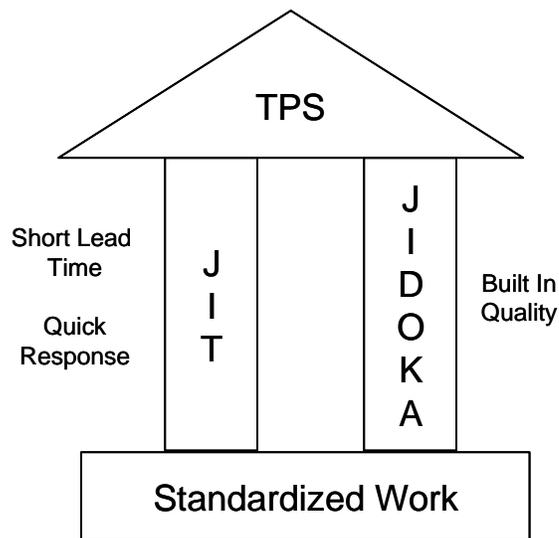


Training Recommendations for Implementing Lean

By Marek Piatkowski

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



It is a pictorial representation of the principles and strengths of the Toyota Production System (TPS). The foundation of TPS is standardized work. The two major pillars supporting TPS are just-in-time (JIT) and jidoka, (also known as automation) or as I call it, stop the line, fix the problem.

The first time I heard about JIT was in 1980 when NBC showed a television documentary called “If Japan Can, Why Can’t We?” Later on, I came across two books written by Richard J. Schonberger called *Japanese Manufacturing Techniques* and *World Class Manufacturing*. 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 the performance of our companies through the lean production approach based on TPS.

We started to study any publication that came out of Japan. We learned about quality circles, waste, 5S, kanbans, kaizens, single-minute exchange of dies (SMED), flow, cell layout, supermarkets, and value-stream mapping. We learned a lot. During the last 20 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.

What we are forgetting is that we need to have a total understanding of all lean processes 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. It took Toyota over 50 years to develop what we now call the TPS. You cannot expect long-term results by rushing the implementation or not investing in training.

A lean environment requires a different style of management, style of leadership, performance measurements, organizational structures, thinking, and 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 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 following pages, I will try to answer these questions, give some directions, and offer recommendations in the area of training requirements for implementing lean.

When Toyota opened its first manufacturing facility in North America in 1984 with the launch of the NUMMI joint venture with GM, there was a lot of promotion regarding the amount of training that would be offered to new employees. Training was one of the major attractions to getting a job at Toyota, beginning with NUMMI and later on with TMM in Georgetown, Kentucky, and TMMC in Cambridge, Ontario. I joined TMMC in June of 1987 as the 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 discoveries about training at Toyota was that there was very little written about TPS. 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 was.

Toyota very heavily depends on the spoken word to train and 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 sit-down sessions as well as visits to the manufacturing floor or to the warehouse or to the office to observe actual processes in action.

TPS 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 major business unit whose primary responsibility is to help senior managers move the organization towards the ideal state. Many of these individuals have received intensive training through Toyota's Operations Management Consulting Division (OMCD). It was established to develop and diffuse the system through Toyota and its suppliers. Each leader is responsible for teaching and training his or her 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 TPS. 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 teach something outside the principles and philosophies of TPS. This is where we learned the meaning of a Japanese proverb, “The nail 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 the second day of my first trip to Japan, I spent eight hours working on the car assembly line. This is where I learned the meaning of OJT or learning by doing.

In 1988, TMMC hired its 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 with books, instructors, homework, and final exams. This was not how Toyota intended to train its work force. The main training methodology was OJT. OJT consists not only of training on how to perform your specific job, but also on the proper use of tools, equipment, observation of safety rules, quality procedures, human resource policies, preventive maintenance, ordering materials, and reporting problems. It consists of learning how the individual operating processes worked and what was the role of each team member to support these processes. OJT is conducted on the shop floor by observing, trying out, and practicing different work elements of a job, and using standardized work sheets as guides.

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 are trained on the “secrets of the trade” — the intricacies of every function. 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 the Principles of TPS

All newly hired Toyota employees in North America attend a five-day orientation during the first week of employment. The training consists of classroom training and exercises covering such subjects as the team concept, production system, kanban, kaizen, quality principles, attendance policies, safety policies, labor-management relations, housekeeping, and competitive conditions in the auto industry.

The orientation training is followed by OJT, in which each trainee works side-by-side with a Toyota trainer or a group leader on the assembly line. The same methodology is used for office

employees. Each new employee is assigned a trainer responsible not only for teaching the job elements and job content, but also for explaining how to perform the job in accordance with TPS rules and policies. OJT lasts from six to eight weeks.

All employees are expected to follow their jobs as defined. No variation is tolerated. At the end of the initial OJT, most of the new employees have a fundamental knowledge of the basic TPS principles:

- Teambuilding
- Single-piece flow
- Pull and kanban
- Takt time
- Achieve the highest quality
- Cost drivers
- How to identify, report, and solve problems
- Seven types of waste
- Kaizen
- Three rules of JIT
 1. Produce only what the customer needs
 2. In the right quantity
 3. At the right time

By giving every employee this foundation of TPS knowledge, Toyota creates a very uniform workforce. The result is that everybody knows how to perform their jobs, what the standards are, what is expected, and how to deal with abnormal situations.

Observation 4: Five Necessary Skills of a Leader

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

1. Knowledge of roles and responsibilities
2. Knowledge of job elements
3. Training skills
4. Leadership skills
5. Kaizen skills

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, a commitment to meet the production plan, and following company rules and procedures. A leader's knowledge, responsibility, and authority are directly related to successful implementation of TPS in the workplace, where TPS was developed. This is where the work begins.

2. Knowledge of job elements

Knowledge of job elements means knowledge regarding materials, machinery, tools, processes, methods, and the necessary kinds of technologies concerning fabrication, assembly, machine settings, etc. 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.

3. Training skills

Training skills are needed 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, and preventive maintenance among others. Leaders foster the development of highly skilled employees because each operator is responsible for a range of different processes and quality has to be built in at each process.

4. Leadership skills

Being skillful at handling people is important when trying to build support and maintain smooth employee relationships. TPS emphasizes respect for people and operator participation in improvement activities. Because Toyota bases its work methods on a human-oriented philosophy, it encourages leaders to treat employees as individuals.

5. Kaizen skills

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 as a starting point for making improvements. They determine the work sequence to combine tasks in such a way to eliminate waste.

Observation 5: Development of Managers and Leaders

A manager or a leader is responsible for various aspects of the production process, such as quality, cost, safety, production volume, etc. He or she is responsible for the activities, training, and the development of staff and must maintain the integrity of TPS in the workplace.

In order to achieve this, all new managers, group leaders, team leaders, engineers and specialists receive additional training 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 and JIT
5. Problem solving
6. Kaizen workshops

1. The role of a supervisor

The training material for this course consisted of a videotape about 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 on 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.

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 the information and skills required to perform specific jobs. It also consists of information about the quality standards, materials, work sequence, 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 instruction training teaches a 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, listing all major steps and points of the job. It serves as a checklist to assure that the teaching method is correct. Instructors are taught how to prepare operators to perform jobs, how to show them the jobs — stressing the important steps — and what to look for as operators practice. Toyota's philosophy is, "If the worker hasn't learned, the instructor hasn't taught."

3. Standardized work

The foundation of the everyday operation of TPS is standardized work. It 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:

- Takt time
- Working sequence
- 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. It is determined by dividing total daily (or monthly) working time by daily (or monthly) customer requirements. The work sequence defines the step-by-step order in which an operation is to be performed. The in-process inventory controls 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 in these three forms:

- Standard production capacity sheet
- Standard work combination table
- Standard work chart

4. Principles of a pull system - JIT

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

- Pull
- Continuous flow processing
- 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 eliminates 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.

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. Single-minute exchange of die (SMED) or quick changeover is required where a single piece flow is impossible to achieve due to time-consuming setup 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 provides a format for presenting and reporting facts to others, and 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 the Plan, Do, Check, and Action (PDCA) cycle. 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 recurring.

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 storyboard. 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 come to the table. Kaizen workshops are usually run as a very intense activity over a few days. This is a 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.

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 continues until the defined objectives are accomplished.

Lessons Learned

Toyota employees do not learn TPS from books, classrooms, or by attending seminars. They learn TPS from OJT 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, it should start by creating a position of a lean leader, or even better, by creating a lean leadership organization. These leaders should be trained to 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 the 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.

Change the Way We Train

In 1999, the *Harvard Business Review* published a paper “Decoding the DNA of the Toyota Production System.” This was based on 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. The paper states, “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.”

The paper continues, “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 America cannot be blamed on our culture.

Adults learn best by building on existing knowledge and skills. Toyota utilizes this in 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 workshop, where participants are involved in the actual implementation of a new process.

The best model for developing a lean training is the 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

Training for a 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 logic 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. The objectives of a 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 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. Lean training activities should be divided into two main themes:

1. How to manage in a lean environment
2. Knowledge of lean tools and methodologies

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 taking an exam, by selecting and implementing a project and presenting it to a steering committee or by performing certain

activities to the satisfaction of a manager. 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 (such as 5S and value-stream mapping). 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 is about three years. All courses should be delivered and taken in a sequence described below. (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 leadership training. Any company should be able to put together a very comprehensive training for its change agents, lean participants, and implementers.)

Level I Training: Principles of Lean

Theme: How to Manage in a Lean Environment

Training Module: Leadership Development Training

Success of any new project largely depends on the strength and abilities of its leader.

Implementation of lean should not be seen as any different type of a project than 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 or her abilities to manage the project, but also on 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 its managers, technical staff, supervisors, and hourly personnel to lead, train and manage. Many supervisors and hourly people have never participated in project review meetings, or made a presentation. 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:

- Presentation skills: develop presentation material, and present it to an audience in a way that engages the audience and gets the message across.
- Meeting facilitation skills: participate in a meeting as a leader or a participant, encourage participation, contribute to the meeting, take notes and capture essential information, reach consensus, and make a decision.
- Time management: understand time limitations and requirements, complete assignments on time, and develop a written activities schedule.
- Conflict resolution: evaluate and analyze all aspects of a conflict, achieve a solution, and successfully resolve conflicts.
- Overcoming resistance to change: identify and resolve what is preventing implementation of changes, explain the need for change, and motivate people to change.
- Problem solving: collect and analyze data, graph and plot information, identify a problem, see beyond current boundaries of a problem, create a solution, implement it, follow a standard-problem solving methodology.
- Working in teams: participate in a team assignment, respect others for their contributions, follow instructions, and contribute as a team member.
- Project management: identify all necessary tasks required to complete a project, plan work, identify time constraints, communicate progress, and identify resources necessary to complete the project and follow up.

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

Theme: Knowledge of Lean Tools and Methodologies

Training Module: Principles of JIT and Pull Systems

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 a pull system simulation. At the end of this course, participants are expected to be familiar with pull system terminology.

The objective of this course is to show differences between a traditional process of scheduling production versus building based on customer pull. Several key topics need to be addressed:

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 module should talk about different ways available to communicate production requirements to the shop floor, information exchange to and from customers and

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.

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: nonvalue-added work

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

1. Defects and repairs
2. Overproduction
3. Waiting
4. Transportation
5. Processing
6. Inventory
7. Motion

It should also include a presentation about other waste factors: unevenness and overloading. 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 Suzaki 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 for Workplace Organization

The concept of good housekeeping and workplace organization has been around manufacturing for a very long time. 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 about the benefits this activity can bring.

The term 5S is derived from five Japanese words starting with letter *S* that describe principles of good housekeeping. One of the better translations 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 creates a safer work environment, removes clutter, creates a labeling system for ease of recognition, introduces audit procedures, and creates a more inviting work place.

It is a simple learning activity that can be organized in any department of a company. It is not only shop-floor specific. From management's 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 identify leaders, followers, or nonsupporters. 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 of implementing change.

The best way to learn about 5S is to conduct a one-week 5S workshop. 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, each manager, supervisor, or team leader will be required to return to their work areas 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

The effective use of this method has shortened the learning period, reduced learner anxiety, and improved quality and productivity.

Job instruction training is based on an old industrial methodology known as Training Within Industry (TWI) 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 it 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 for gaining a fundamental understanding of standardized work, best practices, work sequence, and

discipline. It also assures the consistency and preciseness of all further lean implementation activities. It creates a template for 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 hour) 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 them.

Training Module: Value-Stream Mapping

Value-stream mapping is an initial key practical step towards learning and implementing lean. [*Learning to See*](#), the book by Mike Rother and John Shook, is the only way to learn it the right way. The purpose of mapping is not to produce a map of a value stream. The purpose is to open our eyes to existing problems and issues, to identify shortfalls and process breakdowns, and to identify opportunities for improvement. Mapping 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 that all participants should understand prior to mapping:

- Cycle times
- Changeover and setup
- Calculating machine uptime
- Material and information flow; push vs. pull
- Takt time
- Continuous flow
- Kanban
- Kanban loops
- Supermarkets
- FIFO and LIFO
- The pacemaker process
- Level production
- Lead-time

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 and Daily Walk-About Process

Transforming the traditional company atmosphere from a top-down decision making organization to an employee participation style of management is a far greater challenge than practicing 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 most

managers to embrace. It requires them to use skills different from those that have made them successful.

A visually identified team territory or an area of responsibility is the starting point. Work teams need to have a place they can identify as their own – a place to meet, post information, review indicators of the status of work, display symbols of their team identity, and show examples of their product. This can be accomplished by creating what we sometimes called war rooms or information centers. The next step is to create 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 area supervisor in resolving daily issues and to help implement process improvements. This is accomplished by conducting daily review meetings between the support team members and the supervisor at the team's information center.

The final element of this activity is the management daily walk-about process. Every day the plant manager and his or her staff visit the information centers. This is a scheduled and 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, safety, productivity, downtime, attendance, etc. The supervisor is also responsible for updating the status of continuous improvement activities.

This is a lean way of running a business because it eliminates daily conference-style meetings and 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.

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| Targeted audience: | All managers, supervisors, team leaders, engineers, and technical support personnel. |
| Completion requirements: | All participants are required to be members of support teams. They are required to create information centers, collect information, 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

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 rooms and team meeting places
- Maintenance schedules
- Performance indicators
- Work instructions
- Andon boards
- Quality indicators

Visual controls represent self-service information — making the same information commonly available and understandable at a glance to all who view it. This sharing of information brings a new culture to the workplace.

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 or her area. Results are to be evaluated by the steering committee or the management team.

Training Module: Total Productive Maintenance (TPM)

TPM is a systematic, well-defined methodology to eliminate equipment breakdowns and quality defects. TPM is often defined as productive maintenance involving total employee participation and it must be carried out on a companywide 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 technicians, and supervisors. Operators are responsible for conducting TPM activities 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 stoppages
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, and operating time and performance efficiency. They learn how to restore deterioration, correct design weaknesses, 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 correct equipment stoppage and quality issues. The TPM course is delivered on the shop floor.

In principle, TPM is an advanced extension and continuation of 5S 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: Setup Time Reduction

There are two elements to setup time reduction. One addresses equipment modifications (technical improvements), the other deals with the elimination of waste in setup methodology. Both activities will contribute significantly to minimizing setup time. Unfortunately, too many companies spent large amounts of money concentrating on the technical aspects. By eliminating waste from setup methodologies, companies can achieve significant improvements without major capital investments.

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

Training on setup methodology focuses on individual work elements performed by operators. It divides the process into three phases: preparation, exchange of dies (tools and 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 changeover process. The next step is to level the amount of work between all operators, eliminate wasteful operations, and move as many steps as possible to the preparation phase.

Understanding the importance of setup reduction 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 participants, it is an opportunity to explore the benefits of standardized work, learn more about waste elimination, 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: Participants must implement quick changeover in their areas and make presentations to the steering committee for evaluation and approval.

Training Module: Standardized Work

The principle behind standardized work is to perform efficient production in a consecutive sequence by focusing on operator movements and systematically combining work tasks. It creates a standardized order of various manual operations to be performed by each employee and serves as a tool for manufacturing high-quality products with fewer work processes. Standardized work concentrates on operator movements, and 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 trainings available. A Toyota-style 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-on training. There is a small theoretical portion, but most of the learning is achieved through actual line observations, calculating cycle times, completion of standard forms, development of operator balance charts, and manpower utilization charts. The objective is to learn the methodology and be able to identify, document, recommend, and implement improvements. 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 results to the steering committee.

Training Module: Material Flow and Kanban

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 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 the steps for creating a material-handling system for purchased parts is very well defined in the [*Making Materials Flow*](#) book 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 the guidance of a subject matter

expert. It must have very clear deliverables, targets, and objectives. 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. 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 calculate the number of kanban cards needed, design and print cards, and implement the system. They will also train all employees involved in how to work with the cards and on different types of kanbans. The 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: Kaizen and Visual Management

A visual management system signals whenever an abnormal condition exists so timely corrective action can be taken. The first step towards initiating any corrective action is identifying that there is a problem. Initially this is accomplished by becoming familiar with audio/visual signals on the shop floor, such as flashing red lights, warning tones, a steady noise associated with a moving conveyer belt, etc.

The next step is to put together all the knowledge from attending and participating in Level I and II training courses to 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 indicators can be grouped into five categories commonly known as the Five Ms:

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

Examples of abnormal situations include: an operator not following standardized work, ongoing adjustment to a machine, a kanban card laying on the floor, too many empty spots in the parts supermarket, material not delivered on time, a container out of place, poor housekeeping, too much WIP in front of an operator, an operator sorting parts or waiting for work, etc. Visual management training is not only about recognizing problems, but is also about solving them, creating higher standards and expectations. It is about the role of a manager or supervisor in a lean environment not only sustaining the current situation, but also initiating continuous improvement activities. It takes time and persistence 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 for Creating Continuous Flow

Continuous flow is where all the knowledge of lean methodologies, tools, and process are put to an ultimate test of generating cost reductions and improvements to quality, efficiency, and performance. Many companies associate continuous flow only with layout design, line balancing, or waste elimination at 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 shop-floor training conducted over 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. The team will focus its activities in a very specific, well-defined area of operation and on three types of flows: operator movements, information flow, and material flow. The team studies takt times, and cycle times of machinery and operators. It learns how to balance a production line, improve parts delivery and presentation, design more efficient production cells, and identify manpower requirements based on process capability and customer needs.

The objective is not only to identify and implement improvements, but to develop the processes and procedures necessary to sustain the improvements. Participants will be required to develop work instructions, metrics, visual controls, and provide training to operators, managers, and supervisors.

Many companies confuse kaizen training with kaizen workshops. We have a tendency to jump the gun and run events without creating the proper foundation. You must have standardized work and standard processes in place in order to run a kaizen workshop. Kaizen is not about implementing new processes; kaizen is about improving existing processes. Kaizen workshops 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](#) because it truly represents a Toyota approach to creating 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

This 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 team should have successfully completed Level II training.

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

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 are significant and result in a smooth flow of parts, an even workload throughout the factory, lower inventory levels, and shorter production lead time. Implementation will take anywhere from six weeks to six months. An experienced professional, such as a mentor or 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 is [Creating Level Pull](#).

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

Completion Requirements: Successful implementation of level production in one of the value streams. Review and evaluation by the steering committee.

Marek Piatkowski served as the training and education manager at Toyota Motor Manufacturing, Cambridge, Ontario, from 1987 until 1994 where he was a member of the management team responsible for the start-up of operations, including recruiting and training associates. He now is a Toronto-based manufacturing consultant and can be reached at marek.piatkowski@rogers.com or at 416-235-2631.

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