

The Toyota Way

Jeffrey K Liker
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Introduction

It is obvious that there is something special about Toyota. The Japanese automobile manufacturer currently has the fastest product development process in the world. New cars and trucks take 12 months or less to design, while competitors typically require two to three years. Toyota has phenomenal quality levels, that rivals can only dream of matching.

Toyota has turned operational excellence into a strategic weapon not merely through tools and quality improvement methods but a deeper business philosophy rooted in understanding of people and what motivates them. Its success is ultimately based on its ability to develop leaders, build teams, and nurture a supportive culture, to devise strategy, to build deep supplier relationships, and to maintain a learning organization.

Jeffrey Liker is an authority on Toyota. Liker gives an excellent account of how Toyota has become one of the best managed companies in the world. He also outlines how other companies can learn from Toyota and improve their way of doing business. This book makes excellent reading for leaders building learning organizations.

The Toyota Production System

Toyota developed the Toyota Production System after World War II. While Ford and GM used mass production, economies of scale, and big equipment to produce as many parts as possible, as cheaply as possible, Toyota's market in post-war Japan was small. Toyota also had to make a variety of vehicles on the same assembly line to satisfy its customers. By making lead times short and focusing on keeping production lines flexible, Toyota realized it could actually get higher quality, better customer responsiveness, better productivity, and better utilization of equipment and space.

A basic premise of mass production is that machine downtime is obvious waste. A machine shut down for repair is not making parts that could make money. But TPS has challenged this notion.

Often the best thing you can do is to idle a machine and stop producing parts. Over production, is a fundamental waste in TPS.

*Often it is best to build up an inventory of finished goods in order to level out the production schedule, rather than produce according to the actual fluctuating demand of customer orders. Leveling out the schedule (*heijunka*) is a foundation for flow and pull systems and for minimizing inventory in the supply chain. Leveling production smoothes out the volume and mix of items produced so there is little variation in production from day to days.*

Often it is best to selectively add and substitute overhead for direct labor. When waste is stripped away from value-adding workers, high-quality support has to be provided for

them.

It may not be a top priority to keep your workers busy making parts as fast as possible. Companies should produce at the rate of customer demand. Working faster just for the sake of getting the most out of workers may be counter productive.

It is best to selectively use information technology and often better to use manual processes even when automation is available and would seem to justify its cost in reducing your headcount. People are the most flexible resource. The manual process must be streamlined before it is automated.

TPS starts with the customer, by asking, "What value are we adding from the customer's perspective?" *Because the only thing that adds value in any type of process- be it in manufacturing, marketing, or a development process-is the physical or information transformation of that product, service, or activity into something the customer wants.*

TPS is all about commitment to continuously investing in its people and promoting a culture of continuous improvement. When Toyota sets up assembly lines, it selects only the best and brightest workers, and challenges them to grow in their jobs by constantly solving problems. Similarly, Toyota staffs sales, engineering, service parts, accounting, human resources, and every aspect of the business with carefully selected individuals and empowers them to improve their processes and find innovative ways to satisfy their customers. Toyota is a true learning organization that has been evolving and learning for most part of a century.

Many U.S. companies have embraced lean tools but do not understand what makes them work together in a system. They do not understand the power behind true TPS. That lies in Toyota's continuous improvement culture.

A Brief History

The roots of the Toyota Way can be traced back to Sakichi Toyoda, a tinkerer and inventor, who grew up in the late 1800s in a remote farming community outside of Nagoya. As a boy, Toyoda learned carpentry from his father and started designing and building wooden spinning machines. In 1894 he began to make manual looms that were cheaper and more efficient than existing looms.

Toyoda's mother, grand mother, and their friends worked hard spinning and weaving. To relieve them of this punishing labor, he set out to develop power-driven wooden looms. Toyoda eventually developed sophisticated automatic power looms. Among his inventions was a special mechanism to automatically stop a loom whenever a thread broke. This invention led to the concept of *jidoka* (automation with a human touch).

If Sakichi Toyoda put his mark on the industrial world through loom making, Just-In-Time was his son Kiichiro Toyoda's contribution. His ideas were influenced by a study trip to Ford's plants in Michigan to see the automobile industry Kiichiro was also inspired by the U.S. supermarket system of replacing products on the shelves just in time as customers purchased them.

After World War II, the Americans realized the need for trucks in order to rebuild Japan and even helped Toyota to start building trucks again. As the economy gained momentum, Toyota had little difficulty getting orders for automobiles. But rampant inflation made money worthless and collections became very difficult. As the cash crunch worsened, Toyota adopted strict cost-cutting policies, including voluntary pay cuts by managers and a 10 percent cut in pay for all employees. Finally, Kiichiro had to ask for 1,600 workers to "retire" voluntarily. This led to work stoppages and public demonstrations by workers.

Kiichiro accepted responsibility for the failure and resigned as president, even though in reality the problems were well beyond his or anyone else's control. Many workers voluntarily left the company and labor peace was restored. However, his tremendous personal sacrifice had a profound impact on the history of Toyota.

Even before the second world war, Toyota had realized that the Japanese market was too small and demand too fragmented to support the high production volumes in the U.S. Toyota realized that to survive in the long run, it would have to adapt the mass production approach for the Japanese market.

Bigger rivals like Ford had tons of cash and a large U.S. and international market. Toyota had no cash and operated in a small country. With few resources and capital, Toyota needed to turn cash around quickly. Ford had a complete supply system, Toyota did not. Toyota didn't have the luxury of taking cover under high volume and economies of scale afforded by Ford's mass production system. It needed to adapt Ford's manufacturing process to achieve simultaneously high quality, low cost, short lead times, and flexibility. Toyota needed to churn out low volumes of different models using the same assembly line, because consumer demand in Japan was too low to support dedicated assembly lines for one vehicle.

Most businesses use processes that are filled with waste, because work in Step 1 is performed in large batches before it is needed by Step 2. This "work in process" must then be stored and tracked and maintained until needed by step 2. TPS is a "pull system", in which every step of every manufacturing process has the equivalent of a "gas gauge" built in, (called *kanban*), to signal to the previous step when its parts need to be replenished. This creates "pull" which continues cascading backwards to the beginning of the manufacturing cycle.

Identifying waste

The first question in TPS is always " *What does the customer want from this process?*" This defines value. Through the customer's eyes, a process is observed and the value-added steps are separated from the non-value-added ones.

Toyota has identified various types of non-value-adding waste:

1. *Overproduction.* Producing items for which there are no orders. This leads to overstaffing and storage and transportation costs.

2. *Waiting (time on hand)*. Workers merely serving to watch an automated machine or having to stand around waiting for the next processing step, tool, supply, part, etc., or having no work because of stockouts, lot processing delays, equipment downtime, and capacity bottlenecks.

3. *Unnecessary transport or conveyance*. Carrying work in process (WIP) long distances, creating inefficient transport, or moving materials, parts, or finished goods into or out of storage or between processes.

4. *Overprocessing or incorrect processing*. Inefficient processing due to poor tool and product design, causing unnecessary motion and producing defects. Waste is also generated when providing higher-quality products than is necessary.

5. *Excess inventory*. Excess inventory hides problems such as production imbalances, late deliveries from suppliers, defects, equipment downtime, and long set up times.

6. *Unnecessary movement*. Any wasted motion employees have to perform during the course of their work, such as looking for, reaching for, or stacking parts, tools, etc. Walking is also waste.

7. *Defects*. Production of defective parts or correction. Repair or rework, scrap, replacement production, and inspection mean wasteful handling, time, and effort.

8. *Unused employee creativity*. Losing time, ideas, skills, improvements, and learning opportunities by not engaging or listening to employees.

Toyota firmly believes overproduction is a fundamental waste. Producing more than what the customer wants necessarily leads to a build-up of inventory somewhere downstream. The material is just sitting around, waiting to be processed in the next operation. Big buffers lead to other suboptimal behavior, like reducing the motivation to continuously improve operations. Why worry about preventive maintenance on equipment when shutdowns do not immediately affect final assembly anyway? Why get overly concerned about a few quality errors when defective parts can be set aside? By the time a defective piece works its way to the later operation where an operator tries to assemble that piece, there may be weeks of bad parts in process and sitting in buffers.

JIT means removing, as much as possible, the inventory used to buffer operations against problems that may arise in production. Using smaller buffers means that problems like quality defects become immediately visible. This reinforces *jidoka*, which halts the production process. Workers must resolve the problems immediately to resume production. The requirement for working with little inventory and stopping production when there is a problem, introduces a sense of urgency among workers. In mass production, when a machine goes down, there is no sense of urgency. The maintenance department fixes the problem while inventory keeps the operations running. By contrast, in lean production, when an operator shuts down equipment to fix a problem, other operations will soon stop

producing, creating a crisis. So people have to scramble to fix problems together to get the equipment up and running. Moreover, they would try to get the root of the problem so that it does not recur again.

Toyota's Building Blocks

Principle 1. Base your management decisions on a long-term philosophy, even at the expense of short-term financial goals.

Principle 2. Create continuous process flow to bring problems to the surface.

Principle 3. Use "pull" systems to avoid overproduction.

Principle 4. Level out the workload (*heijunka*).

Principle 5. Build a culture of stopping to fix problems, to get quality right the first time.

Principle 6. Standardized tasks are the foundation for continuous improvement and employee empowerment.

Principle 7. Use visual control so no problems are hidden.

Principle 8. Use only reliable, thoroughly tested technology that serves your people and processes.

Principle 9. Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others.

Principle 10. Develop exceptional people and teams who follow your company's philosophy.

Principle 11. Respect your extended network of partners and suppliers by challenging them and helping them improve

Principle 12. Go and see for yourself to thoroughly understand the situation (*genchi genbutsu*).

Principle 13. Make decisions slowly by consensus, thoroughly considering all options; implement decisions rapidly.

Principle 14. Become a learning organization through relentless reflection (*hansei*) and continuous improvement (*kaizen*).

Source: Jeffrey K Liker, "The Toyota Way," Tata McGraw-Hill, 2004

Product development

Thanks to the Prius (hybrid car) project, the company's already excellent product development process has further improved in two key ways:

1. *The cross-functional team and chief engineer work together almost daily in the same room {obeya}. In Toyota's traditional approach, in the planning phase, the chief engineer comes up with a concept, discusses it with the design groups and planning groups, and formulates a concrete plan. With the Prius, a team of specialists from the various design, evaluation, and manufacturing functional groups sat in a big room with the chief engineer and made decisions in real time. To facilitate the discussions, computer-assisted design (CAD) terminals were put into the room and it became known as "obeya" (big room).*

2. *Simultaneous engineering.* Manufacturing engineers now work with design engineers at the concept development stage, to give input on manufacturing issues. This level of cooperation at such an early stage is unusual in the auto industry. Toyota had been incorporating simultaneous engineering for several years before the Prius. But the Prius project intensified it. There was unparalleled cooperation across divisions and between design and manufacturing to meet the tight headlines for the Prius.

Towards one piece flow

To become lean, companies have to create continuous flow wherever applicable. Shortening the elapsed time from raw materials to finished goods (or services) leads to the best quality, lowest cost, and shortest delivery time. Flow also tends to force the implementation of a lot of the other lean tools and philosophies such as preventive maintenance. Creating flow exposes inefficiencies that demand immediate solutions. Everyone concerned is motivated to fix the problems and inefficiencies because the plant will shut down if they don't. Traditional business processes, in contrast, have the capacity to hide vast inefficiencies without anyone noticing.

Flow means that a customer order triggers the process of obtaining the raw materials needed just for that customer's order. The raw materials then flow immediately to supplier plants, where workers immediately fill the order with components, which flow immediately to a plant, where workers assemble the order, and then the completed order flows immediately to the customer. The whole process should take a few hours or days, rather than a few weeks or months.

In a large batch operation, there are probably weeks of work in process between operations and it can take weeks or even months from the time a defect is caused until it is discovered. By then it is nearly impossible to track down and identify why the defect occurred. By making a product flow, we can set in motion numerous activities to eliminate all *muda* (wastes). In lean thinking, the ideal batch size is one.

Creating flow means linking together operations that otherwise are disjointed. There is more teamwork, rapid feedback on earlier quality problems, control over the process, and direct pressure for people to solve problems and think and grow. Ultimately, the main benefit of one-piece flow is that it challenges people to think and improve.

Quality. It is much easier to build in quality in one-piece flow. Every operator is an inspector and works to fix any problems in station before passing them on. But if defects do get missed and passed on, they will be detected very quickly and the problem can be immediately diagnosed and corrected.

Real Flexibility. If we dedicate equipment to a product line, we have less flexibility in scheduling it for other purposes. But if the lead time to make a product is very short, we have more flexibility to respond and make what the customer really wants. Instead of putting a new order into the system and waiting weeks to get that product out, if lead times are a matter of mere hours, we can fill a new order in a few hours. Accommodating changes in customer demand can be done almost immediately.

Higher Productivity. The reason it appears that productivity is highest when operation is organized by department is because each department is measured by equipment utilization and people utilization. But it is hard to determine how many people are needed to produce a certain number of units in a large batch operation because productivity is not measured in terms of value-added work. Much productivity is lost when people are "utilized" to overproduce parts, which then have to be moved to storage. Much time is also lost tracking down defective parts and components and repairing finished products? In a one-piece-flow cell, we can quickly see who is too busy and who is idle. It is easy to calculate the value-added work and then figure out how many people are needed to reach a certain production rate.

Heijunka

Heijunka is the leveling of production by both volume and product mix. Toyota does not build products according to the actual flow of customer orders, which can swing up and down wildly. The total volume of orders in a period is levelled out so the same amount and mix are being made each day.

Where demand fluctuates significantly, Toyota will often keep at least a small inventory of finished goods. This seems to contradict lean thinking. But the small inventory protects the production schedule from being upset by sudden spikes in demand. By living with the waste of some finished goods inventory, companies can eliminate far more waste in their entire production process and their supply chain.

Quality

Toyota's philosophy is to identify defects when they occur and automatically stop production so that the problem can be fixed before the defect continues downstream.

Jidoka is also referred to as *autonation* – equipment endowed with human intelligence to stop itself when it has a problem. In-station quality (preventing problems from being passed down the line) is much more effective and less costly than inspecting and repairing quality problems after the fact.

The last thing management in traditional mass manufacturing allows is a halt in production. Bad parts are simply labeled and set aside to be repaired at another time and by another department. The mantra is to produce large quantities at all costs and fix problems later.

Lean manufacturing dramatically increases the importance of building things right the first time. With very low levels of inventory, there is no buffer to fall back on in case there is a quality problem. Problems in operation A will quickly shut down operation B. When equipment shuts down, flags or lights, usually with accompanying music or an alarm, are used to signal that help is needed to solve a quality problem. *Andon* refers to the light signal for help.

Unfortunately, for many companies, the essence of building in quality has got lost in

bureaucratic and technical details. Things like ISO-9000, have made companies believe that if they put together detailed rule books, the rules will be followed. Quality planning departments are armed with reams of data analyzed using the most sophisticated statistical analysis methods. Six Sigma black belts attack major quality problems with a vengeance, armed with an arsenal of sophisticated technical methods. But Toyota follows a different approach. Toyota keeps things simple and uses very few complex statistical tools. The quality specialists and team members have just four key tools:

- Go and see.
- Analyze the situation.
- Use one-piece flow and *andon* to surface problems.
- Ask "Why?" five times.

Andon works only when employees know the importance of bringing problems to the surface. Unless there is a problem-solving process already in place and people are following it, there's no point in spending money on fancy technology. Toyota prefers to first use people and processes to solve problems, then supplement and support its people with technology.

A common Toyota quality tactic is to anticipate problems as early as possible and put in place countermeasures before the problems even occur. Occasionally a time-out is required to reflect on the purpose and direction of the project before moving on. The Toyota Way emphasises stopping or slowing down to get quality right the first time to enhance productivity in the long run.

Standardisation

Toyota believes standardized work is the basis for empowering workers and innovation in the work place. If the process is shifting, then any improvement will just be one more variation that is occasionally used and mostly ignored. One must standardize, and thus stabilize the process, before continuous improvements can be made.

Workers follow very detailed standardized procedures that touch every aspect of the organization. In the workplace, everything must be in its place. There is strict discipline about time, cost, quality ... and safety-virtually every minute of the day is structured. But Toyota also values many of the characteristics associated with flexible organizations referred to as "organic": extensive employee involvement, a lot of communication, innovation, flexibility, high morale, and a strong customer focus.

Standardisation does not necessarily imply a bureaucratic approach. A coercive bureaucracy uses standards to control people, catch them breaking the rules, and punish them to get them back in line. Unlike Taylorism, the Toyota Way preaches that the worker is the most valuable resource-not just a pair of hands taking orders, but an analyst and problem solver. Toyota's enabling systems are simply the best practice methods, designed and improved upon with the participation of the work force. The standards actually help people control their own work.

The critical task when implementing standardization is to find that balance between providing employees with rigid procedures to follow and providing the freedom to innovate and be creative to meet challenging targets consistently for cost, quality, and delivery. The key to achieving this balance lies in the way people write standards as well as who contributes to them.

First, the standards have to be specific enough to be useful guides, yet general enough to allow for some flexibility. Second, the people doing the work have to improve the standards. Nobody likes rules and procedures when they are imposed on them. Imposed rules that are strictly policed become coercive and a source of friction and resistance between management and workers.

The 5S

The five Ss (*seiri, seiton, seiso, seiketsu, and shitsuke*) are:

1. Sort-Sort through items and keep only what is needed while disposing of what is not.
2. Straighten (orderliness)- A place for everything and everything in its place.
3. Shine (cleanliness)- The cleaning process often acts as a form of inspection that exposes abnormal and pre-failure conditions that could hurt quality or cause machine failure.
4. Standardize (create rules)-Develop systems and procedures to maintain and monitor the first three S's.
5. Sustain (self-discipline)-Maintaining a stabilized workplace is an ongoing process of continuous improvement.

Source: Jeffrey K Liker, "The Toyota Way," Tata McGraw-Hill, 2004.

Technology

Toyota introduces new technology only after it is proven through direct experimentation with the involvement of a broad cross-section of people. Before introducing new technology, Toyota will go to great lengths to analyze the impact it may have on existing processes. First, it will examine firsthand the nature of the value-added work being performed by the workers for the particular process. It will look for new opportunities to eliminate waste and even out the flow. Toyota will then use a pilot area to improve the process with the existing equipment, technology, and people. When it has accomplished as much improvement as possible with the present process, Toyota will ask again if it can make any additional improvements by adding the new technology. The technology is then carefully analyzed to see if it conflicts with Toyota's philosophies and operating principles. These include principles of valuing people over technology, using consensus decision making, and an operational focus on waste elimination. If the technology violates these principles or if there is any chance of disrupting stability, reliability, and flexibility, Toyota will reject the technology or at least delay adopting it until the problems are resolved.

If the new technology is acceptable, the guiding principle is to use it to support continuous flow in the production process and help employees perform better within the Toyota Way standards. This means the technology should be highly visual and intuitive used right

where the work is being done and be able to support the actual work process while not distracting people from the value-added work. Throughout this analysis and planning, Toyota will broadly involve all key stakeholders in a consensus-building process. Once Toyota has thoroughly gone through this process, it will quickly implement the new technology.

Leadership

Throughout Toyota's history, key leaders have 'been found within the company, at the right time, to shape the next step in Toyota's evolution. Toyota's leaders are home grown. Leaders must live and thoroughly understand the company's culture day by day. A critical element of the culture is *genchi genbutsu*, which is interpreted within Toyota to mean *going to the place to see the actual situation for understanding*. *Gemba*, the more popular term, refers to "the actual place" and means about the same thing as *genchi genbutsu*. The first step of any problem-solving process, development of a new product, or evaluation of an associate's performance is grasping the actual situation, which requires "going to *gemba*."

Toyota promotes and expects creative thinking, but it should be grounded in a thorough understanding of all aspects of the actual situation. Leaders must demonstrate this ability and understand how work gets done at a shop floor level. Toyota believes that, a superficial impression of a situation will lead to ineffective decision-making and leadership. Someone trained in the Toyota Way, takes nothing for granted and knows what he is talking about, because it comes from firsthand knowledge.

Toyota leaders are passionate about involving people who are doing the value-added work in improving the process. Yet encouraging employee involvement by itself is not enough to define a Toyota leader. In-depth understanding of the work in addition to general management expertise are also needed. So Toyota leaders, are respected for their technical knowledge as well as followed for their leadership abilities. Instead of giving orders, they lead and mentor through questioning. They will raise questions about the situation and the person's strategy for action, but they will not give answers to these questions even though they may have the knowledge.

For Toyota, the decision making process is just as important as the quality of the decision. In fact, management will forgive a decision that does not work out as expected is acceptable if the right process was used. But a decision that works out well, but was based on a shortcut process, is not.

Toyota believes in making decisions slowly by consensus by thoroughly considering all options and then implementing them rapidly. *Nemawashi* is the process by which junior people build consensus by developing a proposal and circulating it broadly for management approval. In the *nemawashi* process, many people give their input and this generates consensus. By the time the formal proposal comes up for a high-level approval, the decision is already made. Agreements have been reached and the final meeting is a formality.

Managing people

Toyota has taken various steps to build high performance teams:

Stage 1: Orientation. The group needs strong direction from the leader and must understand the basic mission, rules of engagement, and tools the members will use.

Stage 2: Dissatisfaction. After going to work, the members discover it is harder than they thought to work as a team. In this stage, they continue to need strong direction (structure) from the leader but also need a lot of social support to get through the tough social dynamics they do not understand.

Stage 3: Integration. The group starts to develop a clearer picture of the roles of various team members and begins to exert control over team processes. The leader does not have to provide much task direction, but the team still needs a lot of social support.

Stage 4: Production. The group becomes a high-performing team, no longer dependent on the leader.

In an assembly line, people do the same mindless task repeatedly and are responsible only for a tiny piece of an overall product. Toyota has attempted to enrich jobs in various ways. Some of the features that make the job more enriching include job rotation, various kinds of feedback on how workers are doing at their jobs, the *andon* system and significant work group autonomy over the tasks. Toyota became interested in job enrichment in the 1990s and redesigned its assembly lines so that the parts that make up a subsystem of the vehicle are installed in one specific area on the assembly line. Rather than a work group assembling electrical systems and then putting in floor mats and then door handles, a work group might focus almost exclusively on the electrical system under the hood. For white collar workers, Toyota organizes teams around complete projects from start to finish. For example, the design of the interior of the vehicle is the responsibility of one team from the design phase through production. Participation in the project from beginning to end enriches and empowers the employee.

People are motivated by challenging but attainable goals and measurement of progress toward those goals. Toyota's visual management systems plus policy deployment means that teams always know how they are doing and are always working towards stretch improvement targets. Policy deployment sets challenging, stretch goals from the top to the bottom of the company. Careful measurements every day let work teams know how they are performing.

Vendor management

Toyota is a tough customer. Toyota has very high standards of excellence and expects partners to rise to those standards. But Toyota will also help partners to improve their standards.

Toyota has made serious investment in building a network of highly capable suppliers who are tightly integrated into Toyota's extended lean enterprise. Toyota's high quality

standards result from the excellence in innovation, engineering, manufacture, and overall reliability of Toyota's suppliers. Without dependable suppliers, JIT cannot work.

There is much hype about "streamlining" the supply chain through advanced information technology. What is not adequately emphasized is the enormous complexity of coordinating detailed, daily activities to deliver value to the customer. One is not likely to hear about relationships across firms-about how partners must work together toward common goals. Yet, this is one of Toyota's key strengths.

Toyota gives new suppliers very small orders to start with. They must prove their sincerity and commitment to Toyota's high performance standards for quality, cost, and delivery. If they demonstrate this for early orders, they will get increasingly larger orders. Toyota will teach them the Toyota Way and adopt them into the family. Once inside, a supplier is not removed except in extraordinary circumstances.

Toyota keeps challenging its suppliers with aggressive targets. Toyota believes in having high expectations for their suppliers and then treating them fairly and teaching them. Treating them softly or beating them up without teaching them would be very disrespectful. And simply switching supplier sources because another supplier is a few percentage points cheaper is unthinkable. Suppliers want to work for Toyota both for the prestige involved and because they know they will get several opportunities to learn and improve.

Toyota is very careful when deciding what to outsource and what to do in house. Like other Japanese automakers, Toyota outsources a lot, about 70% of the components of the vehicle. But it still tries to develop internal competency even in case of components it outsources.

A learning organization

When processes are stable and waste and inefficiencies become publicly visible, there is an opportunity to learn continually from improvements. To be a learning organization, it is necessary to have stability of personnel, slow promotion, and very careful succession systems to protect the organizational knowledge base. To "learn" means having the capacity to build on the past and move forward incrementally, rather than starting over and reinventing the wheel with new personnel with each new project.

The Toyota philosophy emphasises that true problem solving requires identifying the root cause which often lies hidden beyond the source." The answer lies in digging deeper by asking why the problem occurred. The most difficult part to learn is grasping the situation thoroughly *before* proceeding with five-why analysis. Grasping the situation starts with observing the situation with an open mind and comparing the actual situation to the standard. To clarify the problem, one must start by going to where the problem is (*genchi genbutsu*). For Toyota, problem solving is 20% tools and 80% thinking. For most other companies, it seems to be 80% tools and 20% thinking.

A key to learning and growing, not only within Toyota but in Japanese culture, is *hansei*,

which roughly means "reflection." Hansei means reflection on the process of developing the vehicle. Hansei is the check stage of PDCA. It is used most often at the end of a vehicle program, but is being now moved further upstream so there are several hansei events at key junctures in the program.

Toyota has judiciously used stability and standardization to transfer individual and team innovation into organization-wide learning. It is one thing for individual employees to come up with innovative ways to do things. But to become organization - wide learning, the new way must be standardized and practiced across the organization until a better way is discovered. This is the foundation for the Toyota Way of learning-standardization punctuated by innovation, which gets translated into new standards.

Performance measurement

Toyota is not particularly strong at developing sophisticated metrics across the company. Toyota measures processes everywhere on the factory floor, but prefers simple metrics and does not use many of them at the company or plant level.

There are at least three types of measures at Toyota:

Global performance measures-how is the company doing? At this level, Toyota uses financial, quality, and safety measures very similar to those used by other companies.

Operational performance measures-how is the plant or department doing? Toyota's measurements are timelier and better maintained than at other companies. The people at the work group level or the project manager's level painstakingly track progress on key metrics and compare them with aggressive targets. The metrics tend to be specific to a process.

Stretch improvement metrics-how is the business unit or work group doing? Toyota sets stretch goals for the corporation, which are translated into stretch goals for every business unit and ultimately every work group. Tracking progress toward these goals is central to Toyota's learning process.

Creating flow

There are five steps to creating flow:

1. Identify who the customer is for the processes and the added value they want delivered.
2. Separate out the repetitive processes from the unique, one-of-a-kind processes and learn how you can apply TPS to the repetitive processes.
3. Map the flow to determine value added and non-value added.
4. Think creatively about applying the broad principles of the Toyota Way to these processes using a-future-state value stream map.
5. Start doing it and learn by doing using a PDCA cycle and then expand it to the less repetitive processes'

Source: Jeffrey K Liker, "The Toyota Way," Tata McGraw-Hill, 2004.

Culture

The Toyota Way goes to the level of basic assumptions of the most effective way to "perceive, think, and feel" in relation to problems. Things like *genchi genbutsu*, recognizing waste, thorough consideration in decision making, and the focus of Toyota on long-term survival are the DNA of Toyota.

The Toyota Way is explicitly taught to new members. Toyota conducts seminars on the Toyota Way. The Toyota Way also gets transmitted through action in day-to-day work where leaders demonstrate by their actions.

Toyota has also attempted to spread the culture to global operations. The most intensive effort has been in North America. All U.S. senior managers were assigned Japanese coordinators. The coordinators had two jobs: coordinating with Japan, where there are continuous technical developments, and teaching U.S. employees the Toyota Way through daily mentorship. Every day is a training day, with immediate feedback shaping the thinking and behavior of the U.S employees.

Toyota has used trips to Japan, to influence the cultural awareness of U.S. employees. Toyota has also sent over senior executives to instill the culture in new American leaders. This started with managers from Japan and has evolved to homegrown managers in North America. Toyota has used the TPS technical systems, or "process" layer of the Toyota Way, to help reinforce the culture Toyota sought to build. By creating flow across operations using TPS and lean product development in its overseas operations, Toyota is helping change this behavior and shape the culture it seeks to nurture.

Conclusion

Becoming a lean enterprise involves a lot of hard work. The author recommends the following steps:

1. Start with action in the technical system; follow quickly with cultural change. The social and technical systems of TPS are intertwined. If a company wants to change the culture, it must also develop true lean leaders who can reinforce and lead that cultural change. The best way a company can develop this is through action to improve the company's core value streams, supported by committed leaders who reinforce culture change. Leaders must be involved in the value stream mapping and shop floor transformation so they can learn to see waste.

2. Learn by doing first and training second. The Toyota Way is about learning by doing. In the early stages of lean transformation there should be at least 80% doing and 20% training and informing. The best training is training followed by immediately doing or doing followed by immediate training. Toyota puts people in difficult situations and lets them solve their way out of the problems.

3. Start with value stream pilots to demonstrate lean as a system and provide a go see" model. Within a value stream defined by a product family, a model can be created. Often

this means creating one lean product line, beginning with raw materials received and ending with finished goods. The model line should become a singularly focused project with a great deal of management attention and resources to make it a success.

4. *Use value stream mapping to develop future state visions and help "learn to see."* A cross-functional group consisting of managers can authorize resources and doers who are part of the process being mapped. The team members learn together as they see the waste in the current state, and in the future state they come together to figure out how to apply the lean tools and philosophy. Mapping creates a language and tool for the team to actually pick apart a specific process, see the waste, develop a lean vision, and apply it to that particular process. Value stream mapping should be applied only to specific product families that will be immediately transformed.

5. *Use kaizen workshops to teach and make rapid changes.* Using a talented and experienced facilitator who has a deep understanding of lean tools and philosophy with a specific problem to tackle makes all the difference in what can be accomplished. However, the *kaizen* workshop should not become an end in itself. In many companies, "lean efforts" revolve around having numerous workshops: the more the better. This leads to "point kaizen"-fixing individual problems without straightening out the core value stream. *Kaizen* workshops are best used as one tool to implement specific improvements guided by a future state value stream map.

6. *Organize around value streams.* In most organizations, management is organized by process or function. In a factory, there may be the paint department, the assembly department, and the maintenance department. In a bank, there may be order processing, order fulfillment, customer complaints, etc. In other words, managers own steps in the process of creating value for customers and nobody is responsible for the value stream. Value stream managers have complete responsibility for the value stream and can answer the customer. Someone with real leadership skills and a deep understanding of the product and process must be responsible for the process of creating value for customers and must be accountable to the customer.

7. *Make it mandatory.* If a company looks at lean transformation as a nice thing to do in any spare time or as voluntary, it will simply not happen.

8. *A crisis may prompt a lean movement, but may not be necessary to turn a company around.* A sinking ship certainly mobilizes management and the work force into getting serious about lean. But the essence of lean leadership is proactive thinking and long-term learning.

9. *Be opportunistic in identifying opportunities big financial impacts.* When a company does not yet believe in the lean philosophy heart and soul, it is particularly important to achieve some big wins.

10. *Realign metrics with a value stream perspective.* Metrics are used very differently by Toyota compared to most companies. They are an overall tool for tracking the progress of

the company and they are a key tool for continuous improvement. At most companies they are mainly a tool for short-term cost control by managers who do not understand what they are managing. For example, companies track indirect/direct labor ratios. The way to make the ratio look good is to have lots of direct labor and keep those people busy making parts, even if they are overproducing or doing wasteful jobs. The first step is to eliminate non-lean metrics that are wreaking havoc with those seriously invested in improving operational excellence. The next step is to measure a variety of value stream metrics from lead time to inventory levels to first-pass quality and treat these metrics as seriously as labor productivity and other short-term cost metrics.

11. Build on your company's roots to develop your own way. When it works with other companies to teach TPS, Toyota insists that these companies develop their own system. It is alright to borrow some of the insights from the Toyota Way. But companies need to put them into their language in a way that fits their business and technical context. The Toyota Way has evolved through some inspired leaders who have provided a very rich cultural heritage. Each company must build on its heritage.

12. Hire or develop lean leaders and develop a succession system. Leaders must thoroughly understand, believe in, and live the company's "way." All leaders must understand the work in detail and know how to involve people. Without top management involvement, the transformation will not happen.

13. Use experts for teaching and getting quick results. A company needs a *sensei* or teacher to provide technical assistance, facilitate the transformation, get quick results, and keep the momentum building. But a good teacher cannot do everything. To develop a lean learning enterprise, companies need to build internal expertise--senior executives, improvement experts, and group leaders who believe in the philosophy and will spread the lean culture throughout the organization over time.