we have learned the meaning of a Japanese proverb “the nails that sticks out gets hammered in”.

OBSERVATION #2 - ON-THE-JOB TRAINING (OJT)

All new managers and team leaders hired by Toyota in North America are required to spend a day working on the Line. During my second day of my first trip to Japan I spent eight hours working on the car assembly line. This is when I learned the meaning of OJT (On-the-Job Training). Learning by doing. This was completely different from what I expected.

In 1988 TMMC hired their first group of team leaders. After an initial four weeks of training in Japan they returned to Cambridge, where under the supervision of the Japanese instructors they started to learn how to assemble cars. After a period of time, some of our team leaders started voicing a certain level of disappointment that they were not receiving the amount of training that they were promised. We discovered that many of our employees were expecting to attend a traditional classroom style of training. Training with books, instructors, homework and final exams. This was not how Toyota intended to train their work force. The main training methodology was OJT.

OJT consisted not only of training on how to perform you specific job, but also on the proper use of tools, equipment, observation of safety rules, quality procedures, HR policies, preventive maintenance, ordering materials and reporting problems. It consisted of learning how the individual operating processes worked and what was the role of each team member to support these processes. OJT was conducted on the shop floor. The training was done by observing, trying out and practicing different work elements of a job, using Standardized Work sheet as a guideline.

Toyota emphasizes not only the ability to perform the job, but also to perform it well (according to the standard) and within the Takt time. In order to do this operators were trained on the “secrets of the trade” - the minute intricacies of every function, ins and outs of the jobs, “knacks and tricks”. For example: the proper use of a spray gun in order to paint a part in three passes rather than five, the proper use of an air gun to create a required torque and to prevent injuries, the proper use of a welding torch to prevent pinholes, or the proper use of metal cutters.

OBSERVATION #3 - UNDERSTANDING PRINCIPLES OF TPS

All newly hired Toyota employees in North America had to attend a New Employee Orientation. This was a five-day training session offered during the first week of employment. This was our first introduction to Toyota Production System. This training consisted of classroom style training and exercises covering such subjects as the team concept, production system, Kanban, Kaizen, quality principles, attendance policies, safety policies, labor-management relation's philosophy, housekeeping and the competitive condition in the auto industry.

The New Employee Orientation training was followed by OJT, in which each trainee worked side-by-side with a Toyota trainer or a Group Leader on the assembly line. The same methodology was used for office employees. Each new employee was assigned a trainer who was responsible not only for teaching the job elements and job content, but also explaining how to perform the job in accordance to TPS rules and policies. On-the-Job Training lasted from six to eight weeks.

The role of the Trainer was to explain to the Trainee **why** certain work elements of a job need to be done in a certain way. In their explanations Trainers always referred to at least one or two principles of Toyota Production System. Unfortunately sometimes this explanation consisted of statements like: "this is how Toyota does things", or "this is what TPS wants us to do". Regardless of understanding or accepting these explanations all employees were expected to follow their jobs as defined. No variation was tolerated.

At the end of the initial OJT most of the new employees had a fundamental knowledge of basic principles of TPS and Toyota's philosophies:

- Teambuilding
- Concept of a single piece flow
- What is continuous flow processing
- How does the Pull system work - including Kanban
- What is Takt time
- How to achieve the highest quality of the product
- What drives the costs
- How to identify, report and solve problems
- What are the seven types of Waste
- What is Kaizen
- Three rules of Just-in-Time
 - Produce only what the Customer needs
 - In the right quantity
 - At the right time

By developing this foundation of every employee having knowledge and understanding of the basic principles and philosophies of TPS, Toyota has created a very uniform work force. The result has been that everybody knew how to perform their job, what are the job standards, what was expected of them and how to deal with any abnormal situation.

OBSERVATION #4 - FIVE NECESSARY SKILLS OF A LEADER

Toyota requires five basic levels of knowledge and skills from a leader.

1. Understanding and Knowledge of Role and Responsibilities
2. Understanding and Knowledge of Job Elements
3. Training Skills
4. Leadership Skills
5. Skills in Kaizen

1. KNOWLEDGE OF ROLES AND RESPONSIBILITIES

Knowledge of work responsibilities includes understanding one's role, responsibilities and authority as a leader at Toyota. It includes the awareness of the need to perform work according to company policy, concern to meet the production plan, observe and follow the company rules and procedures.

A leader's knowledge, responsibility, and authority are directly related to successful implementation of Toyota Production System in the workplace. This is where the TPS was developed; this is where the work begins.

2. UNDERSTANDING AND KNOWLEDGE OF JOB ELEMENTS

Knowledge of Job Elements means knowledge regarding materials, machinery, tools, processes, methods, and necessary kinds of technologies concerning fabrication, assembly, machine settings, etc. This kind of knowledge is required in an ever-changing workplace.

This also includes know-how, skills in combining materials, machinery, and workers for maximum efficiency. It requires practical knowledge of the workplace. Consequently, this system cannot be used effectively until the processes, fabrication methods, and other necessary technologies are understood. This kind of practical knowledge of work is a very important requirement of a leader implementing Toyota Production System practices. It should not be overlooked.

3. TRAINING SKILLS

Training Skills are necessary in order to provide adequate education and training for operators. This skill requires an understanding of basic tools, such as Standardized Work Sheets, Job Instructions, Standard Work Tables, Work Instruction Sheets, principles of a Pull System, Preventive Maintenance, etc.

Teaching skills are important for many reasons. First, leaders must foster the development of highly skilled employees. At Toyota, each operator is responsible for a range of different processes. Thus, it is necessary to provide **multi-function training**.

Second, since quality must be built in at each process, it is necessary to provide adequate training. In this way, we ensure that employees understand and carry out their work accurately, safely, and conscientiously. For these reasons, **training** is an extremely important part of the leader's role at Toyota.

4. LEADERSHIP SKILL

Being skillful at handling people is important, especially when trying to build encouragement and maintain smooth employee relationships. It aids the leader in ensuring everyone's cooperation.

One of the principles of Toyota Production System includes respect for people. It is a system whereby all operators participate in improvement activities. Because Toyota bases its work methods on a human-oriented philosophy, it encourages leaders to treat employees as individuals. The leader must work together with his/her team and others to create a cheerful, pleasant workplace.

5. KAIZEN SKILL

Leaders must be skillful at conducting Kaizen and eliminating waste in the workplace. This is how they help raise work efficiency, improve quality, ensure safety, and lower costs.

At Toyota Team Leaders and Group Leaders develop Standardized Work. They analyze, study, and simplify work methods. It is a starting point for making improvements. They determine the working sequence; this is where tasks are combined in such a way to eliminate waste.

OBSERVATION #5 - DEVELOPMENT OF MANAGERS AND LEADERS

Toyota Production System is a logical collection of philosophies, practices, methodologies and tools. A manager or a leader is responsible for various aspects of the production process, such as quality, cost, safety, production volume, etc. He is responsible for the activities, training and the development of his staff. He must also maintain the integrity of and implement TPS in the workplace. In order to achieve this all new Toyota Managers, Group Leaders, Team Leaders, Engineers and Specialists receive additional training on TPS.

Toyota offered several classroom style advanced courses on TPS. These courses were offered gradually over a period of three years. As each North American operation matured and started to depend less and less on the knowledge of Japanese trainers, the North American managers were given the responsibility to sustain TPS.

These courses included:

1. The Role of the Supervisor
2. Job Instructions
3. Standardized Work
4. Principles of a Pull System - JIT
5. Problem Solving
6. Kaizen Workshops

1. THE ROLE OF A SUPERVISOR

The training material for this course consisted of a videotape “A day in a life of a Group Leader in Japan” and a training manual called “The Role of Supervisor”. It was a detailed description of all activities that a Supervisor is expected to perform during the course of a day or a week. It divided the responsibilities among Team Leaders, Group Leaders and Assistant Managers.

It not only defined the expectations and the responsibilities of the Supervisor, but it also provided information and how and when to perform these functions. It spelled out in minor detail what time to arrive for work, how to start a work day, what reports to complete, what to do during every moment of a work day, what changes to look for, what to monitor and control and how to address any issues. It defined the scope of activities and responsibilities with respect to quality, safety, production, maintenance, people and costs.

All Supervisors and Managers were expected to participate and present during daily regular walk-about meetings, quality review meeting, manpower planning meetings, quality audits, production review meetings, etc. A day in a life of a Toyota Supervisor was very well defined.

2. JOB INSTRUCTIONS

In order to be an effective instructor each Leader must have the knowledge of the actual job elements and possess instructional skills. Job knowledge consists of information and skills required to perform specific jobs. It also consists of information about the quality standards, materials, work sequence, tools and expectations. Each Leader must also possess the technical skills to perform each operation. Instructional skills refer to the ability to transfer this information, knowledge and skills to others.

Job Instructions training teaches a very well defined standard methodology of learning and it teaches job training techniques. Learning is achieved through three steps:

- Explanation
- Demonstration
- Participation

Each job is defined by using a Job Breakdown sheet. The Job Breakdown sheet lists all major steps and points of the job and it serves as a checklist to assure that the teaching method is correct. Instructors are taught how to prepare the operator to perform the job. How to demonstrate to the operator the way the job should be performed, stressing the important steps and key points. They also learn what to look for during operators try out performance.

When creating work sequence and timing each work element, Toyota's philosophy is that any operator should be able to perform this function. This philosophy is carried into Job Instructions, where the motto is "If the worker hasn't learned, the Instructor hasn't taught".

3. STANDARDIZED WORK

The foundation of everyday operation of TPS is Standardized Work. Standardized Work regulates every single step in the entire process of producing an automobile. It concentrates on operator movements and identifies the best and the most efficient sequence for each manufacturing and assembly process. It is always repeated in exactly the same way, therefore avoiding unnecessary motion and wasted effort, maintaining quality, assuring safety and preventing equipment damage.

Standardized Work establishes guidelines for three central elements of a work process:

1. Takt Time
2. Working sequence
3. Standard in-process inventory

Takt time is the amount of time required to produce a single part or to complete a given amount of work. The work sequence defines the step-by-step order in which operation is to be performed. The in-process inventory control the flow of material by defining how much inventory should be stored in-between processes.

Work is not considered standardized until necessary information is documented onto these three forms:

1. Standard Production Capacity sheet
2. Standard Work Combination table
3. Standard Work chart

Standardized Work is a base line used to identify potential problems, abnormalities and efficiencies of the process. Standardization is the first step towards improvement (Kaizen).

Standardized Work training combines theoretical training with a real shop floor experience. Participants are asked to observe and analyze a real manufacturing process, collect data, document the current situation and propose improvements by eliminating waste and changing the sequence of work elements.

4. PRINCIPLES OF A PULL SYSTEM - JIT

Just-in-Time refers to producing and moving what is needed, when it is needed and in exactly the amount it is needed. Just-in-Time relies on three operating principles:

1. The Pull system
2. Continuous flow processing
3. Takt Time

As we know it is virtually impossible to achieve accurate timing in getting the right part to the right place. Toyota reversed a traditional process of information flow controlling the flow of parts. At Toyota, the next process picks up what is needed from the previous process. Material flow dictates the information flow and the tool used to accomplish this is Kanban.

Continuous flow processing attempts to eliminate the stops and starts that are common in a traditional production system. To accomplish continuous flow processing it is necessary to produce an item and immediately pass it on to the next small process. All processes produce and move only one piece at a time – single piece flow.

Takt Time is the necessary time to finish a given amount of work, conduct a simple operation, produce a component or assemble an entire car. Takt time is determined by dividing total daily (or monthly) working time by daily (or monthly) customer requirements.

A level production schedule is a system used by the Production Control department. It attempts to level and sequence production, by averaging both the volume and a sequence of different model types on a mixed-model production line.

SMED - Quick changeover is required in the processes where a single piece flow is impossible to achieve due to time-consuming set up changes. This typically is a batch production process, where lot sizes must be reduced as much as possible.

5. PROBLEM SOLVING

Toyota defines a problem as a discrepancy between the current situation and a standard or ideal situation. The Toyota Problem Solving process assists on a systematic approach to problem solving provides a format for presenting and reporting facts to others, provides a common language and methodology. There are several general purposes for solving problems. These include problem solving to maintain the current level or status, to improve the current capacity or capability and preventive problem solving to keep problems from re-occurring.

The Problem Solving model involves four phases and it is based on P-D-C-A – Plan, Do, Check and Action. Each phase contains several components including: problem identification, analysis, formulation of countermeasures, development of plan of implementation, communication and buy-in of the plan and execution. Following the execution there are steps required to monitor and measure the progress of implementation, modifications to the plan if necessary, evaluation of final results and standardization of the process to prevent problems from re-occurring.

Problem solving training also introduces a standard way of collecting and analyzing the information, presenting countermeasures and the implementation plan. This problem solving report became known as an A3 Report, which has frequently been called a "Story Board". The A3 report is the only way that any issues, problems or proposals are presented to management for review, evaluation or approval.

6. KAIZEN WORKSHOPS

During the Kaizen Workshop all previously obtained knowledge and experience about TPS methods and practices comes to the table. Kaizen workshops are usually run as a very intense activity over a period of few days. This is SWAT type of an approach to improvements or solving problems. Objectives of a Kaizen workshop are to achieve specific objectives in the area of quality, productivity or cost. Not achieving these objectives is considered a failure.

A Kaizen workshop starts with an assumption that the cost of making something varies greatly depending on the manufacturing methods used. Production increases can be obtained by increasing the number of working hours, or by increasing the number of workers, or by adding more equipment or by simply working harder. A Kaizen workshop does not accept any of the above-mentioned approaches; it focuses its activities on eliminating waste from each step of the process.

In a Kaizen Workshop participants start by identifying all work elements of the process and by analyzing every step of Standardized Work. They collect data, they analyze the layout of the operation, they investigate material and information flow, equipment downtime, quality issues and they identify opportunities for improvement. Solutions are created and changes to the physical layout or methodologies are implemented overnight. Newly implemented changes are immediately evaluated and this process is continuous until defined objectives are accomplished.

LESSONS LEARNED

Many attempts have been made in the last twenty five years to discover the secret of what it takes to train and educate a manufacturing work force on principles of Lean (TPS). Organizations studied extensively Toyota's training materials and training methodologies. They watched several Toyota manufacturing sites being opened in North America. Where American and Canadian workers were hired and within a short period of time they were very successfully trained on principles of Toyota Production System.

Toyota employees do not learn Toyota Production System from books, classrooms or by attending seminars. They learn TPS from OJT (On-the Job training) and from their superiors, their managers, their leaders and their Mentors. Who continuously advise, review, correct and drive the knowledge.

Every company initiating Lean training should follow this model. When a company decides to implement Lean they should start by creating a position of a Lean Leader or even better by creating a Lean Leadership organization. These leaders should be trained and become Lean Practitioners capable of teaching, coaching and mentoring the implementation of Lean. Lean Practitioners should then teach all managers and supervisors not only the knowledge of Lean tools and methodologies, but also their roles and responsibilities. **All managers and supervisors must know how to manage in a Lean environment and apply this knowledge daily.** All managers and supervisors must be made accountable for a success or a failure of the Lean implementation process. This is not optional – either you are in or you are out. Too many times a task of implementing Lean is assigned to an individual from manufacturing, engineering or a quality department without proper support and training in place. When companies are not able to achieve the same results as Toyota they started looking for reason and excuses.

CAN'T BLAME IN IT ON THE CULTURE

In 1999 Harvard Business Review published a paper "Decoding the DNA of the Toyota Production System". This was a very extensive four-year study of the Toyota Production System in more than 40 plants in Japan, Europe and in the United States. It was an attempt to find a scientific answer to why Toyota is so successful. Here is an abstract from this paper: *"So why has it been so difficult to decode the Toyota Production System? The answer, we believe, is that the observers confuse the tools and practices they see in their plants with the system itself".*

Here is another one: *"Thousands of executives from hundreds of businesses have toured Toyota' plants in Japan and in North America. Frustrated with their inability to replicate Toyota's performance, many visitors assume that the secret of Toyota's success must lie in its cultural root. But that's not the case."* Toyota has very successfully launched several manufacturing plants in North America employing American and Canadian workers. Many of these plants (I worked in one) have outperformed their sister plants in Japan. Failure to implement Lean in North American cannot be blamed on our culture.

I fully agree with a statement that people touring Toyota manufacturing plants confuse tools and practices with the system itself. I have conducted many of these types of tours and I have presented at many conferences and on several occasions people did not believe me that this system can work. I have helped companies implement Lean in Canada, US, Mexico, England, France, Spain, Italy, Poland and other countries. In each one of these countries there was always someone who tried to tell me "Lean will not work here, because we are different". Yes these are different countries with different languages, history, customs and traditions, but Toyota has successfully launched new plants all over the world. Blaming the culture is a very poor management excuse for the failure to implement Lean.

WE CAN ONLY BLAME OURSELVES

It took me about three years to begin to understand a logical connection between all aspects of Toyota Production System. The Toyota style of training is very similar to that of a Military Boot Camp where you might question the value of learning trivial and silly things or that of a Karate Kid - "wax on, wax off, wax on, wax off". *I will teach you a small task and when you demonstrate to me that you learned it, I will teach you another one.* I was assigned a Mentor, my personal Sensei, who shadowed me everywhere I went. I was learning from him TPS and Toyota's way of doing business; and to some degree he was learning from me about the Western life style.

The more I study Toyota Production System the more I am convinced that TPS fundamentals are based on a Military style of training and operation. Several processes and methodologies like Job Instructions, PDCA, Standardized Work, company uniforms, identification stripes on colored hats, 5S, style of morning meetings (parades) and operating discipline. The Military does not only teach you how to perform in a certain situation, but you have to demonstrate that you understand what to do and you have to operate in the mode for the rest of your carrier. When we deliver training to our employees we hope that they will "learn something" interesting, exciting which will motivate them to implement a new process in their area.

We very rarely make our manufacturing managers or supervisors accountable for the training, implementation and a success of Lean activities. They are too busy, or too under staffed to run day-to-day activities - fighting fires. In the Military every officer is a teacher and practitioner. How many of your managers can teach any of the Lean training topics?

Toyota Production System is a collection of logical tools, practices and methodologies that have to be implemented in a certain sequence in order for them to work. We have learned about these tools and methodologies but we still fail to implement them correctly. We spent too much time trying to analyze them, debate them challenge them and undermined them.

WHY DO WE HAVE TO KNOW WHY?

We live in a society that we have to know WHY, before we do anything. Toyota as a company has a 50 year old track record of growth, prosperity, global domination and excellent products. Lean Manufacturing, which is based on a Toyota Production system, has proven many times its effectiveness. So, why do we still after all these years waste time analyzing and challenging its value.

Why do we spend time analyzing the DNA of the Toyota Production System, looking for answers, rather than focus our efforts on training and redefining our knowledge on how to implement Lean. Several times in the last few years I stood in front of a production manager who told me that: “nothing is going to get done around here until I fully understand how this Lean is going to help me”. There are some aspects of Lean that can be explained and there are aspects of Lean that you can only experience by implementing it. Our decision makers should learn to stop asking why and concentrate their efforts on supporting a well-defined training and implementation process. I Jim Womack’s words: “create a crisis, hire a Sensei, map out a Value Stream and go and do something”.

When I started working for Toyota I kept asking “why?” all the time. There were things about TPS that I understood and they made sense. But there were things so different that I had no clue what to do with them. When my Trainer could not explain them to me he always gave me the final answer: “because this is TPS, this is how Toyota does it and it works”. With time and some “hard to believe” results I learned to trust and respect the process and I stopped asking why.

When I start a project with a new company during our kick-off meeting I always make a simple statement: “There will be things about Lean that I can explain to you, there will be things that I can show you how they work, but there are things about Lean that I do not know how to explain them to you. You have to make a leap of faith and trust me. And in a few weeks when we implement these changes and you will be able to see the results, you simply will stop asking me the question **why?**”

There are things about Lean that do not make sense if you look at them from the individual point of view. Let me give you an example. I do not know how to explain to the Fork Lift driver, whose job it is to deliver material to the line, why I want him to deliver one box at a time ten times per shift, rather than a single skid full of boxes once per shift. From his perspective this does not make sense, it is more work for him and he is right. What he does not want to understand and accept is the fact that by implementing this process we are able to reduce inventory levels, get more output from the value adding operator on the Line, create more manufacturing floor space, create a better information flow to the rate of consumption and reduce lead time. His Supervisor or Manager might understand that, but my Fork Lift operator never will. All he remembers about Lean is that I created more work for him.

WE CRASH AND BURN

We jump into the implementation of Lean without having the proper knowledge, a long term commitment and a realistic plan. We do not fully understanding the implementation sequence, we do not provide proper training and we expect the results the next day. And if we do not get the results right away, we throw our hands in the air and we give up. Than we tell the world that this system will never work here. We give up too easy.

We fail to support and properly maintain newly implemented processes. In my experience implementation phase of Lean represents only about 30% of the effort for success. 70% of the effort is a daily maintenance and improvements to the process. When a company decides to implement Lean it creates a momentum and it allocates resources to do it. When the training and implementation is “complete” participants return to their “regular jobs”. Limited resources are assigned to maintain the system, audit the new processes, resolve issues, and monitor results and to sustain the change.

WE HAVE TO CHANGE THE WAY WE TRAIN

People learn in two ways: by studying and by practicing. Our initial introduction to learning is through our schooling system, where we learn how to read and write. We also learn different subjects: languages, geography, history, art, music, math, physics, chemistry and biology.

Schools teach us limited practical knowledge. To learn more we need to continue our education into colleges, universities, trade schools or academies. When we graduate we become doctors, lawyers, engineers, accountants or skilled technicians, tradesman, fireman, policeman, electricians or pilots. Unfortunately many companies still depend on an elementary classroom style of training.

When we talk about training and implementing Lean we quite often talk about a change in a work place. We talk about a different style of management; we talk about implementing new manufacturing processes and a new way of doing business. But have we changed the way we train our people to learn about Lean? Can we honestly say that we have adapted our training style to match that of Toyota? We need to change the way we train.

I am convinced that Microsoft Windows Power Point is the best and the worst thing that could have happen to the training industry. Power Point allows us to create incredible training material and presentations, incorporating pictures, color, sounds and motion. It makes training interesting, exciting and very informative. On the other hand we are spending far too much time, dazzling our audience with complicated and busy charts. We trying to present too much information and cover too many topics in lengthy training sessions. We overwhelm our audience. In my opinion any theoretical training over three hours is not effective.

It is a well know fact, in adult education, that adults learn best by building on existing knowledge and skills. Toyota utilizes this in the OJT. Every training module or a topic presented in a classroom must be followed by a realistic and practical exercise on the shop floor or in the office environment. Participants have to have a chance to observe the current situation, identify waste, collect and analyze data and recommend solutions. This also can be done in a form of a Workshop, where participants are involved in the actual implementation of a new process. All participants must demonstrate that they have learned something and they have to “pass” the course. All training is must lead to some sort of certification, licensing or recognition. This can be accomplished by writing a final test or by making a presentation in front of a Steering Committee or a Management Team.

The best model for developing a Lean training that I can think of is a process of getting a driver's license. You study theory - rules and regulations. You then must pass a written exam in order to get a temporary license. Then you practice driving on different roads and in different conditions under supervision. The final step is a Driving Test, where a certified examiner takes you through variety of driving conditions and if you pass you get your license. You repeat this process until you pass. Once you have a license to drive a car, you apply your skills everyday, but you also know that the learning never stops.

TRAINING RECOMMENDATIONS FOR IMPLEMENTING LEAN

Any organization facing implementation of Lean understands that they are about to venture on a new journey. As with any new journey or any new activity there are aspects of it that we understand and know what needs to be done, and there are the unknowns. The success of this new activity will depend on how well we apply our knowledge and experience from the past in combination with obtaining the new knowledge about Lean. We also need time to absorb this new knowledge, become comfortable with our new skills and gain experience. Toyota has taken over 25 years – do expect to implement Lean in one year.

Training on Lean Implementation is a multi-dimensional activity. It is not as simple as just creating a list of lean tools and methodologies, and learning how to use them. There is a logical connection and reasons why certain tools or methodologies must be implemented first and only after we learn how to use them correctly, we can learn more.

Some tools and methodologies can be presented in a classroom; some must include exercises, a practical portion of training and the others you can learn only by applying them - learning by doing. All training activities must conclude with a demonstration by participants that they have learned and understand how to use the new process or the new tool.

My recommendations on what and how to train for Lean Implementation are based on what I have learned from Toyota and from my consulting experience working with companies to implement Lean. Objectives of the Lean training program are:

1. To create an understanding of Lean theories and principles – all employees should participate in this training
2. To train and to identify roles and responsibilities of individuals responsible for implementing and sustaining specific Lean processes – all managers, supervisors and technical support people should participate in this training
3. To develop a certification program of a Lean Practitioner – this training is should be given only to a selected group of people who will be responsible for driving the implementation of Lean throughout the organization, monitoring progress of activities and continuously improving the process

Training activities that I recommend are a combination of lectures and practical shop floor exercises combined with the implementation and evaluation of actual business driven Lean projects. There is also a time factor involved in order to implement new processes and evaluate the results.

Lean training activities should be divided into two main themes:

1. Knowledge of Lean Tools and Methodologies
2. How to Manage in a Lean Environment

Each main theme should have several training modules (courses) ranging from very basic to advanced. Delivery of these training modules should be synchronized and follow a well defined sequence. Participants are not allowed to skip any level of training. Participants advance to the next level of training only by successfully passing the course – demonstrating that they have required knowledge and skills. This can be done by writing a final exam, or by selecting and implementing a project and presenting it to a Steering Committee or simply by immediate Manager evaluating and approving participants’ activities. Courses can be taken as many times as is needed in order to obtain a passing grade.

Training modules are grouped into three levels of advancement. Each course is designed for a specific audience. Some of this training should be mandatory; some of it could be made available to the employees who are interested in learning and advancing on their own. The three levels are:

Level I (Basic) – Principles of Lean

Level II (Intermediate) – Activities Based Training

Level III (Advanced) – Sustaining and Improving

Level I courses are designed for all employees. They explain some of the fundamental principles of Lean and introduce participants to some terminology, tools and basic applications. Level II courses teach more theory and they begin to introduce participants to some practical applications (5S, VSM). As training of Level II courses progresses participation requirements begin to be more specific with a lot of mandatory participation for managers, supervisors and technical support people. Level III courses are designed to be conducted 100% on the shop floor and participants are company designated Lean professionals. Approximate time to complete all three levels of training and receive a Lean Practitioner certificate is about three years. All courses should be delivered and taken in a sequence described below.

LEVEL I TRAINING – PRINCIPLES OF LEAN

THEME: HOW TO MANAGE IN A LEAN ENVIRONMENT

TRAINING MODULE: LEADERSHIP DEVELOPMENT TRAINING

The factory game today is changing. Lean Manufacturing strategies cannot be adopted successfully in an authoritarian organization. They require a partnership among workers, managers, and skilled and technical staff in which the parties are responsible to each other for the outcome. And to produce that desired outcome, all partners must be informed and working together.

Success of any new project largely depends on the strength and abilities of their Leaders. Implementation of Lean should not be seen as any different type of a project than for example: launching a new product, installing a new production line, building a new facility or venturing into a different market. Fundamental project management skills and abilities to complete tasks on time are mandatory requirements. A successful Leader depends not only on his abilities to manage the project, but also on his skills to get others engaged in creative thinking, overcoming of obstacles, creating solutions and completion of assignments.

People involved in implementing Lean Manufacturing are expected not only to be great leaders, trainers and communicators, but they also face a challenging task of changing cultural icons, reversing traditional way of conducting business, motivating people and explaining unexplainable. They need to learn to deal with these challenges and overcome them. They truly need to become Change Agents prior to attempting to implement any Lean tools or methodologies.

Any organization venturing into implementation of Lean Manufacturing should check the competencies of their managers, technical staff, supervisors and hourly personnel to lead, train and manage. Many companies pride themselves on getting supervisors and hourly employees involved in implementing Lean. This is a correct and right way to go, but let's make sure that your supervisors and hourly folks can operate on par with seasoned engineers and technical experts. I set through many meetings where people are intimidated by not being able to keep with the terminologies, the pace of a meeting, ability to create a graph and the use of computers. Many supervisors and hourly people have never participated in project review meetings, or made a presentation, or were requested to analyze the information, or asked for an opinion. We need to train them on some of the fundamental elements of managing a project and on the development of leadership skills.

The minimum competencies that are expected from every Lean implementer or a participant are as follows:

- **Presentation Skills** – ability to develop presentation material, ability to present in front of an audience, ability to communicate, and ability to get the audience engaged in the presentation, ability to get the message across and ability to achieve the objective of the presentation.
- **Meeting Facilitation Skills** – ability to participate in a meeting as a leader or a participant, ability to encourage participation, ability to contribute to the meeting, ability to prepare yourself for a meeting, ability to take notes and capture essential information, ability to reach consensus and to make a decision.
- **Time Management** – ability to understand time limitations and requirements, ability to complete assignments on time, ability to effectively schedule your own time, ability to develop a written activities schedule, ability to use time effectively.
- **Conflict Resolution** – ability to evaluate and analyze all aspects of a conflict, ability to compromise without giving up the objective, ability to reach consensus, ability to achieve solution acceptable to all, ability to successfully resolve conflicts.
- **Overcoming Resistance To Change** – ability to identify and resolve elements preventing implementation of changes, ability to adapt and maintain the change, ability to explain the need for change, ability to motivate.

- **Problem Solving** – ability to collect and analyze data, ability to graph and plot information, ability to identify a problem, ability to see beyond current boundaries of a problem, ability to create a solution to a problem, ability to implement the solution and ability to follow a standard problem solving methodology.
- **Working in Teams** – ability to share work among team members, ability to participate in a team assignment, ability to lead or to follow, ability to respect others for their contributions, ability to follow instructions, ability to contribute as a team member.
- **Project Management** – ability to identify all necessary tasks required to complete a project, ability to plan work, ability identify time constraints of a project, ability to communicate the progress of the project, ability to identify resources necessary to complete the project, ability to delivery, ability to understand and complete the objectives, ability to report progress, ability to follow up.

Targeted Audience: All managers, supervisors, technical staff, team leaders and interested employees.

In this paper I do not intend to go beyond just highlighting the need for Leadership Development skills. There are many books and programs available on the market on Leadership training. Any company should be able to put together a very comprehensive training for their Change Agents, Lean participants and implementers and achieve expected results. I do intend to stress the need for such training. Many companies attempt to implement Lean Manufacturing just by learning Lean tools and methodologies and in the end they fail. You cannot solely depend on outside consultants and “one week” seminars to successfully implement Lean. You need a strategy for the development of an internal organization and the development of internal skills.

THEME: KNOWLEDGE OF LEAN TOOLS AND METHODOLOGIES

TRAINING MODULE: PRINCIPLES OF JIT AND PULL SYSTEM

This is a very basic introduction to the principles of JIT and Pull. This training module should be a one-hour presentation using slides and pictures. This course could be enhanced to a full day training activity by including Pull System simulation. At the end of this course participants are expected to be familiar with Pull system terminology.

Pull system is one of the pillars of TPS. The objective of this course would be to show differences between a traditional process of scheduling production versus building based on Customer Pull. There are several key topics that need to be addressed in this course:

1. Takt Time
2. Material Flow
3. Information Flow
4. Role and types of Kanban
5. Principles of Single piece flow
6. Level production schedule
7. Concept of lead time

The Material Flow portion should explain types of material storage: warehouse, supermarket, point-of-use storage and Work-in-Process Inventory. It also should address types of material deliveries, frequencies, available equipment and methodologies.

The Information Flow should talk about different ways available to communicate production requirements to the shop floor, information exchange to and from Customers and to and from Suppliers. It should explain the operating principles of MRP, different ways of transferring the information, different types of schedules and the role of a Kanban card for scheduling production and for initiating parts deliveries. It should explain the concept of lead-time and its overall impact on operating costs and customer expectations. It should demonstrate a difference between batch production and a single piece flow operation.

The best way to demonstrate how all these elements affect day-to-day operation of a factory is through a Pull game or simulation. There are several of these games available on the market or you can create your own. Participants in the game simulate an operation of a small factory either by making Styrofoam boxes or Lego sets or by building paper airplanes. They go through different variations of the factory operation from a large batch operation, to a small lot production finally through a single piece flow using Kanban. There is a trained group of instructors that help to monitor lead-time, cost per part, productivity and meeting Customer requirements.

Targeted Audience: All employees.

Completion Requirements: Participation

TRAINING MODULE: ELIMINATION OF WASTE

This should be a four-hour training course combining a presentation with an actual exercise to observe and analyze waste. The concept of waste and ability to recognize it is one of the fundamentals necessary to implement Lean. Everybody in the organization should participate in this training and learn how to look for waste.

The course material should include presentation and examples of three types of work:

1. Value added work
2. Incidental work
3. Waste – non-value added work

It should include definitions and examples of seven types of waste:

1. Waste of defect repair
2. Waste of overproduction
3. Waste of waiting
4. Waste in transportation
5. Waste in processing
6. Waste of inventory
7. Waste of motion

It should also include presentation about other waste factors: unevenness and overload.

A very effective element in conducting this type of training is for participants to observe a videotape of a manufacturing process and go through a group exercise of identifying all possible types of waste.

There are many books and off-the-shelf training programs available on the market. Kiyoshi Suzuki in his book “The New Manufacturing Challenge” has a single chapter devoted to elimination of waste that I think is very good. Another good book is “Putting 5S to Work”, by Hiroshi Hirano.

Targeted Audience: All employees.

Completion Requirements: Participation

LEVEL II TRAINING – ACTIVITIES BASED TRAINING

THEME: HOW TO MANAGE IN A LEAN ENVIRONMENT

TRAINING MODULE: 5S – WORKPLACE ORGANIZATION

The concept of good housekeeping and workplace organization has been around manufacturing for a very long time. These activities do not include new management operating style or theories or some revolutionary breakthroughs. They therefore do not excite the imagination of managers, who are accustomed to keeping abreast the latest technology. However, once they understand the logic behind a 5S campaign they become excited the prospect of benefits this activity can bring.

The term “5S” is derived from five Japanese words, starting with letter “S”, that describes principles of good housekeeping. One of a better translation of these five words came from the Masaaki Imai book “Gemba Kaizen” and they are:

1. Sort
2. Straighten
3. Scrub
4. Systemize
5. Standardize

5S is lot more than just simple housekeeping. It cleans and organizes areas around machinery and equipment. It introduces us to certain color-coding for better recognition and visibility, it creates a safer work environment, it removes clutter, it create a labeling system for the ease of recognition, it introduces us to audit procedures and it creates more inviting work place.

5S training also introduces an organization to a very important discovery about Lean - that Lean values the **process** as much as the **results**. “Follow the process and you will get the results”. 5S forces shop floor management to carefully plan, organize and execute the 5S activities. It sends a message to the entire organization that 5S, followed by Lean, is not a fad, a flavor of the month, but an ongoing part of daily life.

It is a simple learning activity that can be organized in any department of a company. It is not only shop floor specific. By going through all the steps of 5S training program, employees have an opportunity to work together on a meaningful project. It opens their eyes and their minds to “waste”, it gets them involved in a decision making process and quizzes them to find answers and solutions to existing problems.

From the management prospective 5S is the first activity that will test organizational readiness for Lean and the management commitment to implement change. It will point out organizational weaknesses and it will identify leaders, followers or non-supporters. It will force the entire organization to learn not only how to successfully implement a project, but it will teach participants about the importance of discipline and standardization, which are key elements when it comes to implementing change.

The best way to learn about 5S is to conduct a one-week “5S Event”. There are many good, off-the-shelf 5S training programs available on the market. You can buy one or you can buy a good book and deliver the training yourself.

Targeted Audience: All employees.

Completion Requirements: Upon completion of this training course each manager, supervisor or a team leader will be required to return to their work area and organize a 5S event within 30 days. Results and findings of this activity should be documented and presented to the Steering Committee or the Management team for a review.

TRAINING MODULE: JOB INSTRUCTIONS

This course provides an opportunity to learn the “Job Instructions Method” and to improve teaching abilities of any manager, supervisor or a leader. The effective use of this method has proven to shorten the learning period, reduce learner anxiety and improve quality and productivity.

Job Instructions training is based on an old military methodology known as TWI – “Training within Industry” and it has been around since World War II. Many companies make a mistake of not introducing this training during their implementation of Lean. They find Job Instructions training too trivial, boring and unnecessary. They would rather skip this training and accelerate the implementation of more complex Lean tools and methodologies. Job Instructions training is extremely important to a fundamental understanding of Standardized Work, best practice, work sequence and discipline. It is a necessary foundation on which Lean is build on.

Another advantage for an organization that chooses to conduct Job Instructions training is the consistency and preciseness of all further Lean implementation activities. It creates a template on how to conduct successful training and it gives instructors the skills and techniques necessary to teach in an effective and productive way. Not all subject matter experts are good trainers.

Job Instructions training should be conducted in three to four short (2 hours) modules over a period of one week. It gives participants a chance to learn the methodology, practice it and demonstrate the newly learned skills.

Targeted Audience: Mandatory for all managers, supervisors and leaders and any employees who will be conducting any form of training.

Completion Requirements: Develop a set of Job Instructions and demonstrate.

TRAINING MODULE: VALUE STREAM MAPPING

Value Stream mapping is a first key practical step towards learning and implementing Lean. The book by Mike Rother and John Shook “Learning to See” is the only way to learn it the right way. The whole training package on Value Stream mapping available through Lean Enterprise Institute is probable one of the best practical ways you start learning about Lean you can get.

But before you have your entire organization mapping all your value streams a word of advise. The purpose of Value Stream mapping is not to produce a “map” of a value stream. The purpose of VSM is to open our eyes to existing problems and issues, to identify shortfalls and process breakdowns and to identify opportunities for improvement. VSM is just a tool and if you do not know how to use it correctly it will have no meaning.

There are several very important Lean concepts and methodologies and all participants should understand prior to drawing their first VSM. These pre-requisites are:

- Understanding seven types of Waste
- Understanding cycle times
- Understanding principles of changeover and set-up
- How to calculate machine uptime
- Material and Information flow - Push vs. Pull
- Understanding concept of Takt time
- Understanding benefits of Continuous flow
- What is a Kanban card and how does it work
- What is a Supermarket and how does it work
- What is FIFO or LIFO
- How to identify a Pacemaker process
- What is Level Production schedule and how does it work
- How to calculate Lead-time

Only after reviewing with your participants all the pre-requisites to VSM and making sure that they understand the meaning and application of them, you can proceed to creating your first Value Stream map.

Targeted Audience: All managers, supervisors, team leaders, engineers and technical support personnel.

Completion Requirements: Each participant must develop a Value Stream map and present it to the Steering Committee or the Management Team for a review.

TRAINING MODULE: INFORMATION CENTERS & DAILY WALK-ABOUT PROCESS

This activity is 100% OJT (On-the-Job) training. This is true learning by doing. It might take anywhere from three to six month for participants to achieve acceptable results. This is a major change from a traditional management style of meeting and making decisions in a conference room to making decisions and reviewing progress on the shop floor.

Transforming the traditional company atmosphere of a top-down decision making organization to a more favorable employee participation style of management is a far greater challenge than educating and practicing particular Lean techniques. One of Toyota's operating philosophies is to "push the decision making process to the lowest possible level". This is a very difficult mind set change for Managers to embrace. It requires them to use skills different from those that have made them successful to date.

A visually identified team territory or an area of responsibility is the starting point. Work teams, departments need to have a place they can identify as their own – a place to meet, to post information, to review indicators of the status of work, to display personal touches and symbols of their team identity as well as examples of their product. This can be accomplished by creating what we sometimes call “War Rooms”, Information Centers or Team’s areas.

The next necessary step is a creation of Support Teams. This is done by assigning representatives from different internal departments to individual work teams. These individuals should represent the following departments:

- Maintenance
- Engineering
- Quality
- Production Control
- Safety
- Human Resources

The purpose of a Support Team is to assist the Supervisor in the area in resolving daily issues, concerns and to help implement process improvements. This is accomplished by conducting daily review meetings between the Support Team members and the Supervisor in front of Team’s Information Center.

The final element of this activity is the Management Daily Walk-About process. Every day the Plant Manager and his staff visit Team’s Information Centers. This is a scheduled and very well structured activity. It should start every day at the same time, preferably in the morning, and it should follow a well-defined route. The visit to each Center should not take more than 10 minutes. This is a report-out type of a meeting, where the Supervisor is responsible for reviewing key performance indicators including: schedule attainment, quality concerns, safety, productivity, downtime, attendance, etc. The Supervisor is also responsible for updating the status of Continuous Improvement activities.

This is a really “Lean” way of running a business. It eliminates any daily conference style meetings, it minimizes the duplications and triplications of charts, reports and schedules. Because these are stand-up style meetings they have a tendency to be lot shorter and more efficient than the typical conference room presentation. Decisions are made quicker, because all participants have all information in front of them. Since these meetings take place on the Shop Floor, the employees can see and understand what the management team is doing to correct their problems.

Targeted Audience: All managers, supervisors, team leaders, engineers and technical support personnel.

Completion Requirements: All participants are required to form and participate as members of a Support Team. They are required to create Information Centers, collect information centers and review and present Continuous Improvement activities. It is a management decision to identify which participants and teams meet the expectations.

THEME: KNOWLEDGE OF LEAN TOOLS AND METHODOLOGIES

TRAINING MODULE: VISUAL CONTROLS

Visual Controls are forms and signals of Just-in-Time information transfer in the factory. Implementation of Visual Controls starts by installing simple communication tools and by initiating some simple shop floor activities including:

- Hourly Production tracking boards to monitor schedule attainment
- Designated and clearly marked parts storage locations
- Address signs identifying work cells locations, delivery and storage addresses
- Pictures and information about final products
- Attendance and manpower tracking boards
- Team members' pictures
- Team rooms and Team meeting places
- Posting Maintenance schedules
- Posting performance indicators
- Posting work instructions
- Andon boards
- Posting Quality indicators

The idea behind Visual Controls is to create more appealing ways of displaying information and updating it on more frequent basis. Creating almost a "live" feedback of information to the employees and management. Away from a traditional method of posting departmental memos, reports, governmental regulations and company regulations on bulletin boards. Visual Controls are based on intentions. They work only when one wants to become a recipient, contributor and a participant. It is a new medium for communication and decision making process that can work only in a new context.

Visual Controls is self-service information – it makes the same information commonly available and understandable at a glance to all who view it. This sharing of information brings a new light and life to the culture of the workplace. It is one of the fundamental principles required for successful implementation of Lean.

Targeted Audience: All managers, supervisors, team leaders, engineers and technical support personnel.

Completion Requirements: Each participant must work with his area support team to implement Visual Controls in his area. Results are to be evaluated by the Steering Committee or the Management Team.

TRAINING MODULE: TPM – TOTAL PRODUCTIVE MAINTENANCE

Total Productive Maintenance is a systematic well defined methodology to not only eliminate equipment breakdowns but also to eliminate any quality defects. TPM is often defined as productive maintenance involving total employee participation and it must be carried out on a company wide basis. Unfortunately many companies confuse TPM with Preventive Maintenance (PM) and leave the repairs and improvements to equipment and processes to a specialized group of engineers and maintenance personnel.

The purpose of a TPM program is to aim at maximizing equipment efficiency not only from the profitability point of view but also from the operator point of view. It establishes a thorough system of preventive maintenance plans and procedures for the equipment's life span. Once these plans are developed it identifies all levels of responsibilities for operators, engineers, maintenance and supervisors. Operators in the area are responsible for conducting TPM and supervisors are responsible for following and maintaining this process.

TPM focuses its methodology on elimination of six major obstacles to equipment effectiveness:

1. Equipment failure
2. Setup and adjustment
3. Idling and minor stoppage
4. Reduced speed
5. Production of scrap and defects
6. Reduced yield from start up to stable production

This is achieved by maintaining well-defined basic conditions, adhering to proper operating procedures, restoring deterioration, improving weakness in design and improving operation and maintenance skills.

Participants in the TPM course learn how to measure machine availability, operating rate, loading time, planned downtime, operating time and performance efficiency. They learn how to restore deterioration, correct design weaknesses and how to measure and tell the difference between a chronic loss and sporadic loss. They also learn how to develop cause and effect diagrams to identify and to correct equipment stoppage and quality issues. TPM course is 100% delivered on the shop floor.

In principle Total Productive Maintenance is an advanced extension and continuation of a 5S - Workplace Organization activity and it is a responsibility of a Supervisor to implement and sustain a TPM program.

Targeted Audience: All managers, supervisors, team leaders, engineers and technical support personnel.

Completion Requirements: Upon completion of this training course each participant will be required to return to their work area and organize or to participate in a TPM event within 30 days.

TRAINING MODULE: SET-UP TIME REDUCTION/QUICK CHANGEOVER

There are two elements to Set-up time reduction; one addresses equipment modifications (technical improvements) the other one deals with the elimination of waste in Set-up methodology. Both activities will contribute significantly to minimizing the Set-up time. Unfortunately too many companies spent large amounts of money and concentrate their entire efforts only on a technical aspect of a Set-up process. By eliminating waste from the Set-up methodologies companies can achieve significant improvements with major capital investments.

The technical aspect of Set-up reduction training focuses on creating a new way of thinking about Set-up equipment and challenging some of the traditional practices. It introduces participants to concepts of changeover carts, bolsters, clamping devices rather than bolts, use of wing nuts on bolts, minimizing variety of fastening tools, minimize the number of screw turns, standardizing die heights, use of two-headed uncoilers, rotating die tables, auto feed vs. manual feed, etc. This type of training requires a knowledgeable instructor with an extensive technical background.

Training on Set-up methodology or actual Set-up and Changeover process focuses on individual work elements performed by operators. It divides the process into three phases: Preparation, Exchange of Dies (tools, material) and Adjustment. It starts by simply documenting current conditions and listing all work elements performed by each operator, timing them and writing them in a sequence. One of the most effective ways to conduct this type of training is by videotaping the entire process. The next step is to level the amount work between all operators, eliminate wasteful operations and moving as many steps as possible to the Preparation phase of the Changeover process.

Understanding the importance of quick changeover process and reduction of Set-up time is fundamental to implementing Lean. It not only eliminates unnecessary down time, but it also gives an organization an opportunity to improve the flow by minimizing production lot sizes and allowing production of “Every-part-every-day”. For the participants it is an opportunity to explore the benefits of Standardized Work, learn more about elimination of waste, synchronized activities, work as a Team and achieve meaningful and measurable results.

Targeted Audience: Mandatory for all supervisors, team leaders and technical support personnel. Strongly recommended for managers.

Completion Requirements: Each participant must implement Quick Changeover process in their area and make a presentation to the Steering Committee for evaluation and approval.

TRAINING MODULE: STANDARDIZED WORK

Standardized Work is a *method* for manufacturing products at a production worksite. The principle behind the Standardized Work is to perform efficient production, in a consecutive sequence, by focusing on operator movements and systematically combining work tasks. Standardized Work is a system that allows each line employee and each supervisor to regulate and to control every single work process.

Standardized Work can be defined as a standardized order of various manual operations to be performed by each employee and a tool for manufacturing high-quality products with fewer work processes. Standardized Work concentrates on operator movements, setting up the best work sequence for each production and assembly process. Once the most efficient sequence has been determined, it is always repeated in exactly the same way, so that employees can always avoid unnecessary motion and wasted effort. Besides maintaining quality and efficiency, Standardized Work guarantees safety, and prevents equipment damage.

There are many versions of TPS based Standardized Work training available in the industry. A genuine Toyota style Standardized Work training must be based on working with three standard forms:

1. Standard Production Capacity sheet
2. Standard Work Combination table
3. Standard Work chart

This is true activity based hands of type of training. There is a small theoretical portion to it, but majority of learning is achieved through actual line observations, calculation of cycle time, completion of standard forms, development of operator balance charts and manpower utilization charts. There are two objectives behind Standardized Work training; one is to learn the methodology, the other is to be able to identify, document, recommend and implement improvements. It takes two days to deliver the course, but it takes at least three months to truly become a practitioner of Standardized Work.

Targeted Audience: Mandatory for all managers, supervisors, team leaders, engineers and technical support.

Completion Requirements: Each participant must develop Standardized Work for at least three processes in their area and present to the Steering Committee.

TRAINING MODULE: IMPLEMENTING MATERIAL FLOW – KANBAN SYSTEM

Toyota Production System uses a well-defined standard process to implement Material Flow. Taiichi Ohno originated this methodology in the early 50's and many Toyota suppliers in North America have successfully implemented it. Training on the implementation of Material flow is a next logical step leading towards implementation of Lean.

There is a theoretical and practical part to this training. In the theoretical part participants learn about a certain sequence of activities that must be followed in order to implement Material and Information Flow. They also learn about Material Flow tools and methodologies and they learn how to sustain and improve newly implemented processes. All these steps and how to teach the course is very well defined in the “Making Materials Flow” book by Harris, Harris & Wilson, available through LEI.

The practical part of this course requires participants to actually develop and implement Material Flow in a Value Stream. This activity must be conducted under a guidance of a subject matter expert. It must have very clear deliverables, targets and objectives. This is true learning by doing.

It starts by developing a Plan-for-Every-Part (PFEP), which includes not only information about parts and components, but also information about container sizes and types, customer requirements, delivery methods, frequencies and Min/Max levels of inventory. The next step is the actual construction of parts Supermarkets and delivery points, including the design of shelves and racks. Then all the existing parts and components are sorted and stored in new Supermarkets. The construction of Supermarkets is followed by the design of the delivery routes and the delivery methods.

The next step is the implementation of a Kanban based Information Flow system. Participants will calculate the number of Kanban cards needed, design and print Kanban cards and implement the system. They will also train all employees involved on how to work with Kanban cards and on different types of Kanbans - cards for scheduling production and cards for ordering parts. Participants of the Implementing Material Flow course will be responsible for identifying and resulting all barriers preventing successful implementation and the operation of the new Material Pull system. Duration of this training varies from three to six months.

Targeted Audience: Selected supervisors, team leaders, engineers and Production Control staff

Completion Requirements: Successful implementation and operation of a Kanban based Material flow system over a period of at least three months.

LEVEL III TRAINING – SUSTAINING AND IMPROVING

THEME: HOW TO MANAGE IN A LEAN ENVIRONMENT

TRAINING MODULE: GEMBA KAIZEN – VISUAL MANAGEMENT

In Japanese *Gemba* means *real place* – the place where real action occurs. *Kaizen* means continuous improvement. I like to call it Visual Management. A primary principle behind Visual Management is an objective that whenever an abnormal condition exists, the system will give a signal requiring the timely corrective action. When there is a deviation from the standard, it should be made obvious to any manager or supervisor so that corrective action can be taken. This is “Learning to See”; development of an ability to recognize abnormal conditions and the only way to learn it is a 100% training on the shop floor. It is a common practice at a Toyota plant to see a manager standing in a single place for hours observing the operation.

The first step towards initiating any corrective action is an ability to identify that there is a problem. Initially this is accomplished by becoming familiar with any audio/visual signals on the shop floor; flashing red lights, audio warning tones, repetitive “hit” from a press or a lack of, steady noise associated with a moving conveyer belt, cycling of a machine, continuous flow of parts and more.

The next step is to put together all the knowledge from attending and participating in Level I & II training courses and develop an understanding how all these processes and systems should work together in a logical and harmonious environment.

Visual Management starts by recognizing new “Lean” indicators that any manager or supervisor should learn. These Lean indicators can be grouped into five categories commonly know as **Five Ms**:

1. Manpower (Operators)
2. Machines
3. Materials
4. Methods
5. Measurements (Metrics)

Examples of abnormal situations are: operator not following Standardized Work, work is not balanced, too many steps in a process, ongoing adjustment to a machine, machine operating too slow, a Kanban card laying on the floor, too many empty spots in the parts Supermarket, material not delivered on time, container out of place, poor housekeeping, too much WIP in front of operator, operators sorting parts, operator waiting for work, and many more.

Visual Management training is not only about recognition of problems, but it is also about solving problems, creating higher standards and expectations. It is about the role of a Manager or a Supervisor in a Lean environment not only to sustain the current situation, but also to initiate Continuous Improvement activities. This is where all the theoretical knowledge of Lean tools and methodologies are applied and put to practice. It takes time and persistency to develop this ability. It also requires a knowledgeable Sensei.

Targeted Audience: All manufacturing managers, supervisors, team leaders and technical support people.

Completion Requirements: Each participant must successfully pass Management Review.

THEME: KNOWLEDGE OF LEAN TOOLS AND METHODOLOGIES

TRAINING MODULE: KAIZEN WORKSHOP - CREATING CONTINUOUS FLOW

Continuous flow is an ongoing and critical objective of lean manufacturing. This is where all the knowledge of Lean methodologies, tools and process is put to an ultimate test of generating cost reductions and improvements to quality, efficiency and performance. Many companies associate continuous flow only with a design of a layout, balancing the line and taking waste out of a work cell. Continuous flow it is lot more than that. Creating continuous flow looks at the entire Value Stream, from raw materials to finished goods. It studies production pace, manpower requirements, equipment utilization and manufacturing methodologies.

This is a 100% shop floor style training conducted over a period of time – days or weeks. It is lead by an experienced Lean Practitioner and participants are organized into a Kaizen Team. The purpose of a Kaizen Workshop is to identify problems and opportunities and to implement changes needed to achieve very specific management objectives. For example: Takt time reduction, manpower reduction, production output increase and more. In creating Continuous Flow, the Kaizen team will focus their activities in a very specific, well-defined area of operation.

Participants in the Continuous Flow workshop concentrate their activities on three types of flows: Operator movements, information flow and material flow. They learn how to identify unnecessary stops in the flow, causes and effects of unbalanced work stations, incorrect layouts, and waste elements built into the process, out of cycle activities and impact of overproduction. They will conduct gap analysis, study Takt times and cycle times of machinery and operators. They will learn how to balance a production line, improve parts delivery and presentation, design more efficient production cells and identify manpower requirements need to operate a production line based on process capability and customer needs.

The objective of a Continuous Flow workshop is not only to learn how to identify and implement improvements, but is also to develop the processes and procedures necessary to sustain the new methodology. Participants will be required to develop work instructions, metrics, and visual controls and provide training to operators, managers and supervisors.

Many companies confuse Kaizen training with Kaizen events. We have a tendency to jump the gun and run Kaizen events without creating the proper foundation. You must have Standardized Work and standard process in place in order to run a Kaizen Workshop. Kaizen is not about implementing new processes; Kaizen is about improving existing processes.

Kaizen Workshops must be lead by a knowledgeable and experience Leader. It must follow a well-defined sequence of events and activities. All decisions and solutions must be supported by data. One the best training books available on the market for Continuous Flow workshops is "Creating Continuous Flow" by Rick Harris and Mike Rother. It truly represents a Toyota approach of creating Continuous Flow.

Targeted Audience: All manufacturing managers, supervisors, team leaders and technical support people.

Completion Requirements: Successful implementation of a continuous flow process. Review and evaluation by a Steering Committee.

TRAINING MODULE: LEVEL PRODUCTION SCHEDULE – SCHEDULE ATTAINMENT

Manufacturing operation is constantly changing and it is difficult to control. We need to implement control processes to reduce the level of fluctuation in all areas of manufacturing activities. This can be achieved by developing a steady flow of material throughout the factory. A methodology to accomplish this is called Level Production Schedule.

Level Production schedule should be implemented by conducting a Kaizen Workshop or by assigning a team of Lean Practitioners. This Team should represent manufacturing, production control, engineering and maintenance. All members of the implementation Team should have successfully completed Level II of Lean training.

The principle behind Level Production schedule is to buffer all unexpected changes to production volume and to create a steady daily (or a weekly) demand of proper mix of parts. Production scheduled is issued only to a single department, which acts as a Pacesetter. All other manufacturing departments build based on a Pull signal.

In order to accomplish this all parts and component Supermarkets must be in place to avoid parts shortages. Quick changeover procedures also must be in place to allow small lot production and all equipment must be operational. Benefits from Level Production schedule are significant and it will result in smooth flow of parts, even workload throughout the factory, reduction of inventory levels and production lead time. Unnecessary expediting, checking, rework and delays will be eliminated. Implementation of Level Production schedule will take anywhere from six weeks to six months.

An experienced professional, a Mentor or a Sensei, must lead this training activity. Guidance, directions and process checks must be conducted weekly. One of the better books available on the market to give you a step-by-step approach to learn and to implement Level Production schedule is “Creating Level Pull” by Art Smalley. This book is available from LEI. As with any Lean processes there are well defined standard steps, tools and procedures. “Creating Level Pull” takes you through these steps and helps you with transition from a traditional scheduling process to Level Production schedule.

Targeted Audience: Selected managers, supervisors, team leaders and technical support and people.

Completion Requirements: Successful implementation of Level Production schedule in one of the Value Streams. Review and evaluation by a Steering Committee.

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