

Toyota Production System (TPS)

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Introduction

Craig Woll, PhD

- Program Manager / Senior Strategist at Intel Corporation
- Organizations I've Worked With
 - Intel Corporation, Sun Microsystems, Applied Materials, Tokyo Electron, KLA Tencor, Varian, Novellus, Hitachi, Icon Health and Fitness, Idaho National Laboratories
- Education
 - PhD Utah State University; Instructional Technology
 - M.S. Utah State University; Instructional Technology
 - B.S. Brigham Young University; Psychology
- Shingo Prize Literature Reviewer
- Recent Publications
 - Nguyen, F., Woll, C. A. (2006) A Practitioner's Guide for Designing Performance Support Systems. *Performance Improvement*, 45(9), 37-45.
 - Mahesh, V., Woll, C. A. (2006-In Press) Blended Learning in High Tech Manufacturing: A case study of cost benefits and production efficiency. *Journal of Asynchronous Learning Networks*

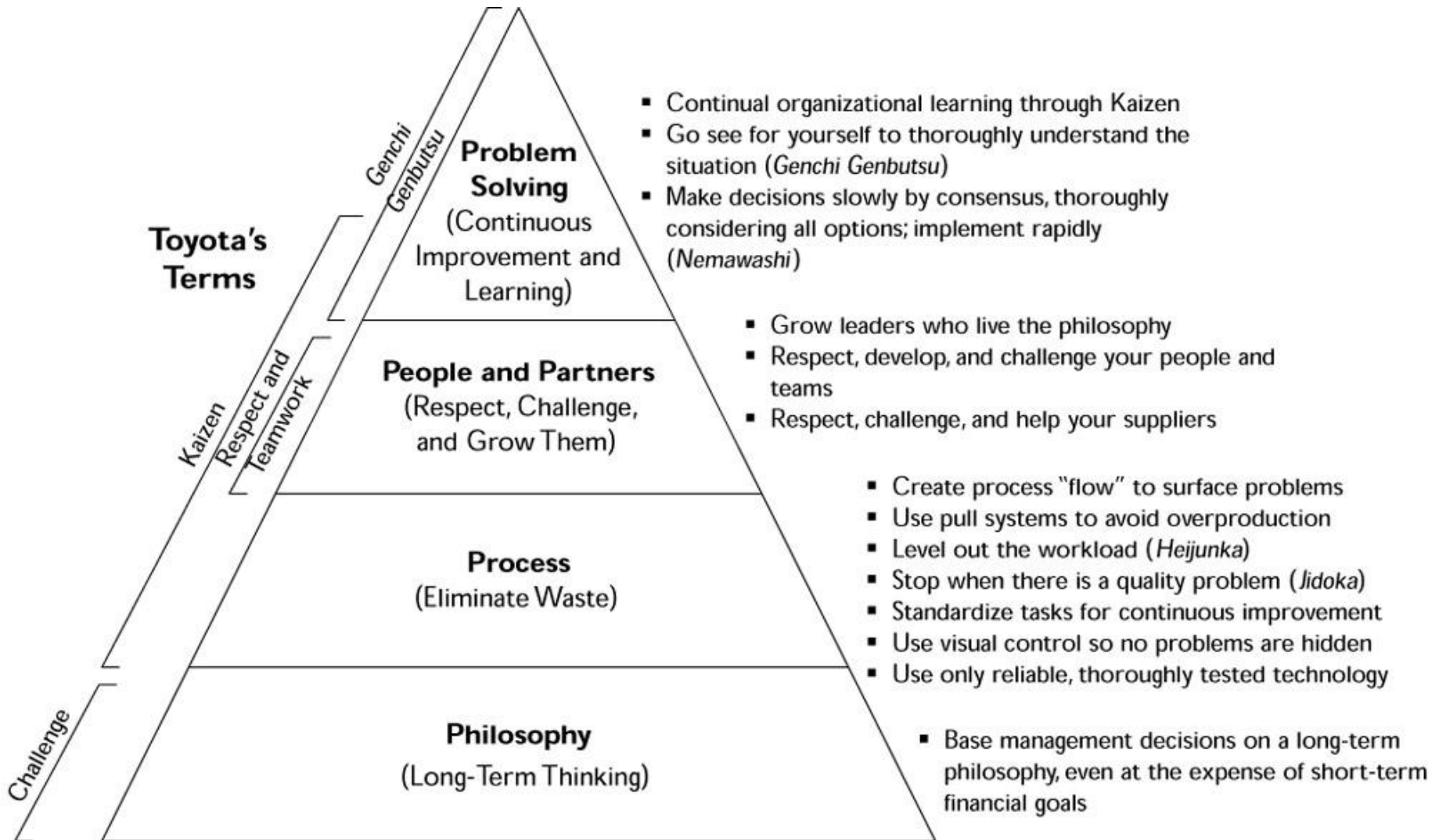
Toyota Production System (TPS)

- I. Toyota's Philosophy
- II. Identifying Value
- III. Mapping the Value Stream
- IV. How to Create Flow
- V. The Importance of Standardization
- VI. How to Perform Kaizen
- VII. Genchi Genbutsu
- VIII. Nemawashi
- IX. How to do Poka Yoke
- X. How Toyota Does Learn by Doing
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I. Toyota's Philosophy

- Why should you be interested in Toyota?
 - Toyota is positioned to become the largest auto manufacturer in the world within the next year
 - Toyota invented “lean production” (also known as “the Toyota Production System” or “TPS”), which has triggered a global transformation in virtually every industry
 - Toyota is benchmarked as the best in class by all of its peers and competitors throughout the world for high quality, high productivity, manufacturing speed, and flexibility.
 - Toyota’s annual profit is larger than the combined earnings of GM, Chrysler, and Ford, ... Its net profit margin is 8.3 times higher than the industry average.
 - The company has made a profit every year over the last 25 years and has \$20-\$30 billion in its cash war chest on a consistent basis.

I. The Toyota Way



I. Toyota's Philosophy: Long-Term Thinking

Toyota is serious about long-term thinking. The focus from the very top of the company is to add value to customers and society. This drives a long-term approach to building a learning organization, one that can adapt to changes in the environment and survive as a productive organization. Without this foundation, none of the investments Toyota makes in continuous improvement and learning would be possible.

(Liker, 2004)

I. Toyota's Philosophy: Process

Toyota is a process-oriented company. They have learned through experience what processes work, beginning with the ideal of one-piece flow. Flow is the key to achieving best quality at the lowest cost with high safety and morale. At Toyota this process focus is built into the company's DNA, and managers believe in their hearts that using the right process will lead to the results they desire.

(Liker, 2004)

I. Toyota's Philosophy: People

The Toyota Way includes a set of tools that are designed to support people continuously improving and continuously developing. For example, one-piece flow is a very demanding process that quickly surfaces problems that demand fast solutions-or production will stop. This suits Toyota's employee development goals perfectly because it gives people the sense of urgency needed to confront business problems. The view of management at Toyota is that they build people, not just cars.

(Liker, 2004)

I. Toyota's Philosophy: Perfection

The highest level of the Toyota Way is organizational learning. Identifying root causes of problems and preventing them from occurring is the focus of Toyota's continuous learning system. Tough analysis, reflection, and communication of lessons learned are central to improvement as is the discipline to standardize the best-known practices.

(Liker, 2004)

I. Womack and Jones Description of Lean/TPS

- Womack and Jones (1996) identify the following 5 components of Lean:
 1. Specify Value
 2. Identify the Value Stream
 3. Make Value flow without interruptions
 4. Let the customer Pull Value
 5. Pursue Perfection
 - Perfection is sought through the use of standards, kaizen/kaikaku, 5 Why's, 5S's, 5M's, and other methods of continuous improvement

II. What Value Is

Value can only be defined by the ultimate customer.

(Womack and Jones, 1996)

II. What Value Isn't: The Seven deadly wastes + 1

1. **Overproduction.** Producing items for which there are no orders, which generates overstaffing and storage and transportation costs because of excess inventory.
2. **Waiting** (time on hand). Workers 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.** Taking unneeded steps due to poor tool and product design or providing higher-quality products than is necessary.
5. **Excess inventory.** Excess raw material, WIP, or finished goods causing longer lead times, obsolescence, damaged goods, transportation and storage costs, and delay.
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. Also, walking is 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 your employees.

II. Identifying value

When Womack and Jones go on consulting visits they ask executives the following question:

1. Can you put yourself in the position of a design as it progresses from concept to launch, an order as information flows from initial request to delivered product, and the physical product as it progresses from raw material to the customer, and describe what will happen to you at each step along the way?
2. Why? because immediate needs of the shareholder and the financial mindset of the senior managers have taken precedence over the day-to-day realities of specifying and creating value for the customer

(Womack and Jones, 1996)

II. The Sienna

Toyota Sienna example from Toyota Way

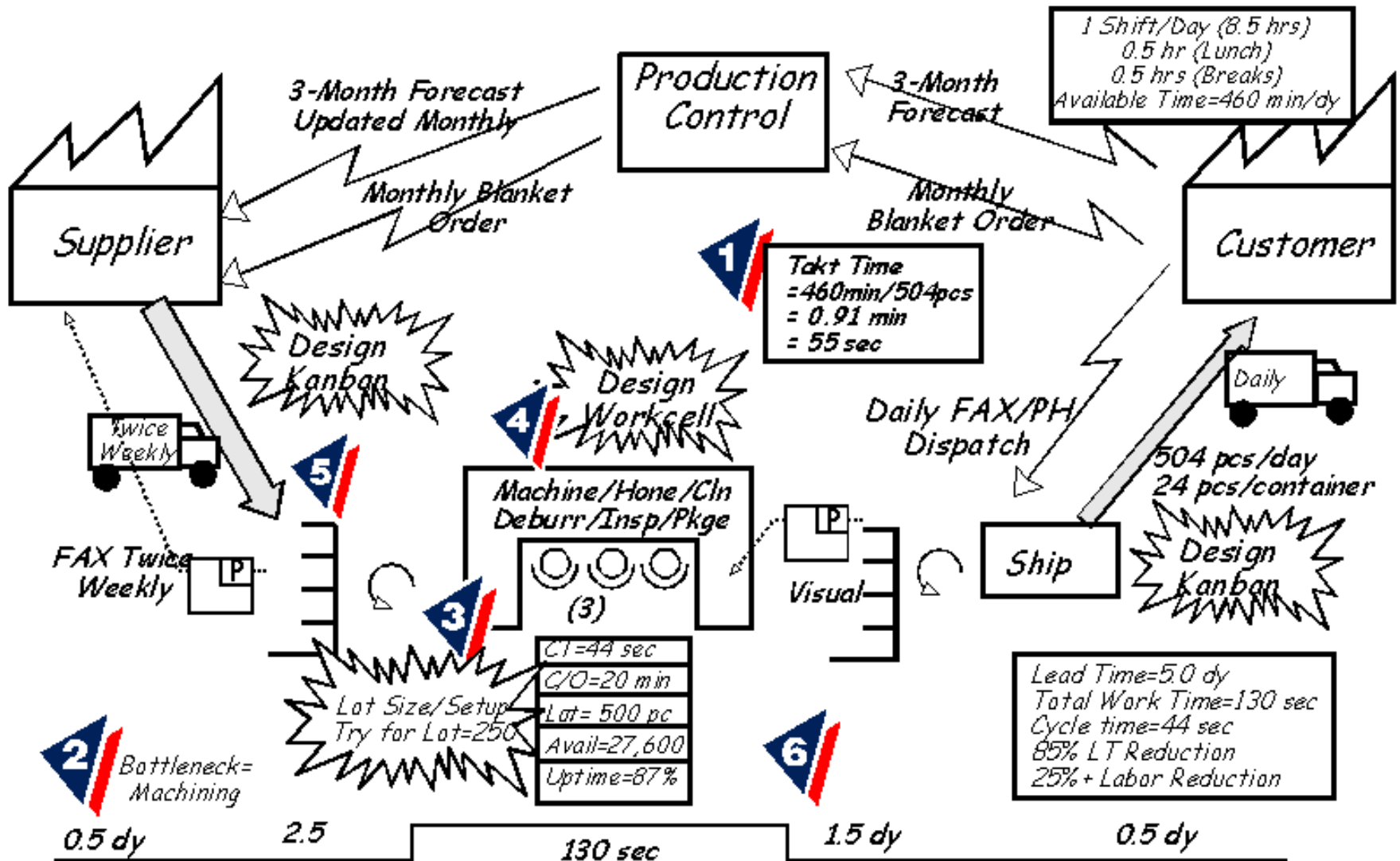
- Yuji Yokoya was chief engineer
- Visited all 50 states and 13 provinces and territories in Canada and parts of Mexico
- Rented a Sienna in each location
- Discoveries
 - Turning radius was too small (Santa Fe)
 - Wind-stability (Ontario)
 - More cup holders needed and they need to be bigger (America)
 - Americans eat in their vehicle
 - 4'x8' plywood needs to fit in vehicle

III. Value stream mapping

The value stream is the set of all the specific actions required to bring a specific product through the three critical management tasks of any business: the problem-solving task running from concept through detailed design and engineering to production launch, the information management task running from order-taking through detailed scheduling to delivery, and the physical transformation task proceeding from raw materials to a finished product in the hands of the customer.

(Womack and Jones, 1996)

III. Future State Map



IV. Flow

Flow is at the heart of the lean message that shortening the elapsed time from raw materials to finished goods (or services) will lead to the best quality, lowest cost, and shortest delivery time.

You will not see Toyota just throwing together machines and suppliers and forcing one-piece flow where it does not fit. Taiichi Ohno wrote that it takes time and patience to achieve flow...inventory buffers are used judiciously where continuous flow is not possible today. But the ideal of flow provides a clear direction. At Toyota it means that using small lots, having processes close together, and keeping the material moving through processes without interruption is better than producing large batches of stuff and having them sit and wait.

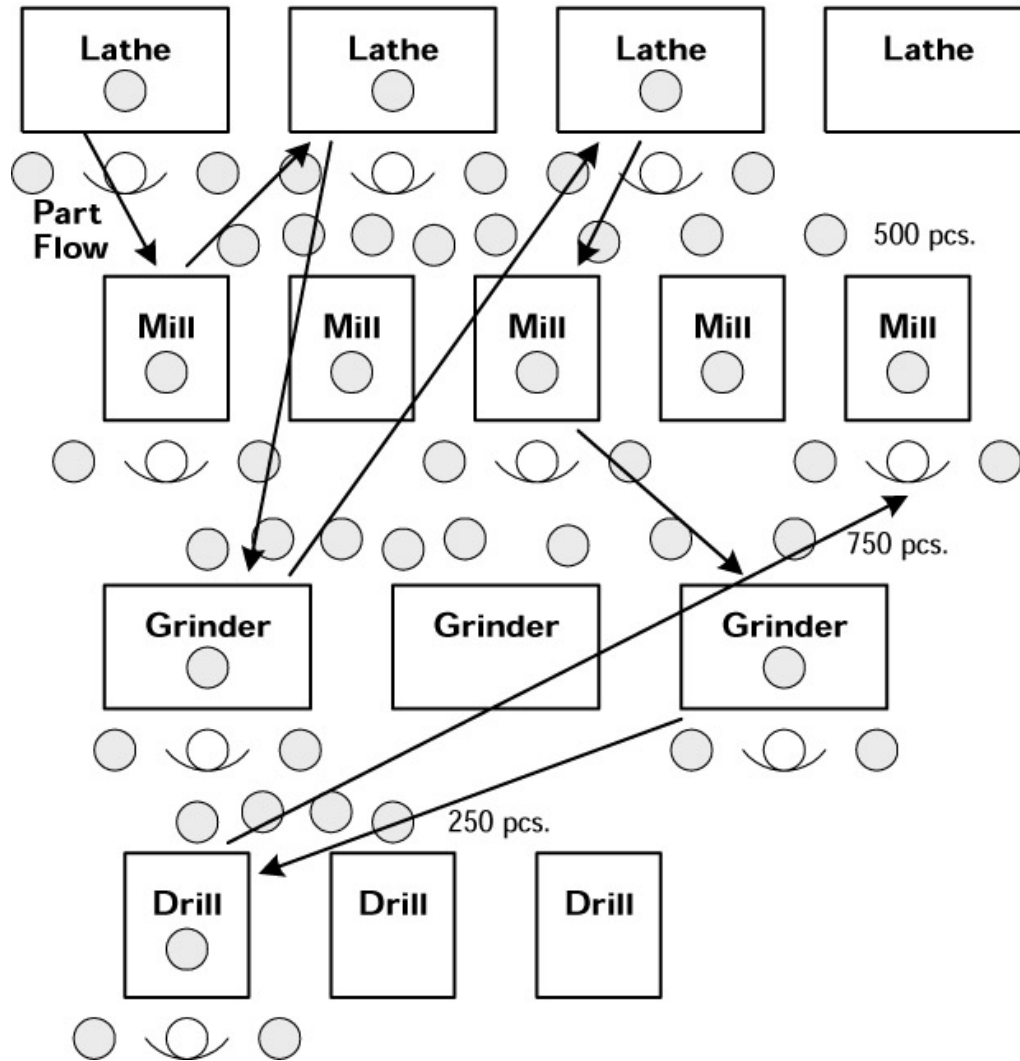
(Liker, 2004)

IV. Benefits of One-Piece Flow

- **Builds in Quality.**
- **Creates Real Flexibility.**
- **Creates Higher Productivity.**
- **Frees up Floor Space.**
- **Improves Safety.**
- **Improves Morale.**
- **Reduces Cost of Inventory.**

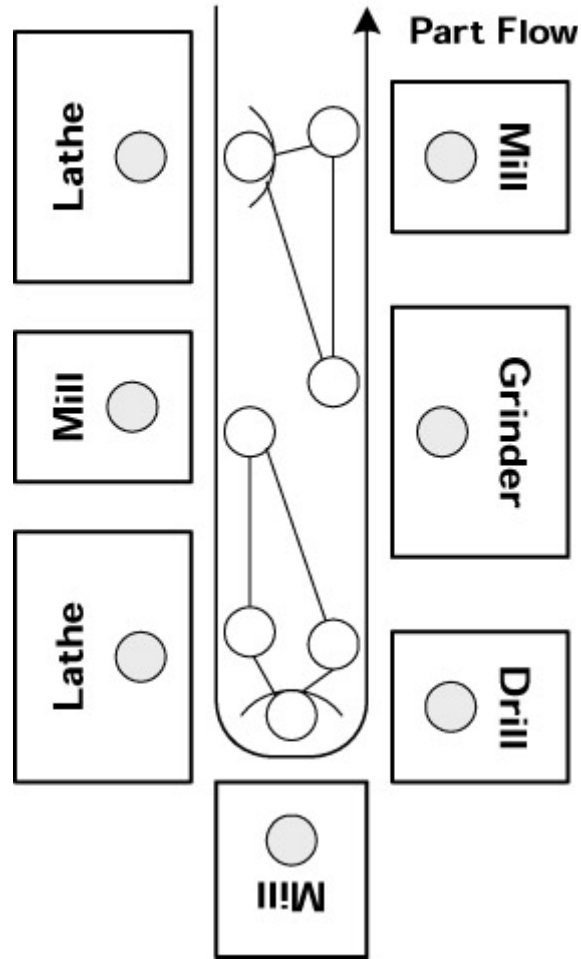
IV. No-Flow

No organization and no control



IV. Flow

Organization and control



V. The Importance of Standardization

"Today's standardization is the necessary foundation on which tomorrow's improvement will be based. If you think of 'standardization' as the best you know today, but which is to be improved tomorrow--you get somewhere. But if you think of standards as confining, the progress stops." Henry Ford

(Morgan & Liker, 2006)

V. The Importance of Standardization

Managers have a misconception that standardization is all about finding the scientifically one best way to do a task and freezing it. As Imai (1986) explained so well in *Kaizen*, his famous book on continuous improvement, it is impossible to improve any process until it is standardized. If the process is shifting from here to there, 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. As an example, if you want to learn golf, the first thing an instructor will teach you is the basic golf swing. Then you need to practice, practice, and practice to stabilize your swing. Until you have the fundamental skills needed to swing the club consistently, there is no hope of improving your golf game.

(Liker, 2004)

V. Key Features of Standardization

Successful management on a day-to-day level boils down to one precept: Maintain and improve standards.

Key Features of Standards

- 1. Represent the best, easiest, and safest way to do a job.**
- 2. Offer the best way to preserve know-how and expertise.**
- 3. Provide a way to measure performance.**
- 4. Show the relationship between cause and effect**
- 5. Provide a basis for both maintenance and improvement.**
- 6. Provide objectives and indicate training goals.**
- 7. Provide a basis for training.**
- 8. Create a basis for audit or diagnosis.**
- 9. Provide a means for preventing recurrence of errors and minimizing variability.**

(Masaaki Imai, 1997)

V. Keys of Standardization

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.**

VI. What is Kaizen? Improvement

Kaizen (Japanese for "change for the better" or "improvement", the English translation is "continuous improvement", or "continual improvement.")

Kaizen is a daily activity whose purpose goes beyond improvement. It is also a process that, when done correctly, humanizes the workplace, eliminates hard work (both mental and physical), and teaches people how to do rapid experiments using the scientific method and how to learn to see and eliminate waste in business processes.

<http://en.wikipedia.org/wiki/Kaizen>

VI. What is Kaizen? Innovative Thinking

Tools, techniques, and metrics aside, Toyota's greatest emphasis is on thinking through problems and solutions. At Toyota, it is said that problem solving is 20% tools and 80% thinking. Unfortunately, I've learned from many Six Sigma programs that some companies get caught up in using all the great and new sophisticated analysis tools, where problem solving seems to be 80% tools and 20% thinking.

(Liker, 2004)

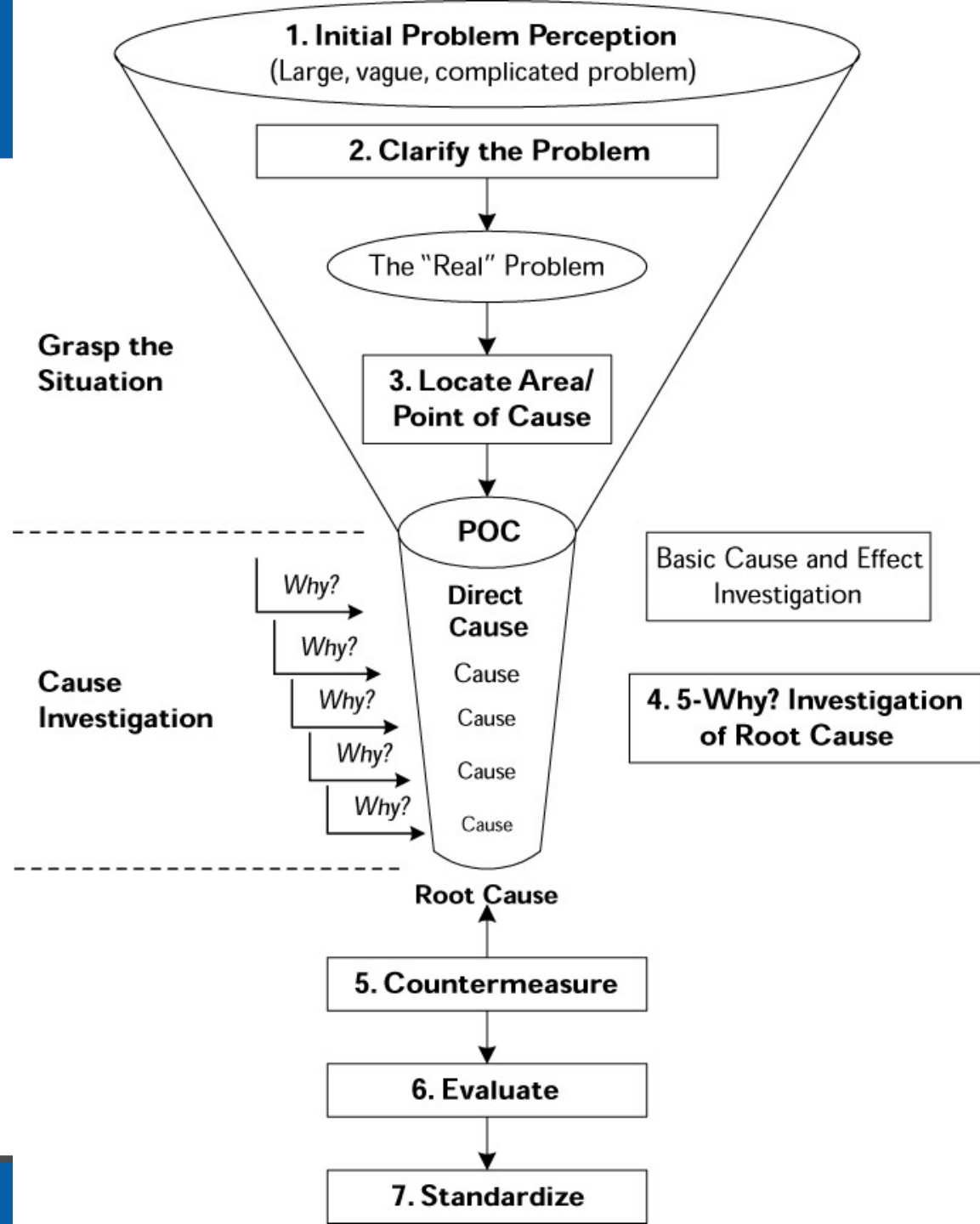
VI. Ten Basic Rules to Kaizen

1. Discard conventional rigid thinking about production.
2. Think of how to do it, not why it cannot be done.
3. Do not make excuses. Start by questioning current practices.
4. Do not seek perfection. Do it right away even if for only 50 percent of target.
5. Correct mistakes at once.
6. Do not spend money for kaizen.
7. Wisdom is brought out when faced with hardship.
8. Ask "Why?" 5 times and seek the root cause.
9. Seek the wisdom of ten people rather than the knowledge of one.
10. Remember the opportunities for kaizen are infinite.

Managers have to be committed for this to work.

(Masaaki Imai, 1997)

VI. Kaizen



VII. Genchi Genbutsu and Gemba

Literally translated, Genchi means the actual location and genbutsu means the actual materials or products. But genchi genbutsu is interpreted within Toyota to mean going to the place to see the actual situation for understanding. Gemba is a term that has become more popular. It refers to “the actual place” and means about the same thing as genchi genbutsu.

(Liker, 2004)

VII. Genchi Genbutsu

Data is of course important in manufacturing, but I place the greatest emphasis on facts.

—Taiichi Ohno

To Ohno the big difference was that data was one step removed from the process, merely “indicators” of what was going on. What you want to do is verify the on-the-scene facts of the situation. Ohno’s approach was very much like that of a forensic scientist investigating a crime scene.

(Liker, 2004)

VII. Example of Genchi Genbutsu

One day Kiichiro Toyoda was walking through the vast plant when he came upon a worker scratching his head and muttering that his grinding machine would not run. Kiichiro took one look at the man, then rolled up his sleeves and plunged his hands into the oil pan. He came up with two handfuls of sludge. Throwing the sludge on the floor, he said: "How can you expect to do your job without getting your hands dirty!"

(Liker, 2004)

VII. Example of Genchi Genbutsu

Story from Don Jackson, VP of Manufacturing

Jackson: Typically my average day is 10 to 12 hours. I usually start out on the production floor around 8:00 and I pick an area of the plant I visit in the morning to sort of assess the last 24 hours of what took place. And from that point on, I'm pretty much confirming different parts of the operation or the annual plan activity throughout the plant. Part of the annual planning process is milestones and how you'll achieve efficiency improvements or quality improvements or supplier improvements. So, based on our annual plan, we are following those items up. And I do weekly department head reviews on the floor. The team members are pretty motivated by that. I actually come, see their improvements, and give them some suggestions.

Liker: So you spend a lot of time here on site, as opposed to traveling.

Jackson: Well, when I was managing quality, I spent probably 50% of my time visiting suppliers and then 50% in the plant, but now probably about 95% in the plant.

VIII. Definition of Nemawashi

Nemawashi in Japanese company culture is an informal process of quietly laying the foundation for some proposed change or project, by talking to the people concerned, gathering support and feedback, and so forth. It is considered an important element in any major change, before any formal steps are taken, and successful nemawashi enables changes to be carried out with the consent of all sides.

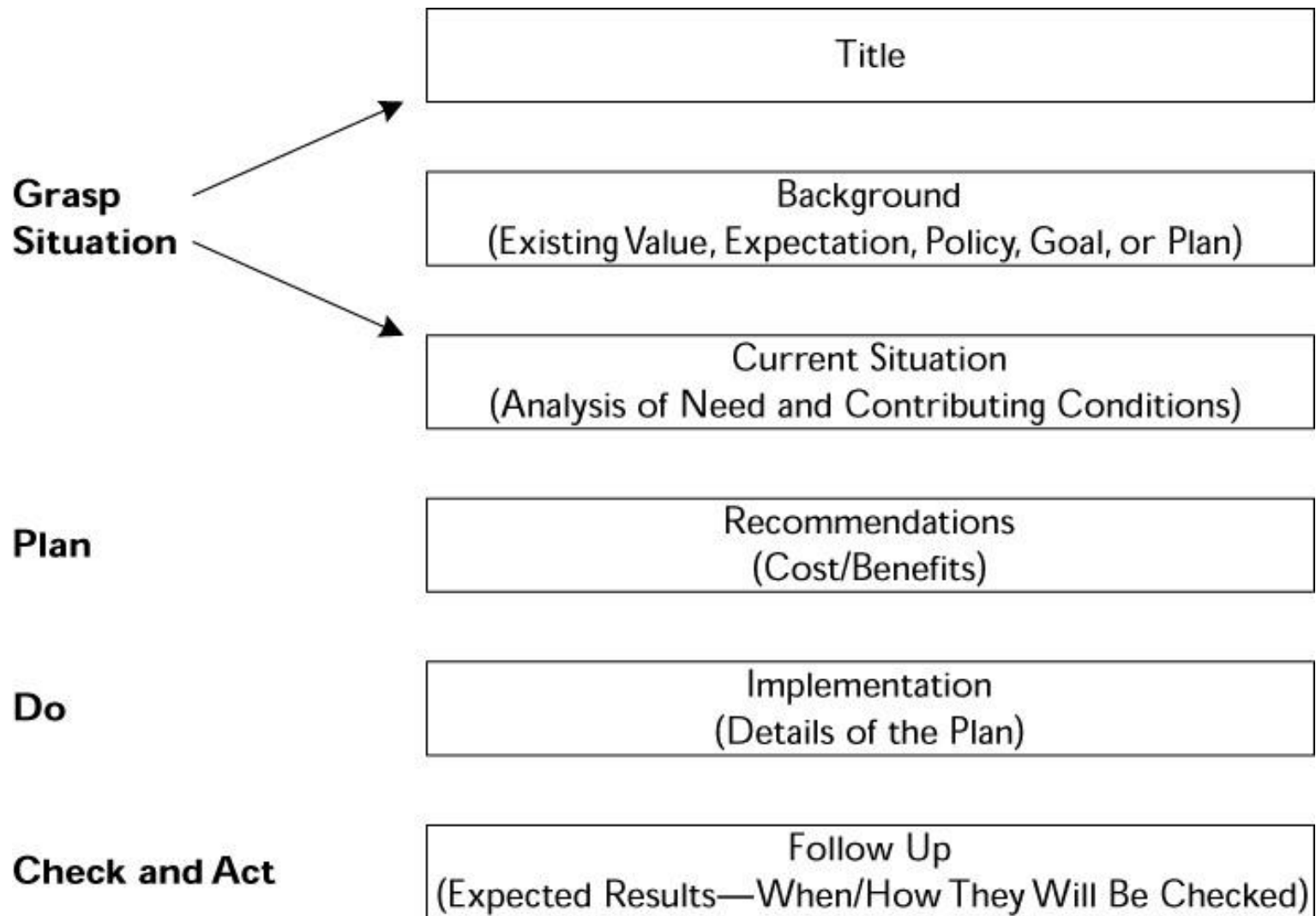
<http://en.wikipedia.org/wiki/Nemawashi>

VIII. 5 Elements of Decision Making

1. Finding out what is really going on, including genchi genbutsu.
2. Understanding underlying causes that explain surface appearances—asking “Why?” five times.
3. Broadly considering alternative solutions and developing a detailed rationale for the preferred solution.
4. Building consensus within the team, including Toyota employees and outside partners.
5. Using very efficient communication vehicles to do one through four, preferably one side of one sheet of paper.

(Liker, 2004)

VIII. The A3 Report as a Communication Tool



VIII. Nemawashi: The A3 Report—Based on PDCA

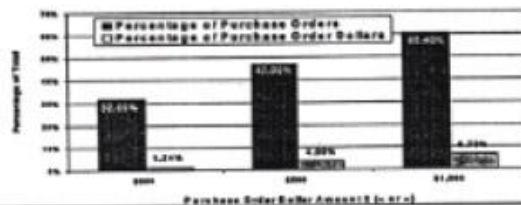
To: Jim Gilrea, VT AFM
 Joe Palmanga, CTO
 Date: August 20, 1996

PURCHASING CARD IMPLEMENTATION

CURRENT SITUATION

Cost to process PO labor & mat'l: Purch. Dept. - \$57.00 AFD - \$39.00 Tech. Dept. - \$27.00 TOTAL = \$103.00/PO
Cost to process Invoice labor & mat'l: Purch. Dept. - \$0.00 AFD - \$27.00 Tech. Dept. - \$27.00 TOTAL = \$54.00/Invoice
1995
N of Purchases: <= \$250.00 - 813 <= \$500.00 - 1200 <= \$1,000.00 - 1523
N of Invoices: <= \$250.00 - 2316 <= \$500.00 - 2740 <= \$1,000.00 - 3026
Time Required: <= \$250.00 - 5525 Hrs. <= \$500.00 - 7184 Hrs. <= \$1,000.00 - 8489 Hrs.

TTC Purchase Order Analysis



PROPOSAL

Implement use of purchasing credit cards for purchases <= \$500.00 to incur the following savings and increases in efficiency:

- Labor hours saved - Tech Groups, Purchasing, AFD
- Labor & Material Cost savings.
- Reduced P.O., RFP, Expense Reports, Invoice paperwork.
- Customer Service to T/A's through reduction of time spent on completion of paperwork.
- Ease of performing spot transactions - Test Trips, Emergency Purchases, Etc.
- Helps to maintain existing ADM & AFD headcount while TTC grows over next 5-10 years.
- Reallocated time used on higher ticket buys, priority projects, etc.

LABOR COST & TIME ANALYSIS

LABOR & MAT'L SAVINGS:	E.O.	INV.
Current Cost/Transaction	\$103.00	\$54.00
Purchasing Card Costs	\$20.00	\$20.00
Savings/Transaction	\$83.00	\$34.00

TIME SAVINGS:	E.O.	INV.
Current process:	3300 Hrs	3900 Hrs
Purchasing Card:	650 Hrs	1550 Hrs
Potential Annual Time Savings	2650 Hr/Yr*	2350 Hr/Yr*

*Approx. 1/3 of time savings is to Tech Grps.

PLAN

-Pilot program starting with Facilities, Purchasing, Tech. Grp. (AA-PED; LA-LAPP; TAPG-VEA)
 -Dept. GM determines which T/A's are issued cards for specific dept. purchases.

-Purchasing is issued cards.

-Acceptable business related purchases using card:

Small Tools	Seminars	Photo Processing & Film
Auto Supplies	Office Supplies	Postage
Minor Equip. Repairs	Printing Services	Copy Services
Electrical Supplies	Safety Supplies	Bldg. Maint. Supplies
Catering	Florists	Coffee Services
Hardware	Signage	

-Unacceptable uses of card (blocked)

Cash Advance	Travel & Entertainment	Independent Contract Services
Computer Hardware	Personal Use	Capital Purchases
Jewelry, Furriers		

IMPLEMENTATION

1. Card user obtains approval from Dept. Manager for each purchase.
2. Card user contacts vendor, places order & provides vendor with appropriate information.
3. Goods shipped as specified and labeled "Purchasing Card" - Cardholder Name.
4. Goods received per standard receiving procedure with following exception: packing list & receipt is forwarded to card user.
5. All packing lists & receipts are retained by requestors and matched against monthly statement.
6. Card user reviews statement, attaches appropriate packing lists & receipts, records JRN #'s, signs and forwards to Dept. Manager.
7. Dept. Manager reviews statement for accuracy and initials and dates statement.
8. Dept. Manager forwards to AFD. AFD audits statement & supporting docs. for compliance, sales tax, 1099.
9. AFD pays from master invoice received directly from the purchasing card bank.

CONTROLS

The following controls are set up prior to the card being issued:

- Monthly dollar limits per card
- Single transaction limits (\$500.00)
- Limited number of transactions per card per day
- Merchant Category (blocking (i.e. cash advances, jewelry stores, appliances, entertainment, etc.))

TTC requires all card users to sign a P-Card Agreement stating that all use of the card will be for business purposes and within the procedures set forth.

TIME LINE

8/3	8/4-9/20	9/14-11/15	11/18-2/31	11/18-3/31	4/1-4/15	4/16-4/18	4/21-5/30	6/2/97
Present at CP Mtg	Policy Guide: lines, Issuer Selection & Supplier Enrollment	Training for Pilot Program - Purch/AID, Management, Cardholders	Pilot Program	Concurrent Reviewing of Policy & Procedure	Audit & Analysis 3 Month Pilot Program	Report Results of Audit	Training - Corporate Wide	Corporate Wide Implementation

VIII. How Nemawashi Yields Results

For example, in 2002 Toyota became aware that a planned mega-development near its Arizona Proving Ground threatened the long-term water supply of the entire surrounding area. Toyota took legal action to stop the developers and worked to get a citizens committee organized to protest the plan. But instead of taking an adversarial approach, Toyota tried to get consensus from all the parties involved—the developer, the surrounding towns, and their local governments. And they searched for a solution all could benefit from. Ultimately, the developers agreed to set aside 200 acres and pay several million dollars in infrastructure costs to create a groundwater replenishment site. Basically, for every gallon of water they used they would purchase a gallon to replace it in the aquifer. As Mallery, who led the consensus-building process, explained:

The Mayor, the developers, and the citizens' committee—all of the contending parties agreed that Toyota had served each of them well and had satisfied all of the parties from each of their perspectives. The town ended up with a more responsible, long-term solution to groundwater subsidence concerns, the problem was solved for the developers, who would have had to address it eventually—maybe 30 years from now. And it helped the surrounding communities that are concerned about irresponsible growth. Everyone came away with greater respect for Toyota—not only what Toyota did but how Toyota did it. It is the what and the how that makes the difference—protecting the land for the next 50-100 years, not just for the short term.

In simple terms, Toyota turned conflict into consensus and created a win-win environment for all parties. From the perspective of a lawyer, this is very unusual. Once you go to court, get involved with local politicians, and take sides politically, the usual assumption is that you are fighting against somebody to win. You win; they lose. Toyota was not satisfied with this, as Mallery explained:

Achieving consensus—it's a belief in reason. Let's work it out. It's a combination of reason and pragmatism with this overlay of integrity and excellence. We were in a political campaign, but Toyota had no thoughts of smearing anybody. There was no negative campaigning.

IX. Definition of Poka Yoke

Poka-yoke refers to mistake-proofing (also error-proofing or fool-proofing). These are creative devices that make it nearly impossible for an operator to make an error.

(Liker, 2004)

The concept was originated by Shigeo Shingo as part of the Toyota Production System. Originally described as Baka-yoke, but as this means "idiot-proofing" the name was changed to the milder Poka-yoke. One example is the inability to remove a car key from the ignition switch of an automobile if the automatic transmission is not first put in the "Park" position... Another example can be found in a normal 3.5" floppy disk: the top-right corner is shaped in a certain way so that the disk cannot be inserted upside-down.

<http://en.wikipedia.org/wiki/Poka-yoke>

IX. Example of Poka Yoke

As an example, though they did not have a poka-yoke to check if the cotter pin was in place, they did have a light curtain over the tray of cotter pins. If the light curtain was not broken by the operator reaching through it to pick up a cotter pin, the moving assembly line would stop, an andon light would come on, and an alarm would sound. Another poka-yoke device required that I replace a tool (somewhat like a file, used to expand the cotter pin) back in its holder after each time I used it or the line would stop and an alarm would sound. It sounds a bit bizarre—one step removed from getting electric shocks for any misstep. But it is effective. Of course there are ways around the system, and the workers on the line find them all. But at Toyota there is a discipline about following the standard tasks that workers tend to adhere to.

(Liker, 2004)

X. The Importance of Learning

“The ability to learn faster than your competitors may be the only truly sustainable competitive advantage”

(De Geus, 1988)

Toyota sets challenging performance goals for every project and holds both real-time and postmortem learning events (called Hansei or reflection) that encourage functional specialists to verify and update their own knowledge databases.

“Toyota’s awesome ability to learn quickly and improve at a regular cadence may well be the characteristic of Toyota its competitors should fear most.”

(Morgan & Liker, 2006)

X. How Toyota does learn by doing

- Supplier technology demonstrations
- Competitor teardown analysis
- Checklists and quality matrices
- Learning focused problem solving
- Know-how database
- Hansei events
- Program manager conferences
- Business revolution teams
- OJT skills matrices and learning-focused career paths
- Resident engineers

XI. Summary

The ideas behind the Toyota Production System have basically diffused and are understood by our competitors. But the know-how regarding how to implement it in specific factories and contexts has not. I believe that Toyota Group companies are better at implementing the ongoing kaizen activities associated with the Toyota Production system.

(Michio Tanaka, Director of International Purchasing, Toyota Corp.)

What is the key to Toyota's System?

The key to the Toyota Way and what makes Toyota stand out is not any of the individual elements.... But what is important is having all the elements together as a system. It must be practiced every day in a very consistent manner—not in spurts.

Taiichi Ohno

Questions



XI. Resources

- The Toyota Way: http://en.wikipedia.org/wiki/The_Toyota_Way
- The 14 Principles of The Toyota Way: <http://www.gpworldwide.com/quick/sep2004/art5.asp>
- A Sociotechnical Learning Organization in Action: <http://www.si.umich.edu/ICOS/Presentations/20050325/>
- The Toyota Production System: http://en.wikipedia.org/wiki/Toyota_Production_System
- Thinking Production System: <http://www.toyotageorgetown.com/tps.asp>
- Toyota Supplier Support Center: <http://www.tssc.com/>
- Moving Forward with Toyota: http://www.cambridge-mit.org/downloads/archive%20version%20MrIshizaka@CMI_Nov05.pdf
- Role of Management in Lean Manufacturing Environment: <http://www.sae.org/manufacturing/lean/column/leanjul01.htm>
- Lean Terms and Definitions: <http://nwlean.net/leandefs.htm>
- Lean Library: <http://www.leanlibrary.com/>

Recommended "Lean" Reading

- Liker, J. 2004. *The Toyota Way*. McGraw-Hill, New York, NY.
- Morgan, J. M. and Liker, J. 2006. *The Toyota Product Development System: Integrating People, Process and Technology*, Productivity Press
- Womack, James P., Daniel T. Jones, and Daniel Roos. *The Machine That Changed the World: The Story of Lean Production*. New York: HarperPerennial, 1991.
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Backup Slides

How do you become Lean?

1. ***Start with action in the technical system; follow quickly with cultural change.***
2. ***Learn by doing first and training second.*** Unfortunately you cannot PowerPoint™ your way to lean. 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 Toyota approach to training is to put people in difficult situations and let 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.*** In a service organization, it is one complete business process from start to finish.
4. ***Use value stream mapping to develop future state visions and help "learn to see."*** When developing the current state map, future state map, and action plan for implementation use a cross-functional group consisting of managers who can authorize resources and doers who are part of the process being mapped. 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.*** Use 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 you can accomplish.

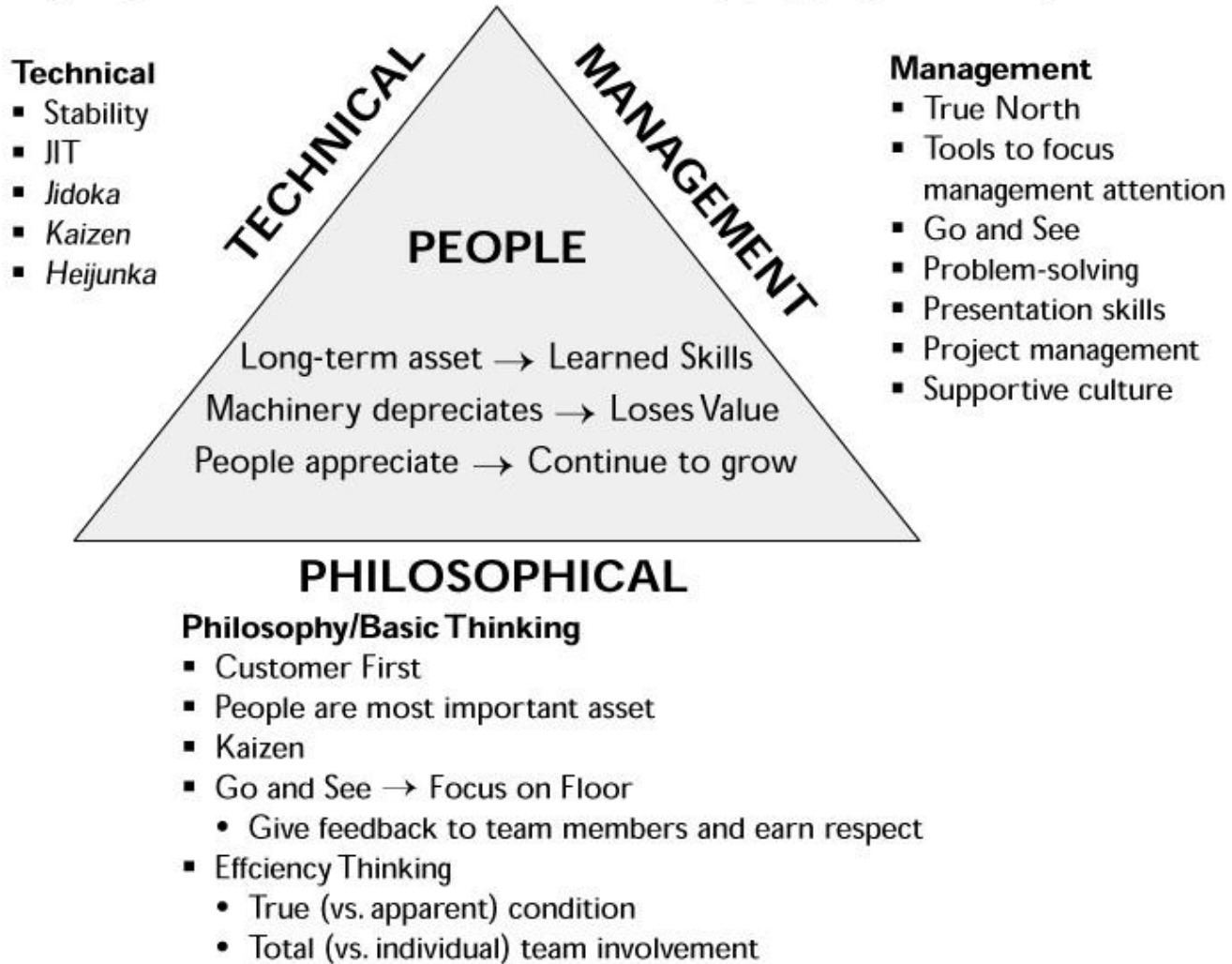
How do you become Lean?

6. **Organize around value streams.** In most organizations, management is organized by process or function. In other words, managers own steps in the process of creating value for customers and nobody is responsible for the value stream. In the second edition of *Lean Thinking* (2003), they recommend a matrix organization where there are still heads of departments but also value stream managers, similar to Toyota's chief engineer system. 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.** What is important is that lean leadership is focused on long-term learning.
9. **Be opportunistic in identifying opportunities for 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.

How do you become Lean?

- 10. *Realign metrics with a value stream perspective.*** Eliminate non-lean metrics that are wreaking havoc with those seriously invested in improving operational excellence. Next measure a variety of value stream metrics from lead time to inventory levels to first-pass quality.
- 11. *Build on your company's roots to develop your own way.*** Toyota has its way. You need to have your way. When Toyota works with companies to teach TPS, they insist that the companies develop their own system. Someone did something right to get you to this point. Build on that. Build on your company's heritage to identify what you stand for.
- 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. If the top is not driving the transformation, it will not happen.
- 13. *Use experts for teaching and getting quick results.*** The word "sensei" is used in Japan with some reverence to refer to a teacher who has mastered the subject. A company needs a *sensei* to provide technical assistance and change management advice when it is trying something for the first time to help facilitate the transformation, get quick results, and keep the momentum building. A good teacher will not do it all for you. You need to get lean knowledge into your company, either by hiring experts or by hiring outside experts as consultants. To develop a lean learning enterprise you need to build internal expertise—senior executives, improvement experts, and group leaders who believe in the philosophy and will spread lean throughout the organization over time.

Toyota Production System = Operations Management System to achieve goals of highest quality, lowest cost, shortest lead time via engaging people toward goals.



VII. Example of Genchi Genbutsu

Minoura: Mr. Ohno wanted us to draw a circle on the floor of a plant and then we were told, 'Stand in that and watch the process and think for yourself,' and then he didn't even give you any hint of what to watch for. This is the real essence of TPS.

Liker: How long did you stay in the circle?

Minoura: Eight hours!

Liker: Eight hours?!

Minoura: In the morning Mr. Ohno came to request that I stay in the circle until supper and after that Mr. Ohno came to check and ask me what I was seeing. And of course, I answered, (reflecting) I answered, "There were so many problems with the process...." But Mr. Ohno didn't hear. He was just looking.

Liker: And what happened at the end of the day?

Minoura: It was near dinner time. He came to see me. He didn't take any time to give any feedback. He just said gently, "Go home."

(Liker, 2004)

VII. Example of Genchi Genbutsu

Toyota Supplier (Japan); Story from David Baxter, VP of Toyota Technical Center

When Toyota launched a version of the Camry in 1997, they had a wire harness problem. Yazaki Corporation, a parts supplier to Toyota in Japan, supplied the problem wire harness... a quality engineer from Yazaki called Toyota to explain what corrective action they were taking...Yazaki sent an engineer to the Camry plant. But then the president of Yazaki actually went out to the Camry plant in Georgetown personally, to watch how workers assembled the wire harness onto the vehicle.

Toyota Supplier (US); Story from Jim Griffith, VP of Toyota Technical Center

The vice president of the business unit that serves Toyota came out to the Toyota Technical Center to discuss what he was doing to solve the problem. He was very reassuring, explaining, "I am deeply sorry about this. Do not worry. This will get my personal attention. We are going to solve this problem. There are no excuses." When Griffith asked him what the problem was and what his plans were, he responded, "Oh, I do not know yet and I do not get into that kind of detail. But do not worry. We are going to get to the bottom of this and solve the problem. I promise." Griffith looked exasperated as he told the story:

And I was supposed to feel better about that? It would be unacceptable in Toyota to come to a meeting like that so poorly prepared. How could he give us his assurance if he did not even go and see for himself what the problem was? ... So we asked him to please go back and do this and then return when he truly understood the problem and countermeasure.

(Liker, 2004)

X. Processes to Facilitate Inter-Firm Knowledge Sharing

Process	Nature of the Transfer Process	Type of Knowledge	Toyota Functions Involved
1. Supplier-Association	Multi-lateral	Explicit Knowledge (some tacit knowledge)	Purchasing
2. On-site Consulting (OMCD)	Bilateral	Tacit Knowledge	OMCD
3. Supplier Learning Teams (Jishuken)	Multi-lateral	Tacit Knowledge	OMCD LAD
4. Problem Solving Teams	Bilateral	Tacit Knowledge	QAD OMCD MOD LAD
5. Employee Transfers	Bilateral	Tacit Knowledge	Purchasing Personnel
6. Performance feedback; Process Monitoring	Bilateral	Explicit Knowledge	Purchasing

Note: OMCD=Operations Management Consulting Division; MOD=Manufacturing Operations Division; QAD=Quality Assurance Division; LAD=Logistics Administration Division. "Tacit knowledge" as referred to here refers primarily to (1) conscious tacit knowledge, and (2) collective tacit knowledge (see Spender, 1996).

X. Describe how Toyota does learn by doing

Research to date suggests that Japanese automotive networks, and Toyota's in particular, have been superior at transferring productivity-enhancing knowledge throughout the network (Nishiguchi, 1994; Lieberman, 1994).

Divisions at Toyota (US) which had significant interactions with suppliers included: (1) Purchasing Division, (2) Operations Management Consulting Division (OMCD), (3) Quality Assurance Division (QAD), (4) Logistics Administration Division (LAD), (5) Manufacturing Operations Division (MOD), and (6) Design Engineering Division (DED).

(Dyer, J.H. & Nobeoka, K., 1998)