Applying a Lean Technology and Social Model of Problem Solving & Knowledge Retention
Structure of presentation

- **Parts of the presentation:**
  - Part 1: Profitable Growth Competitive Advantage (Slides 4 -13)
  - Part 3: Toyota and Technology (Slides 40 – 47)

- **47 slides made up of a mix of Blue Toyota and clear PHRED slides:**
  - Blue slides Toyota Motor Manufacturing’s 2000 presentation about their Practical problem solving/PHRED system
  - White slides PHRED explanations comments and structures
“How do you know you are good at problem solving…,
the absence of déjà vu”

-- Rebecca A. Morgan
www.INC.com
Operations Expert
Part 1: Profitable Growth
Competitive Advantage
If technology is the same what’s the differentiator?

Problem Solving

Knowledge Creation, Conservation, and Sharing

Social Model

Technology
Competitive Challenge

- Knowledge
  - Fading
  - Ineffectively leveraged

- Problem solving across geographically distributed supply chain (supplier, production, distribution)
  - Inadequate communication
  - Inconsistent communication

- Problem solving across culturally distributed chains
  - Thinking alone and culturally separately
  - Different problem solving processes
Competitive Advantage

- Knowledge
  - Conserved
  - Shared

- Geographically distributed supply chain
  - Collaborative communication

- Culturally distributed supply chain
  - Thinking together
  - Consistent problem solving processes
Challenges faced

- Massive growth
- Changing employment patterns
- Dynamic information sharing environment
- Need to preserve Toyota’s unique PPS system
Toyota Production System as a knowledge sharing system

- TPS is a Thinking Production System
- Knowledge creation, conservation & sharing is embedded in the very systems used to build cars
- TPS is a living and constantly evolving system based on:
  - Standardized work processes provide common frames of reference
  - Standardized question / reasoning processes provide basic units of knowledge transfer
  - Sensei provide coaching, expertise and guide reflection
Knowledge **CREATION, conservation & sharing** – The Learning Organization

- Knowledge creation as part of standard work
  - Constant learning by a focus on identifying and solving problems
  - PDCA cycle feedback link between problems and standard work – A foundation for continuous improvement

- Developing peoples abilities as a culture
  - Quantitative- technical, creating expertise
  - Qualitative - thinking & dialogue
Knowledge creation, **CONSERVATION** & sharing – Keeping the knowledge

- Processes and culture to ensure that Knowledge is institutional, not personal
- Business system to capture and keep problem solving knowledge
  - 8D problem reports & visual systems
  - Libraries
- Social Systems – builds experience within the organization
  - Coaching model Coordinators duplicating themselves
  - Increasingly broad views of issues build experience
  - Active open discussion and report outs means that problems can’t be hidden or not remembered
Knowledge creation, conservation & SHARING – If we only knew what we know

- Knowledge sharing is a culture not a personal preference
- Libraries of all kinds
  - Search of ‘Has this happened before?’ part of business process
  - Yokoten knowledge transfer model
  - 8D Thinking that can be followed by others
- Coordinator model of active knowledge transfer
  - Sharing results with similar processes
  - Open and active dialogue
  - Who to talk to – experience of where else it’s happened
**Standardized work processes**

- **Standardized work processes** to provide common frames of reference
  - Create, conserve and share knowledge
  - Foundation for continuous improvement

*Problem solving is no different;*

*It is a business work process*
Without Standardized Problem Solving Processes

- How root cause, temporary fix, and permanent countermeasures are found is **up to the skill of the individual problem solver**
- Just as without standardized production processes:
  - Everyone left to their own devices and disparate skill set
  - Results vary widely
  - Introduces unnecessary variation in the process

**Cumulative disjointed shoot-from-the-hip problem solving is not problem solving at all.**
Part 2: The Lean Problem Solving
Standard Business Process

Mechanical and Social Structure

The social model of problem solving is embedded in and is part of the mechanical process of the solving model.

In fact, it *is* the problem solving model.
The 5 Components of the Lean Problem Solving Business Process

1. Management focus, control and accountability
2. 8D reporting
3. Standardized problem solving thinking structures and tracking process for all problems
4. The coordinator model – duplicating themselves, coaching
5. Knowledge conservation / repositories of knowledge / libraries/ Yokoten
1st & 2nd Components of Toyota Problem Solving Business Process

• 1. Management focus and control
• 2. A3 reporting
• 3. Standardized problem solving process for all problems
• 4. The coordinator model – sharing and process
• 5. Knowledge conservation / repositories of knowledge / libraries/ Yokoten
1. Management Focus and Control

- Problems are air to Toyota – required for life
- **CULTURAL** focal point
- Rigorous control of problem and improvement activity
  - From senior management to the floor
    - Business unit
    - Location
    - Functional area
    - Work process
    - Work activity
    - Problem Owner
    - Individual process, part or machine name and/or number
    - Supply chain components
    - Customers
Management Control of Problems

- Micro ↔ global
- Toyota management track and understand
  - **Thinking**, and
  - **Data** for
  - **Every** problem

*Typical US company:*

**CAR system**

- track problems and solutions
2. A3 Reporting

- **Visual documents**
  - Must read as a visual story
  - A3’s posted on shop floor

- **Presented to:**
  - Management
  - Group and team leaders
  - Team members
  - Coordinators

- Problems are not hidden
3rd Component of Toyota Problem Solving Business Process

- 1. Management focus and control
- 2. A3 reporting
- 3. **Standardized problem solving process for all problems**
- 4. The coordinator model – sharing and process
- 5. Knowledge conservation / repositories of knowledge / libraries/ Yokoten
Common structure for all problems

• Controlled
  – Actively manage problem solving process
  – Stop any slide to US ad hoc thinking

• Compliant
  – Using Toyota Problem Solving Process is *not* optional

• Collaborative
  – Neutral reasoning system reinforces social process
  – Coordinator and coaching structure
Compliance

• Compliant means adherence
  – Accounting systems are not optional
  – Problem solving systems cannot be optional

• System always used
  – Different levels of detail

• Compliance visible
  – A3
  – Self reinforcing system
    » People get better at problem solving the more they use it
PPS Intranet system

- Guides users to address problems through a rigorous reasoning process that progresses over stages to a permanent countermeasure or the identification of an unsolved problem.
Practical Problem Solving

Problem Statement: GROMET not seated at final inspection

- Initial Problem Perception Id: 4
- Problem Breakdown Id: 5
- The Real Problem Id: 10
- Point of Cause Id: 11
- Observations at the Point of Cause Id: 12
- Temporary Measure Id: 14
- Possible Causes Identified Id: 17
- Direct Cause Id: 22
- How direct cause was confirmed/tested Id: 23
- Root Cause Id: 28
- CounterMeasure Id: 29

PLEASE CHOOSE ONE OF THE FOLLOWING:
Standardized Questioning and Reasoning

- The basic unit of knowledge is a question answered
- The basic unit of learning is a question
- Tools share a common methodology
  - Observe
  - Question
  - Reason / Act
  - Reflect

- Based on ‘Genshi Genbutsu’ / go and see
Taiichi Ohno’s model of question to elicit & share reasoning

- What should be happening? What is actually happening?
- What are your observations at the point of cause?
- Root cause analysis
PPS training Example

A welding robot stops in the middle of its operation

Why did the robot stop?
  Fuse in the robot has blown
Why is the fuse blown?
  Circuit overload
Why is the circuit overloaded?
  The bearings have damaged one another and locked up
Why have the bearings damaged one another?
  There was insufficient lubrication on the bearings
Why was there insufficient lubrication on the bearings?
  Oil pump on robot is not circulating sufficient oil
Why is the pump not circulating sufficient oil?
  Pump intake is clogged with metal shavings
Why is the intake clogged with metal shavings?

Root Cause ==> No filter on pump intake (as designed)
The genius of the Toyotas Neutral Fact Based Reasoning Environment

• Why is there conflict in problem solving?
  – The link between Ego and Knowledge
    ▪ Albert Ellis - lessons of REBT (Rational Emotive Behavioral Therapy)
• Reasoning around questions not people
  – Importance off Taiichi Ohno’s model of question to elicit & share reasoning
  – Create focus on an external question
    ▪ For example:
      – What is the standard?
      – What is the variation?

• This is the basis of the system and the lubricant that allows everything to work
4th Component of Toyota Problem Solving Business Process

- 1. Management focus and control
- 2. A3 reporting
- 3. Standardized problem solving process for all problems
- 4. The coordinator model – sharing and process
- 5. Knowledge conservation / repositories of knowledge / libraries / Yokoten
The Current Toyota Model of the Coordinator

- **The grasshopper and the sea** – It’s about teaching observation

- Coordinators act as key coaches of process and subject matter expertise. **Sensei**
  - Enforce problem solving thinking
  - Share knowledge
  - Conserve knowledge

- **New coordinator structure** – mass duplication
  - Multiplying themselves through other people
  - TMC in Japan provided Toyota North America (TNA) with coordinators. TNA needed to recreate this knowledge function. The NAM institute develops coordinators
NAM Institute – Team leader, Group leader, Assistant Manager & Manager Coach structure

- Utilize technical and process experts:
  - Higher, less frenzied level
  - Focus strategically rather than tactically

- Levels of coaching
  - Sharing knowledge between most and less experienced
  - Multiplying themselves

- Optimize expert time
  - A3 See reasoning and data
  - Interactions no longer general “This doesn’t work” to “This is my reasoning and data”

- Experts asks opinion rather than interrogate
  - Right questions for investigator
  - Focus on question and data, not people
To many problems not enough problem solvers in your company?

- Coordinators, Not Firefighters
- They exist in your organization
  - Experts
  - Managers
  - Unofficial network of respected people
- Explicit part of job
  - Managing, coaching and sharing of problem solving information
5th Component of Toyota Problem Solving Business Process

- 1. Management focus and control
- 2. A3 reporting
- 3. Standardized problem solving process for all problems
- 4. The coordinator model – sharing and process
- 5. Knowledge conservation / repositories of knowledge / libraries / Yokoten
Why is it difficult to assimilate and understand other peoples knowledge

- Problem solving across geographically distributed supply chain (supplier, production, distribution)
  - Inadequate communication
  - Inconsistent communication
- Problem solving across culturally distributed chains
  - Thinking alone and culturally separately
  - Different problem solving processes
- The problem with problem solving
  - We all do it all the time
  - Our skills are natural, part of us, instant
  - I do it my way
Problem Knowledge Transfer

Gap

Problem solving is not a rote activity; reasoning is integral to success

- Ad Hoc Problem Solving approach

- PPS Intranet-Based approach

- Reasoning becomes apparent which facilitates the transfer of knowledge
Transference of Knowledge

- Questions break the problem and solution down into smaller, well reasoned components which:
  - Makes the logic transparent
  - Establishes a shared mental model
  - Builds a common problem / solution framework

- There is a deep sharing of reasoning as third parties no longer have to make the “cognitive leap” from problem to solution

- As people understand & benefit from each others experience, active collaborative problem solving communities arise
Shell’s Social Lubricant

- The Catastrophic Failure Analysis group – same piece of steel, a machine different quality of operation
- Knowledge of how to operate the production process units exists across Shell within a series of different relatively isolated knowledge communities
  - Operators, performance specialists and shift coordinator reporting to a module manager
  - On site day support, such as operations specialists, engineering, inspections, etc.
  - Central technical support
- Difference between a community with repeated bad actor units and a safe, reliable, efficient unit is often dependent on the ability of its members to communicate, reason and learn together
The power of the high performing collaborative, cross functional/organizational groups

- Think of your organization in terms of groups across:
  - Your organization
  - Your suppliers
  - Your customers
- When people think together across groups these groups are high performing
- Global microchip chain example
How it all fits together — Build, manage and maintain your social and technical business system

Problem Solving

Knowledge Creation, Conservation, and Sharing

Social Model

Technology
Part 3  Toyota and Technology

• Use only reliable, thoroughly tested technology that serves your people and processes
  – Use technology to support people, not replace people

The Toyota Way
  Jeffrey K. Liker
Challenges faced

- Massive growth
- Changing employment patterns
- Dynamic information sharing environment
- Need to preserve Toyota’s unique PPS system
The Technology Advantage

- Reinforces business process of problem solving and knowledge conservation and sharing
- Offsets natural human tendency to problem solve their own way
- Change in fundamental human behavior
  - “Initiatives” don’t normally work
  - Requires change at the system level for which integrated computer systems as standard work are excellent (see accountancy, Kanban, etc system, )
Partnered with PHRED

- We needed someone who:
  - Had experience with designing question-based reasoning systems
  - Understood qualitative as well as quantitative knowledge issues
  - Could reflect the learning systems inherent in TPS / PPS
Toyota - PHRED Relationship

- PHRED Solutions Inc. was formed in 1991. We provide fact based reasoning systems for problem solving, safety investigation and behavioral safety.
- PHRED Solutions worked with TMMK (Toyota Motor Manufacturing Kentucky) from 1997 until 2001. We translated the existing Toyota PPS (Practical Problem Solving) process into the PHRED question based reasoning software.
- Work in the US was pioneered by David Verbal, Kathi Hanley and Wayne Lowe who brought over PPS from Japan when TMMK opened.
- TMC (Toyota Motor Corporation) in Japan have now provided a tool to do this. We must make it clear that Toyota do not use PHRED now.
- The Toyota parts of this presentation are based on two presentation’s TMMK gave on their work with PHRED in 2000.
- I would like to acknowledge the help of lean experts: Becky Morgan of Inc. Magazine/Fulcrum Consulting and David Verbal, of the Lean Transformations Group in this presentation.
System Built to Reinforce the Business Process of Problem Solving

- **Controlled**
  - Actively manage

- **Compliant**
  - Not optional, part of the work process
  - Self reinforcing training tool

- **Collaborative**
  - Neutral reasoning system to reinforce social process
The PPS Intranet System is composed of:

- Process
- Reasoning / Tacit knowledge elicitation
- Transference of knowledge
- On line coaching / Just in time training
- Access to expert problem solvers, coaches and Sensei
- Knowledge management / Reporting
The End

**Questions?**

"Watch for small problems. They disguise big opportunities."