
Mark Warren
Experienced Manufacturing Professional "Discovering Solutions with People"

Ohno's Secrets

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About a decade ago, after a long conversation about Toyota and the TWI programs with John Shook, he challenged me to understand what Taiichi Ohno did differently than the tens of thousands of other companies that used the TWI programs. Following this challenge, I began to concentrate on understanding the first principles that Ohno had pursued. This was done through an iterative process of asking why (5-Whys), experimenting to validate ideas or information, then returning to ask the next layer of questions.

While I have been practicing '*lean*' in industry about 40 years, my training started much earlier. My father was an architect and built custom houses. At the age of 3, I was allowed to accompany him to watch how the houses were built. Over time you begin to grasp that there is a sequence of operations.. or flow in getting the work done. My mother was trained as a physicist, worked in nuclear medical research before I was born. Then pursued historical research and writing for the last 60 odd years. I was exposed to scientific debate as a child and well as research to establish facts from the source, so the research process seemed only natural for me.

My Journey ...

The first stage of my journey to learn about why the Japanese seemed to have an advantage over the American manufacturers started in the late 1970's. The experts told us that *"If Only"* we would follow the Japanese management practice instead of our *'Theory X'* behaviors, we would be competitive. So, many of the leaders in the companies listened and tried what the experts had suggested. We may have solved a few labor-management issues, but this did not really improve our performance.

Then the experts told us that *"If Only" we* improved our quality we could compete with Japan. The companies dutifully complied by starting training programs on applying SPC (Statistical Process Control) to our processes... eventually to converting some of the British Standards (BS) into ISO, and the rush was on to become ISO certified. To be honest, most companies improved their quality and reliability of the products to the consumer, but this was not the '*magic bullet*' needed to compete with Japan.

Then the experts told us that *"If Only"* we used similar production systems as Japan, then we could be

competitive with Japan. And the rush was on to try to understand what was so special about the Japanese production systems… not just Toyota.

Our *"If Only"* thinking led us to assuming that *"If Only"* we used the same tools and *'looked like'* Toyota we could have the same results. The next decade or two saw a tidal wave of Toyota and '*Lean*' centric books that concentrated on teaching people the tools that Toyota used and what the production lines looked like so we could copy them. With the *'Lean'* term being coined in 1988 and linked to Toyota.

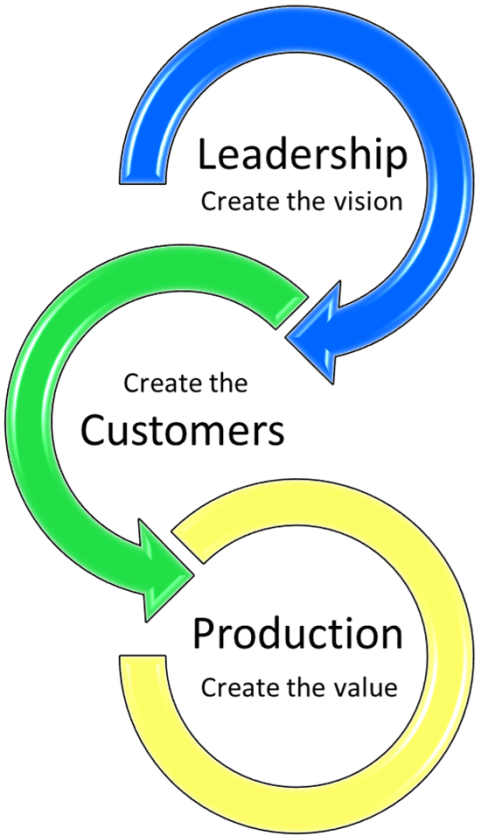
My Journey Continues...

In my quest to uncover what was so special about the Japanese manufacturing organizations, I read every book and article I could find related to Toyota and how they transitioned from a company near bankruptcy in 1950 to a world class manufacturer. Somewhere in this search, references to TWI began to emerge. David Meier was the first to tell me where copies of the originals could be found (Depository Libraries - one in each US state). The credit for rediscovery of the biggest trove goes to Bryan Lund (NARA2 - about 100 boxes of materials).

> *My journey over the last decade has been one of unlearning, as much as it has been one of learning.*

At first, I found it harder to unlearn *what I thought I knew* about lean than to learn the new information. Takahiro Fujimoto's book *"The Evolution of a Manufacturing System at Toyota"* was published in 1999. It is groundbreaking for the mere suggestion that the Toyota Production System was not part of a grand design, but developed mostly by trial and error.

Both Eiji Toyoda (Chairman of Toyota) and Shotaro Kamiya (Chairman of Toyota Motor Sales) published books about their careers at Toyota. These drove the insights that there were major *external* factors at work to drive the development of an effective production system. While Taiichi Ohno often references learning and copying Ford as one of the external factors guiding his development of TPS, I had overlooked the critical leadership shift from ***following*** the current leader, to one of ***becoming*** a leader. The sales group was critical in creating the strong customer demand, without this dramatic growth in demand, the production system would not have been under pressure to improve.



Eiji Toyoda

Spent months at Ford's River Rouge Plant and discovered that they had no new technology that was not available to Toyota, Ford was just bigger.

Vision to catch the US in productivity in three years – they would become a ***leader***, not a ***follower***.

Shotaro Kamiya

Customer focus – sent salesmen to customers to better understand what they wanted and at what price.

Built driving schools – because drivers will want cars.

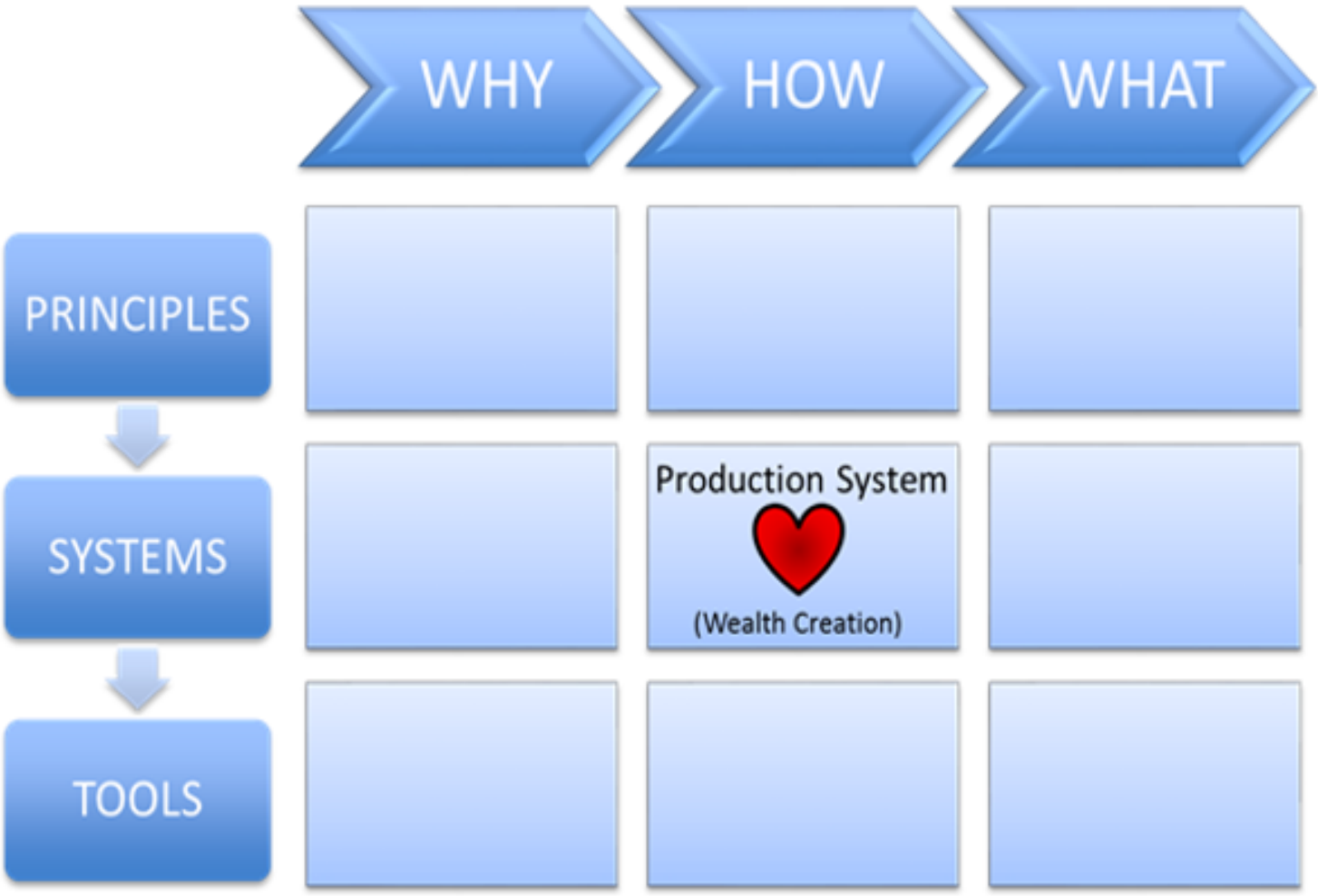
Taiichi Ohno

The focus was to create flow – studied Ford.

Adopted the TWI skills to facilitate creating flow.

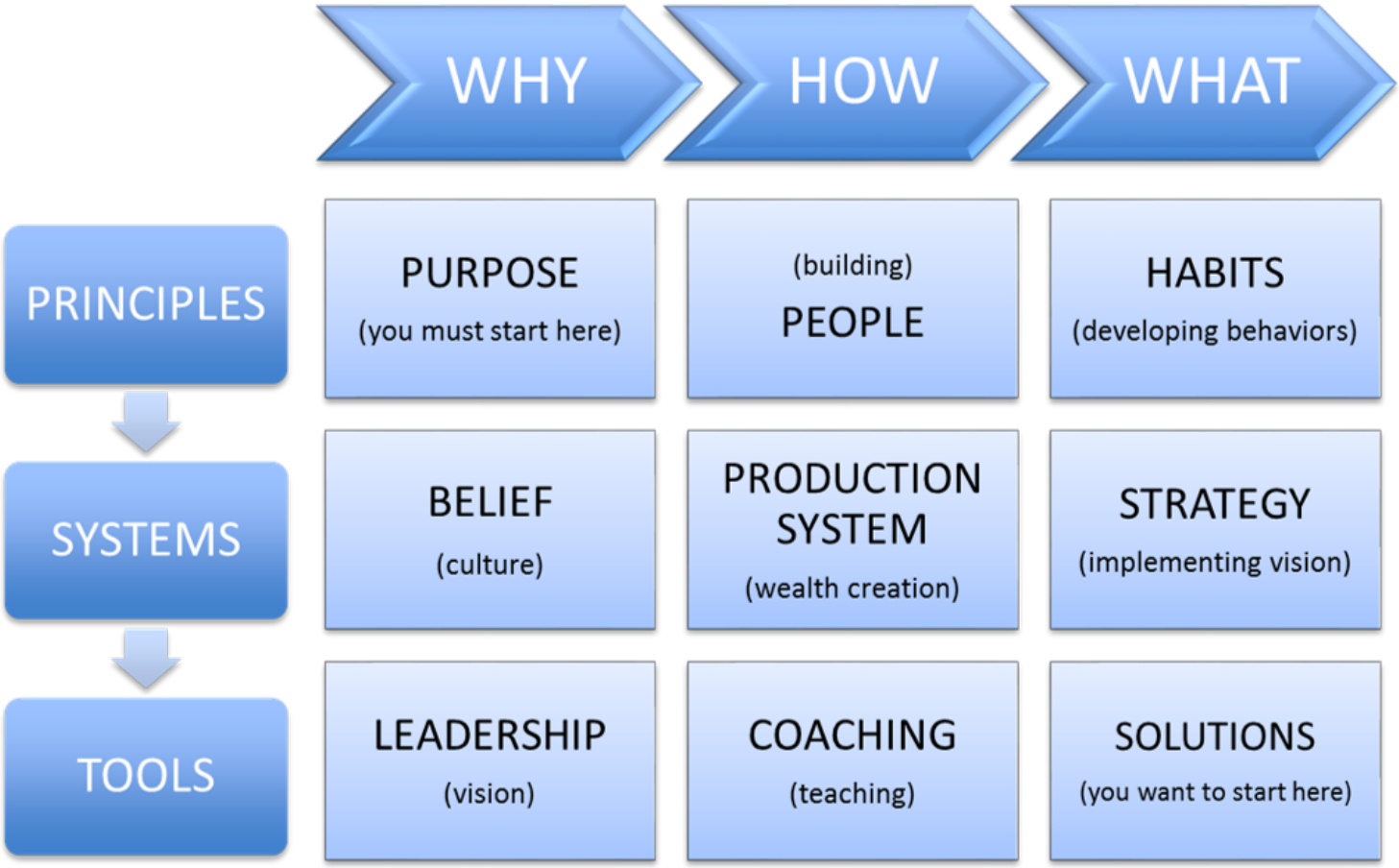
Developed Toyota's own Production System

Once we recognized that the Production System was the *heart* of **how** we delivered our product, service, or both, to the customer and that there were external factors... we had more to learn.



A Matrix begins to emerge ...

Eventually the *Matrix* grew to define the adjacent factors that affect the performance of the Production System. With this new understanding, the pieces of how Toyota's Production System built their culture, grew people (respect for people), developed behaviors, etc... began to come together. We also began to understand why just using the *'lean tools'* (*solutions*) did not work well.



What was Ohno's Primary Objective?

At the same time, we began to question the assumption that one of the primary objectives of lean was to remove '*waste*'. Where did this focus on waste come from and ***why***?

Ohno wrote about being exposed to a different sort of production system a competitor used in the 1930's and how he experimented with it for years in the textile division before his transfer to Toyota. We only had hints about what he had observed, and later understood that it was a factory that had been reorganized for flow (possibly the textile factory by Uneo in 1917, the first one in Japan reorganized for flow).

This only raised more questions, where did it come from? Ueno (or Uyeno) traces his connections back to Taylor, Gilbreth, Carpenter, and other thinkers in the US. Ford's use of flow was named the *progressive system*. By the 1920's, the basic principles of flow were fairly well documented and there are examples around the world. While the idea of creating flow sounds simple, the task of identifying the disruptions is difficult to teach.

Basic Principles of Flow

1. Put Processes in Sequence

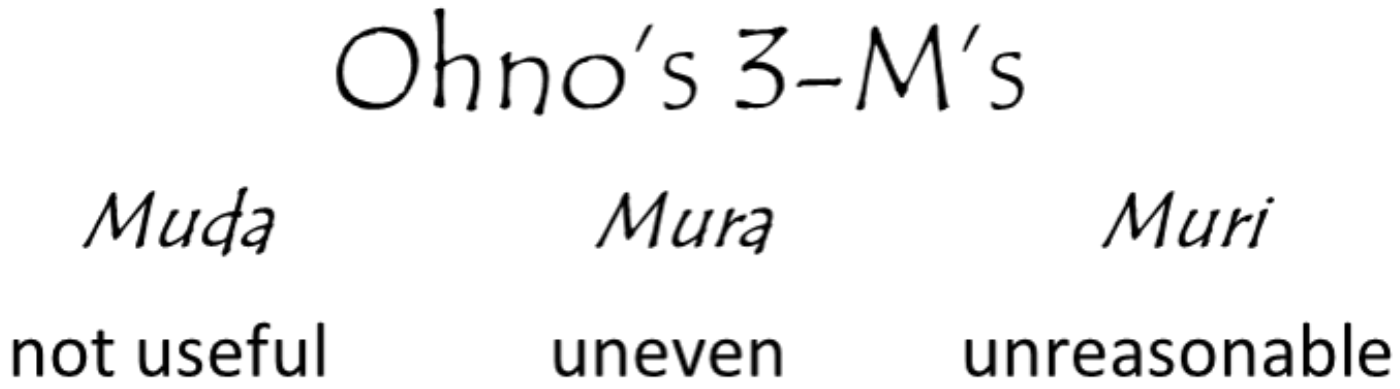
2. Synchronize Processes

3. Balance Work Content

4. Balance Work Pace

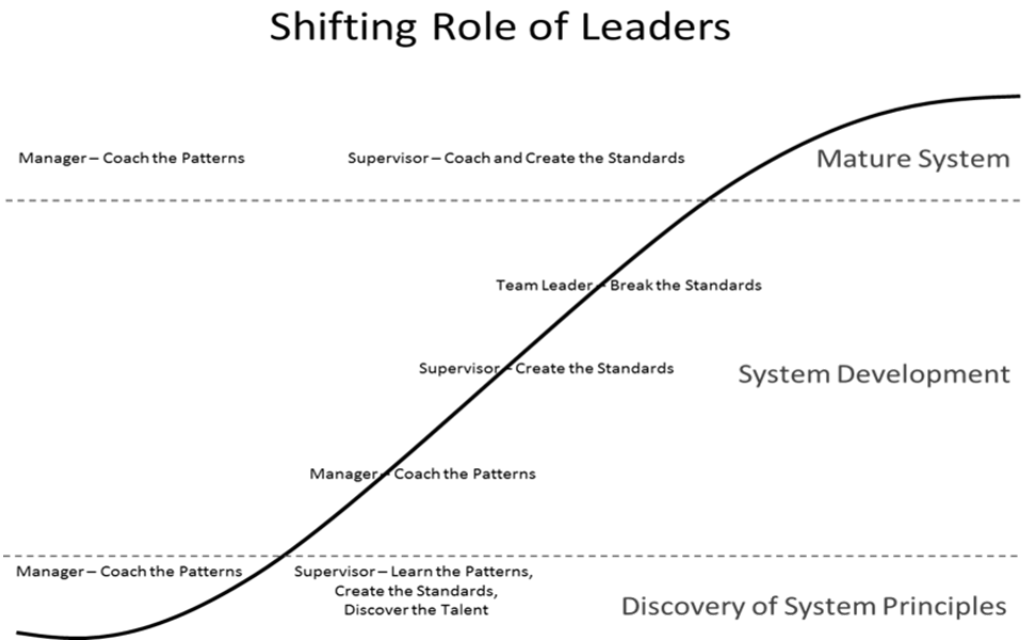
Ohno found a way to simplify identification, by focusing on the *symptoms* of disruption to flow - his three M's - *Muda, Mura, Muri*. Of which, *Muda*, or *waste* is best known.

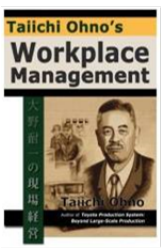
> *A disruption to **Flow** is a **Problem**.*

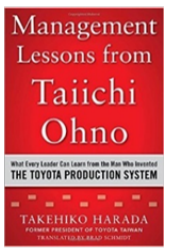


> *" **Flow** where you can, **Pull** where you can't" Taiichi Ohno*

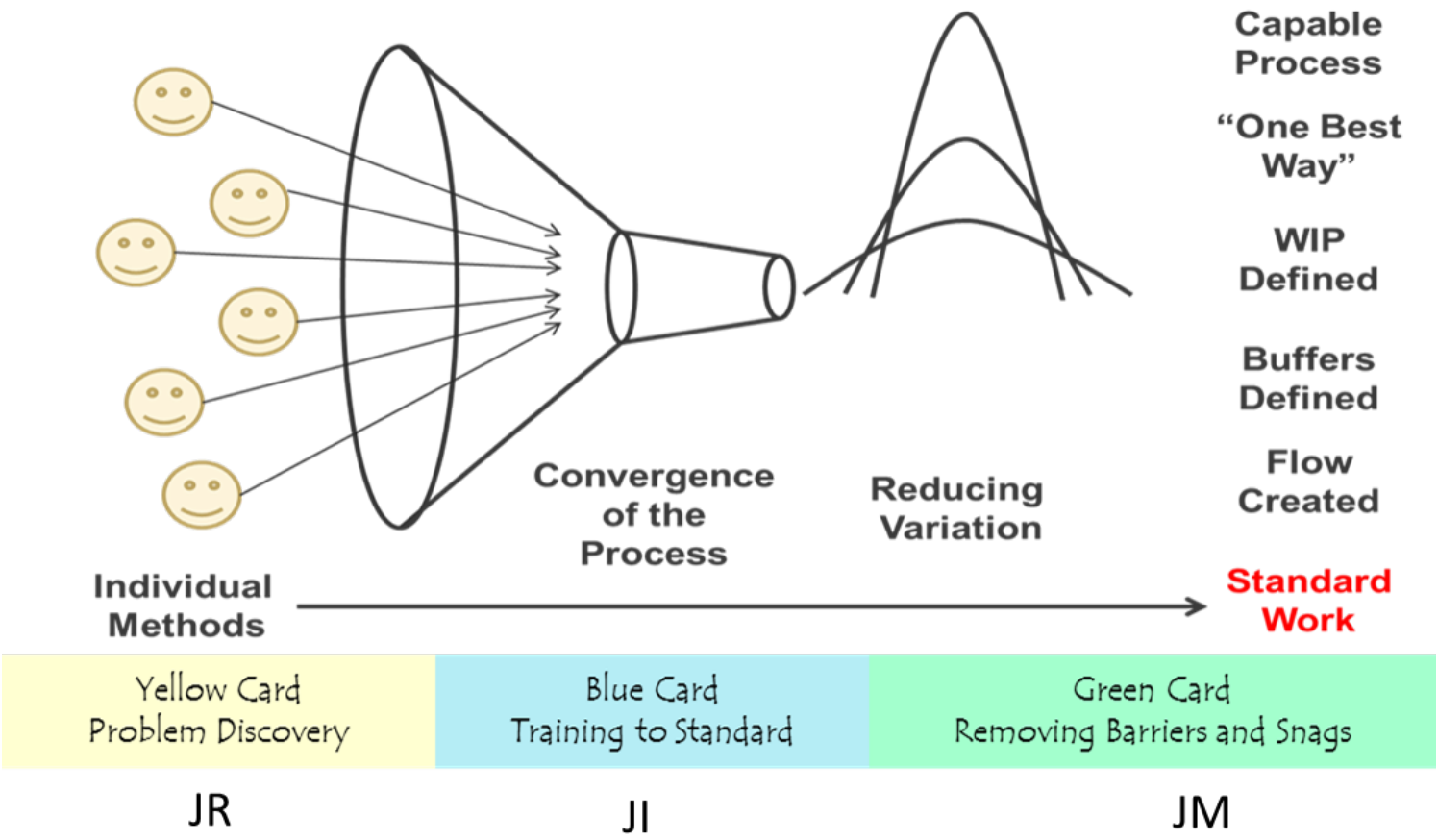
Now that we know the basic principles of flow and know how to identify the problems, how do we begin to solve them? Our first step after we understand the objective of flow is to build the structure to create stability. Understanding that the role of the leader changes as the system matures will help you to see that just copying Toyota would not create the transformation we wanted.



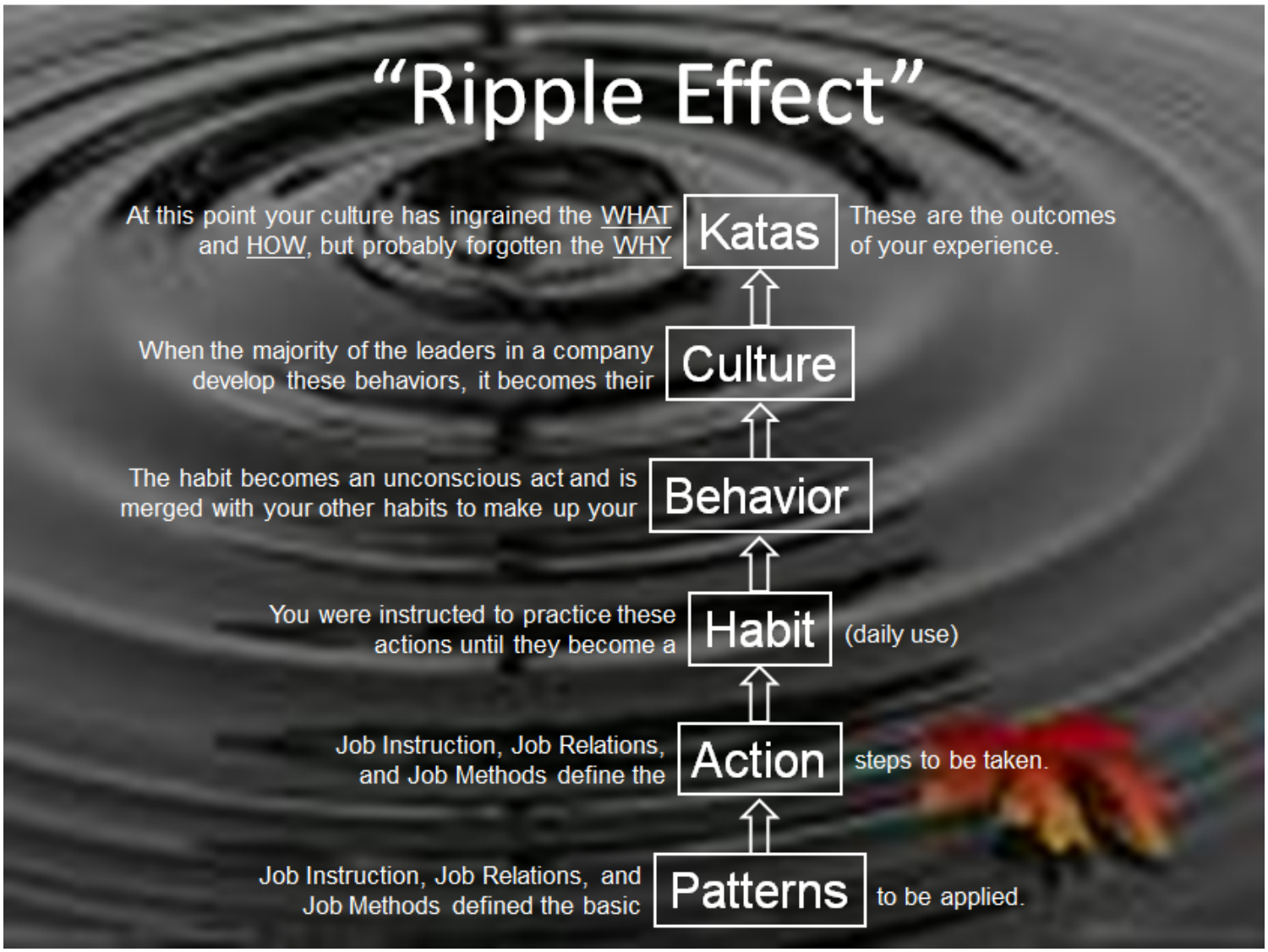




Starting in 1951 Taiichi Ohno started a concerted effort to improve the production system. This is where the TWI programs were added: Job Instruction (JI), Job Relations (JR), and Job Methods (JM). This brought me back to John Shook's original challenge... *what was different*? Instead of using the TWI programs as single '*stand-alone*' skills, they were merged into a problem solving process. One that helped create the *'lean tools'* as *countermeasures* to disruptions to flow.



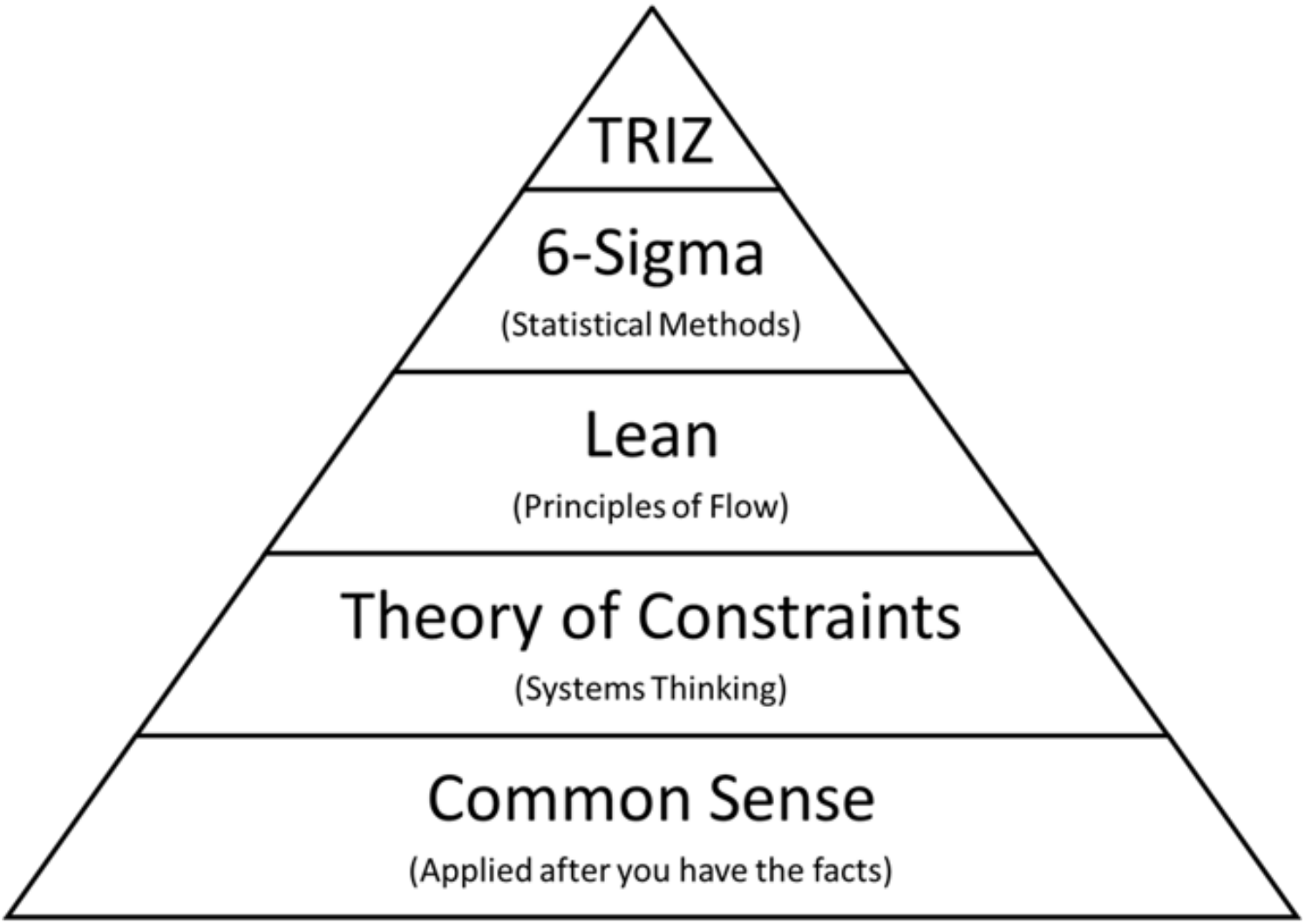
The *deliberate practice* of the TWI skills... where the pattern of *HOW* you solved the problem was more important than the solution. This focus on getting everyone to use the same approach had some positive unintended consequences, a '*ripple effect*'... it built the culture we are trying to emulate today.



How do you apply this different understanding of '*lean*'?

Once you understand *Flow* is the primary objective, you start with simplifying the problem solving process on the floor. Starting with the simplest format possible... after getting the facts to make the first round of decisions.

Problem Solving Methods



Sequence of use: start at the bottom and work your way up.

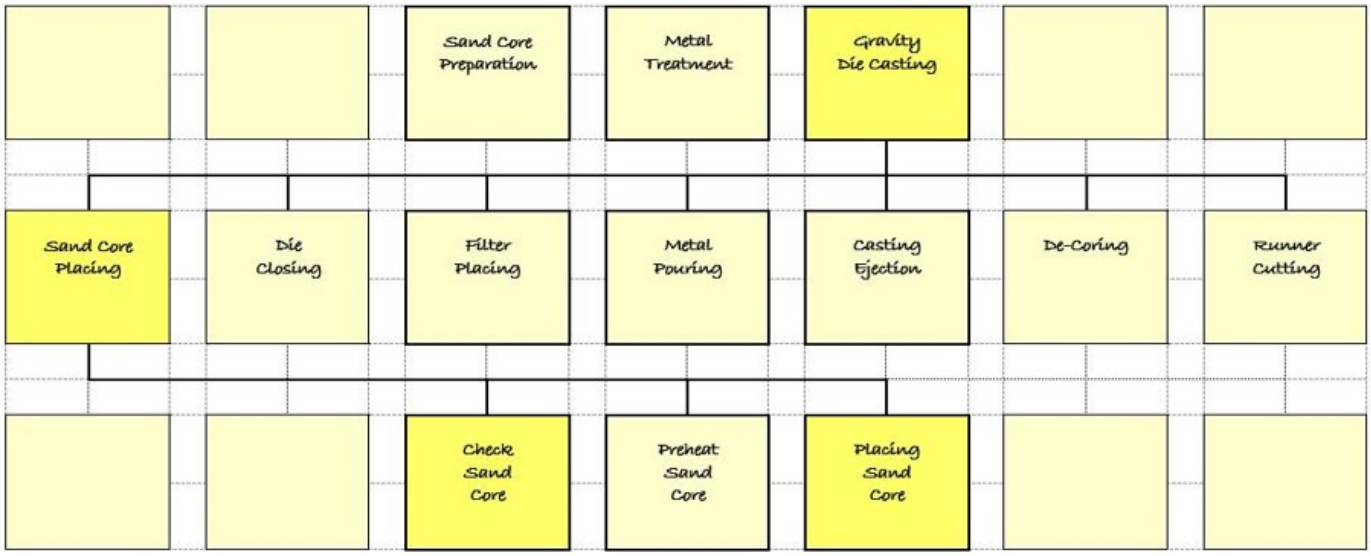
Strive for a solution as simple as possible, but no simpler. ~ Einstein

We pick out one problem that will make the most difference when it is solved.

Heat Map

Process Name: Gravity Die Casting – casting defects

Date: _____



The Heat Map is to help you focus on finding the source of the problem. You start at a high level with about five functions +- 2 (if you are listing more than 7, you are probably starting with too much detail). Select the function that is the most problematic and define its functions. Three layers are on this sample form, but this can be done with sticky notes or on a white board to as many levels as needed.

In this example they were having about 30% casting defects. At the top level, there were three major functions. The Gravity Die Casting function was chosen as the most likely source of the problems. The Gravity Die Casting had seven functions and the Sand Core Placing was chosen as the most probable source of the casting defects. The Sand Core Placing had three functions and the local experts selected two of them as probable contributors to the problem. A Job Breakdown was completed for training operators on the two functions selected.

We follow a standard road map for the problem solving process.

PROBLEM SOLVING PROCESS

SELECT OBJECTIVE TO ACCOMPLISH

PLAN

Identify the problems associated with the objectives
Use problem discovery steps.
Discuss the problem with all concerned
Decide Approach to each problem
Use Guidelines:
Barriers: Yellow card.
Skill Deficit: Blue card.
Process Snag: Green card.
Set follow on assignments.
Fix completion and review dates. Be firm on deadlines.

DO

Deal with one problem at a time
Start immediate action
Coach; offer suggestions if needed
Provide resources, assistance and permission where and when needed

Problem Discovery – Select a Problem

1. GO TO THE WORKPLACE REGULARLY
Avoid Surprises
Do not work from memory.

2. OBSERVE
Be patient, use all of your senses to observe, not just your eyes. (More than one sample.)
Check for
Scrap, breakages, damages, stock write offs, stock holdings, rejects, rework, production targets, holdups, bottlenecks, morale, lack of communication, customer complaints, product returns.

3. QUESTION
Talk to people concerned, get opinions, develop understanding, never blame.
Discover possible impacts – Safety, Quality, Quantity, Cost

4. RECORD THE FACTS
Validation process using F.O.G.
Experiment to validate guesses.
Capture all details revealed.
Is the fact relevant to the problem?

5. CLASSIFY AND STATE PROBLEMS
People – skills, attitude
Method – process, machine, materials, layout flow, suppliers.
List out all the problems you see with evidence.
Arrange in easily understandable way.
Avoid too much of information.

NO PROBLEM, IS A PROBLEM

SELECT APPROACH

Barriers, Relations issues, Ad Hoc issues, uncertain cause

DETERMINE OBJECTIVES

GET AND ANALYZE THE FACTS
See for yourself, first-hand information.
Review the records.
Select manageable problem bit.
Collect general and specific information; isolate and examine critical facts.
What policies, rules, and regulations apply?
Fit the facts together and consider their bearing on each other. Identify all possible root causes
Talk with all individuals concerned and get opinions, feelings and advice.

Be sure you have the whole story

WEIGH POSSIBLE ACTIONS and DECIDE
What possible actions can be taken?

Skill deficit, Nonstandard work methods

GET READY TO INSTRUCT

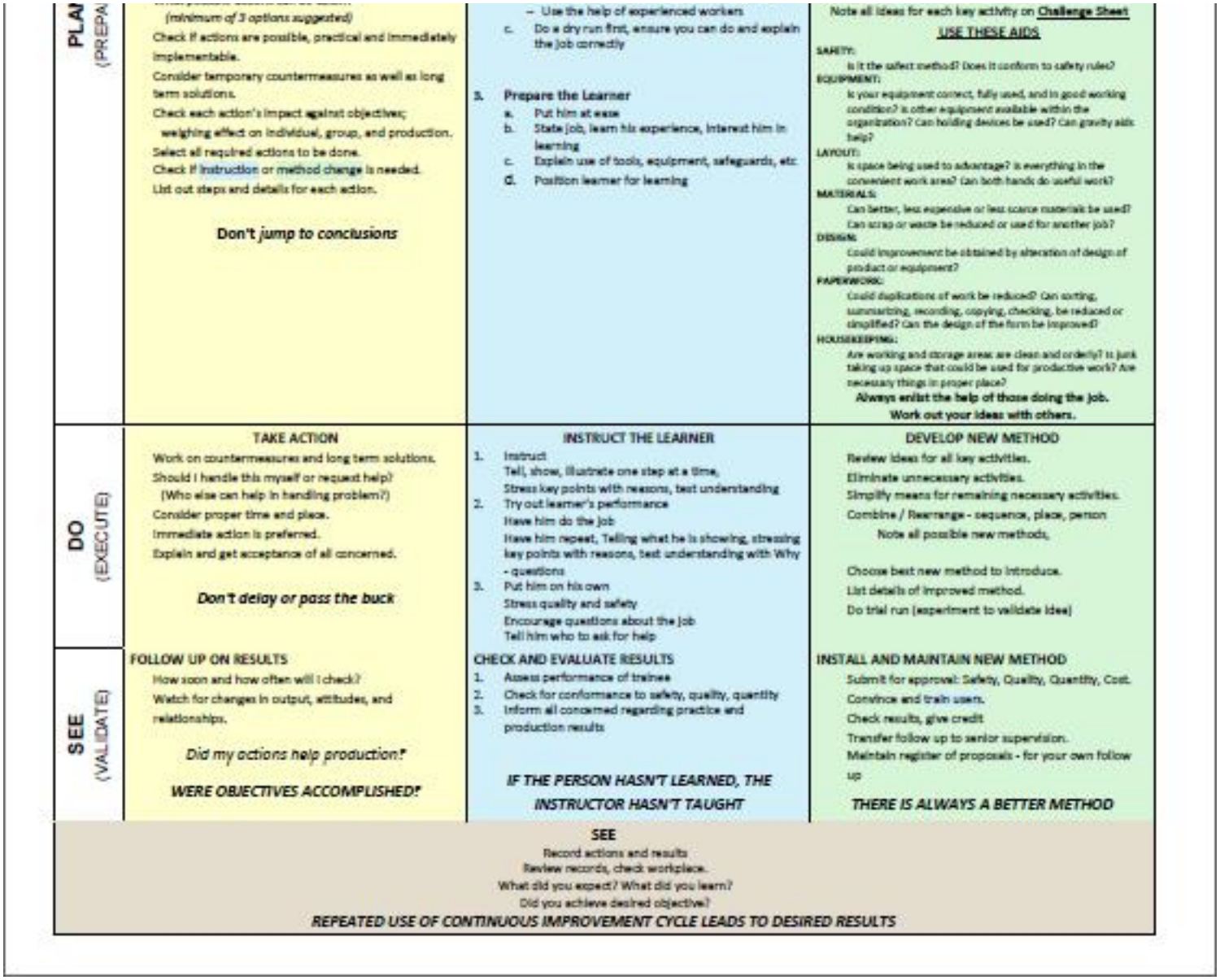
1. **Prepare the Workplace**
   a. Get specific tools, materials, equipment
   b. Arrange for best efficiency

2. **Prepare yourself**
   a. Plan the Instruction
      – Check out New Appointment, Transfer, Temporary absences, Resignations, Promotions, Accidents, Mistakes, Damage, Damage to equipment, Excessive time taken, Low output, Attitudes
      – Who is to be trained, in what skill, by what date
   b. Breakdown the job for instruction
      – Breakdown into coaching units
      – List important steps
      – List the key points and reasons for each step

Process snags, unstable process

ANALYZE AND RECORD
Select appropriate unit, Watch the job being done, list all details
Material Handling, Machine and Hand Work, Delay, Inspection, Transport, and Storage
Note snags and difficulties.
Delays, Awkward Movement, Distance to Walk, Dangers, Unpleasant Task, Quality, Waste, etc.
Select Key Activities to Improve

UNDERSTAND & CHALLENGE EACH KEY ACTIVITY
Why is it done? Is it necessary?
When – Where – Who – How is it done?
Why that way? Is there a better way?
Note all ideas. Use aids below
Question snags and difficulties with a view to their elimination.
Get full appreciation of present method.



Learning by Doing

We have found that the learning process is most effective on the shop floor. In the classroom you can learn some theory or even practice with simulations, however knowledge acquired away from a real problems is difficult to use.

So, what is the effect of this different understanding of '*lean*'?

A few examples where, during training, an environment of problem solving and experimentation was supported. All examples below were completed in the first or second week of a *Learning by Doing* workshop. (All facilities had some lean experience - 1 year to 10+.)

Example #1 - Motorcycle Plant

Tail light assembly breaking

- New model (18 months old)
  - Scrapping about $5,000 per month after rework
  - Had been a QC project for about 6 months
    - Lots of process data, no actions
  - Light assembly not capable to tolerances
    - Supplier working to drawing that did not include assembled tolerances
  - Mounting bracket process not capable
    - Faulted supplier of subassembly that was welded to frame
      - » Issue with fixture holding subassembly at frame welding
  - Third issue discovered in side panel assembly
    - Locating tab irregular
      - » Fixture in robotic welding operation not holding tab tight in place during welding
  - Maintenance repaired problem fixtures
  - Engineering and Supplier met the next day at the assembly line to see the problems
    - Temporary sorting was developed
    - Assembly process modified
  - Rework reduced from average of 130 per day to 4 with temporary measures

Example #2 - Chain Manufacturing Operation

- Oil on floor near stamping press
  - Experiment to wipe oil from strip leaving stamping press
    - 30 minutes cleaning time per shift reduced to 5 minutes
    - Deployed at all presses
- Machine changeover – deep draw stamping
  - Experiment with shims to eliminate adjustments
    - 8 hour changeover to less than 5 minutes
- Mixing of components – found in assembly
  - Experiment to reduce mixing at critical step
    - 50% improvement. Taking steps to further reduce
- Low machine OEE on bottleneck process
  - Found major contributor was absenteeism and supervisor unaware of critical role in plant output
    - Developed plan to staff bottleneck operation even with absences (operators now aware of critical need to keep this process running)

Example #3 - Large Iron Casting Operation (5-ton part)

- Casting porosity – can be detected only after final machining
  - Engineering claimed solution could only be determined if they could a special modeling software to identify cause.
    - Go see, observe, get facts…
      - Critical placing of "chillers" in the mold was highly irregular
        - » JBS developed
        - » Operators trained
          - Porosity failures reduced about 80%

Example #4 - Automotive Component Supplier

- Oil pump assembly
  - Parts machined, assembled and tested
  - Demand 500 per day
    - Current production is 280-350 per day (working 3 shifts – they work weekends and still can't keep up)
    - Manufacturing Engineering solution - $300,000 machining center ordered
      - Fact finding:
        - » Current machine sometimes idle
          - Supplier problems and internal receiving
          - Improved supplier communication – supplier to inspect critical areas where defects were found after machining
          - Internal inspection process modified to remove delays
          - Fixture defects repaired to eliminate scrap caused by fixture
          - Transfer process to assembly in smaller batches
          - Modified testing sequence to increase capacity
        - » Results: 500 per day achieved on two shifts, no weekend overtime

Example #5 - Compact Florescent Light Bulb Manufacturer.

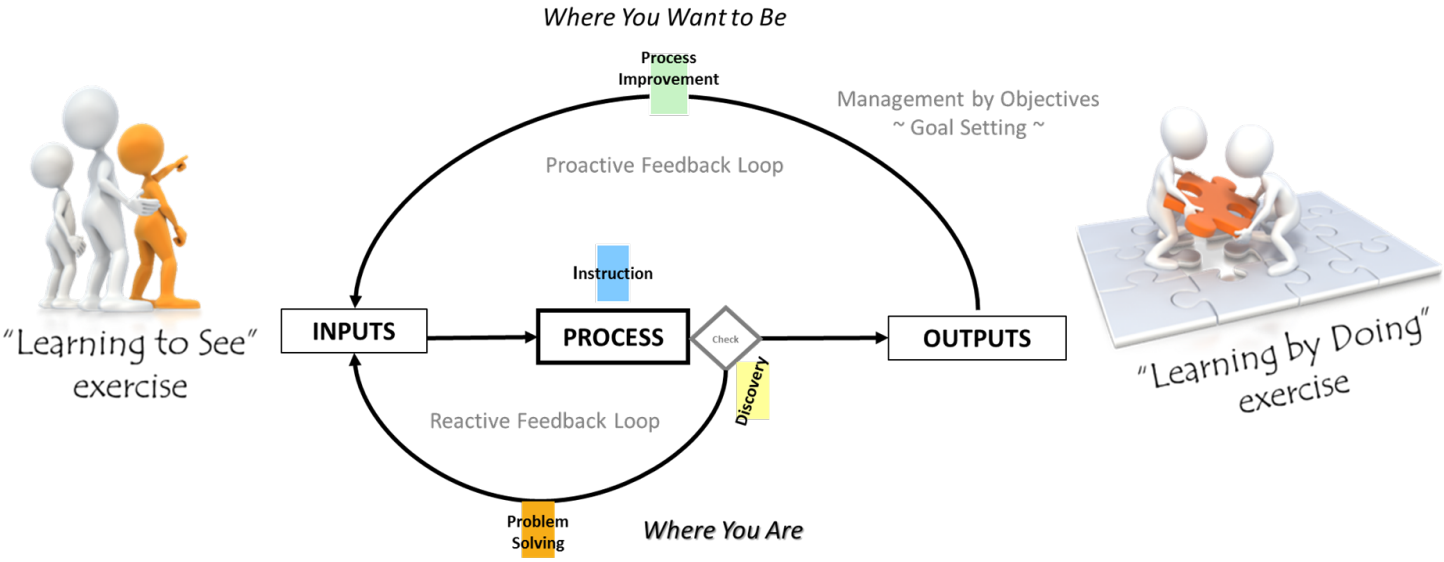
For this example, we were also training a group of trainers. The pilot project selected was for the bulb that is made up of 3 U shaped glass tubes that are heated, bent, coated, then joined before final assembly. There are about a dozen machines the tubes must pass through before becoming a light bulb. Each team was assigned a section of the line to investigate.

At the end of day two, the teams summarized their findings of the problems each segment had and identified which problem solved would have the biggest impact. Overall, cracking and breaking of the glass tube was the largest contributor to losses. At first, they said they were not that concerned because they always recycled the glass (*they ran the glass tube making facility as well*). However, when they began to look at the defect as a disruption to flow, which translated into lost production, their opinions changed.

Day three was spent observing all the locations that cracked or broke the tubes. Ideas were proposed, experiments to test the ideas were developed and a to-do list was handed off to the second shift. On day four,

they confirmed that most of their experiments had worked and the breakage had dropped 70%... the equivalent of an extra hour of production each day!

Adaptive Production System



The Consultant's Trap

"If you ask for the price that you are worth, then they can't afford it. If you sell yourself below value, then they won't value you." – Dr. Christoph Roser

The traditional consulting model is one of billing thousands $$$ per day while the client is watching the billing clock and worrying about ROI results. It is nearly impossible to get results like those posted above if you are watching the clock or have a budget constraint.

> *The traditional consulting model is broken... the barriers are time and money... in terms of reaching people.*

Countermeasure for $$$ Barrier

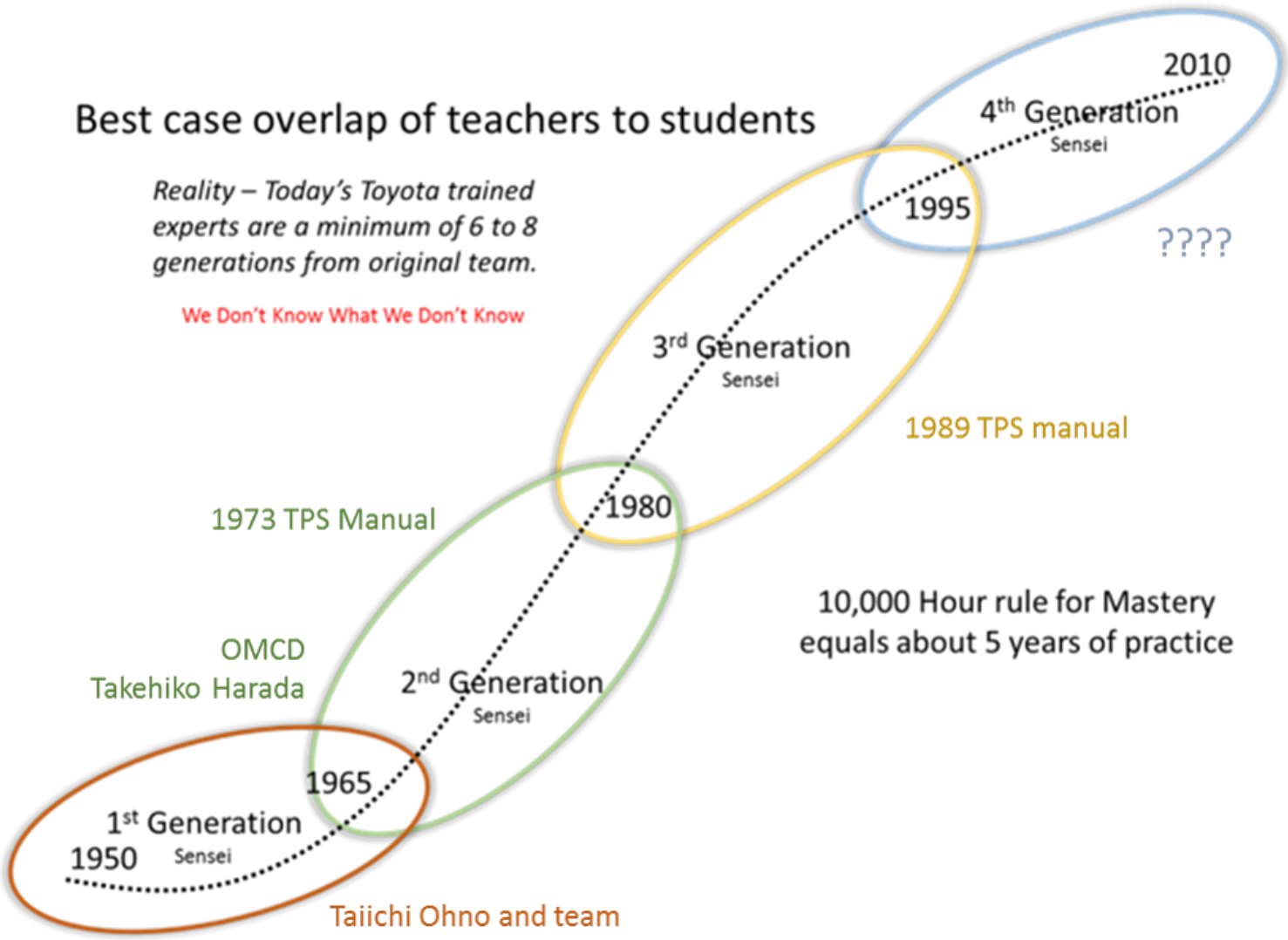
I want to change the model by *removing the money barrier* for a select group of companies.

After 40+ years working in industry around the world, I'm retiring from the traditional consulting format to focus on helping people first... where the focus will be on developing skills they learn by doing and create results.

Interested enough to apply? Contact Mark Warren (mark.tesla2@gmail.com)

> *When the student is ready, the teacher will appear. ~ Lao Tzu*

Ohno's Secrets - Part 2



Written by

Mark Warren
Experienced Manufacturing Professional "Discovering Solutions with People"

9 comments

Sign in to leave your comment

Timofei Rutkevich
Adventurer, Blogger, Hidden Influencer, Radical Life…
··· 4mo

The central in Toyota system: creating the customer. Your quality will increase if every manufacturing worker has the face of the customer in front of him. Quality is the relationship. Without relationship no statistical control will help

Even these days Toyota does many different things right: they have strong following and have cars for budget customers all the way to luxury.

Like Reply

Todd McCann
Executive Lean Transformation Leader I Innovator I…
··· 4mo

Interesting article and full of awesome experience. Thanks for sharing
I learned an interesting point from one of my Sensei's and I believe it was Ohno who said it.
Common sense is always wrong. Took me a bit of time to wrap my head around that statement.
My Sensei had the honor of working with Ohno he added
If it was common sense than everyone would be practicing it. The comment Just made you think deeper.

Thanks again for sharing

Like Reply

Andrew Thomson
Managing Director at Workforce Development Wales
··· 4mo

A really interesting article, thank you for sharing your journey with us.

Like Reply | 1 Like

Henry Parente
Director of Operational Excellence- Perioperative…
··· 4mo

Great article Mark. I really like your hands on approach to the workshops and your continued striving to understand and explain what truly transformed Toyota.

Like Reply | 1 Like

Bryan Lund
Production & Quality Management at Edlund Company LLC
··· 5mo

Hi Mark, great summary of what we have learned over the past decade(s) through the lens of TWI. Business leaders, especially those of small-to-medium sized organizations can benefit from this strategic and pragmatic approach because they already know that being adaptive and flexible is what brought them success. Dogmatic, or rigid, ritual in the Lean church just doesn't sit well with many which may in fact correlate to the staggering implementation failures chronicled by many companies. This approach you describe leads to a shift in thinking, which is the very basis for changing habits in an organization and thereby actually changing performance - not just on paper. Unfortunately, way too many "mainstream" Lean approaches are still copies of things seen through the lens of a journalist or consultant and not actually based in shop floor reality.

Like Reply | 4 Likes

Stefano Relli
Lean Six Sigma Master Black Belt at Essilor of America
··· 5mo

I've struggled with our manufacturing sites coping cell or line designs without the analysis and study needed. I often work with them on "copy - paste special". Use proven ideas, but do the necessary leg work to understand current conditions and future state. It's about learning as you implement, even if the process improvement idea came from somewhere else in the organization.

Like Reply | 1 Like

Mark Graban
Speaker, Consultant, Blogger, Author of "Lean…
··· 5mo

Great questions here about why some organizations are successful with a methodology like Training Within Industry. Same question can apply to why some organizations are successful in adopting or adapting methods like the

Toyota Production System, Lean, Six Sigma or what have you. It makes me think back to W. Edwards Deming who talked about companies trying to copy... but not knowing what to copy.

Like **Reply** | **7 Likes** · **1 Reply**

Victor Johnson MNZM, Dip TD
Owner, Managing Director of Live Streaming New…
4mo

Mark, your comment stands out; 'Great questions here about why some organizations are successful with a methodology like Training Within Industry.'

The original Training Within Industry [TWI] methodology is soundly structured on processes that all certified TWI Trainers must/should adhere to, being the group session delivery manuals for each programme of Job Instruction, Job Relations and Job Methods.

Another essential factor in the TWI methodology is the Trainers responsibility in coaching and followup on the job with each group member post-group sessions, with the ongoing responsibility for that being handed over to the each member's superior.

Like **Reply** | **1 Like**

Cordell Hensley
Principal Consultant at Project7 Consultancy
··· 5mo

"the Toyota Production System was not part of a grand design, but developed mostly by trial and error" - absolutely!

Like **Reply** | **4 Likes**