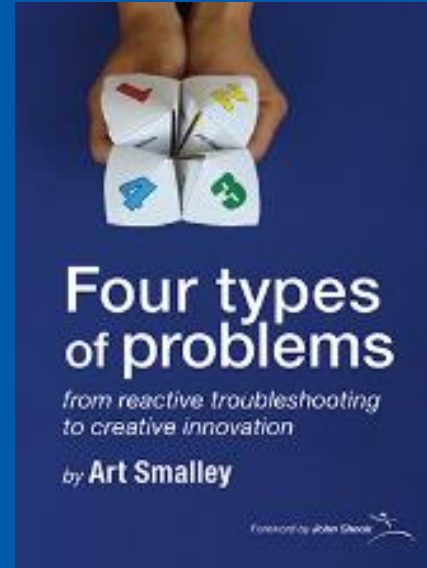


4 Types of Problems

Jan. 17, 2019



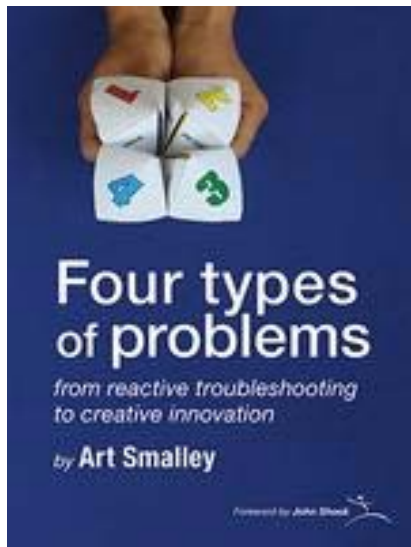
Art Smalley



Housekeeping

- All settings are at the window bottom
- Audio button is at far left
- Chat button for communicating with other attendees is at the middle left
- The Q & A button for submitting questions to the presenter is at the middle right. We'll answer questions during the Q&A at the end of the presentation.
- We won't be using the Raise Hand function today.

Just Published!



Four Types of Problems helps teams:

- Sort out problems faced
- Avoid “hammer & nail” traps
- Pick the right problem-solving tool
- Sustain gains, go faster

Buy at lean.org/Bookstore/

2019 Lean Summit, March 27-28



Learn from Art Smalley in person at the Lean Summit in Houston!

- Take the full day workshop on March 26
- Attend the Learning Session at the summit!

Also learn from:



Register at lean.org/summit

Today's Presenter: Art Smalley



- Among first Americans to work at Toyota, Japan
- Trained at Kamigo engine plant; maintenance manager created stability for Ohno's flow production
- Director, lean manufacturing, Donnelly Corporation
- Lean expert, McKinsey & Company
- Art of Lean; LEI faculty
- *Author, Creating Level Pull; co-author Understanding A3 Thinking*
- Latest book: *Four Types of Problems*

Short Introduction

Work Experience Related

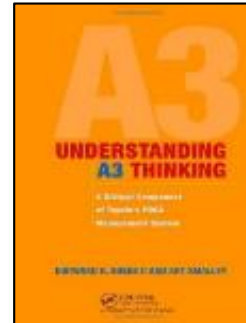
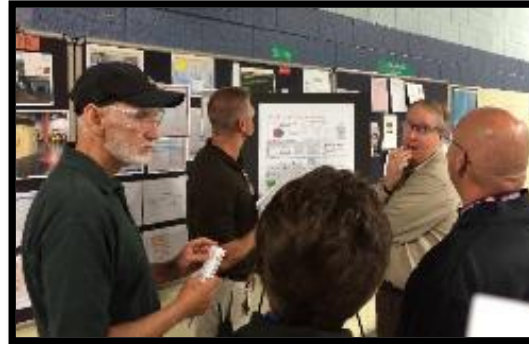
Toyota Motor Corp Japan
Director Donnelly Corporation
McKinsey & Company
Art of Lean, Inc.

Home / Family Related

Wife & 3 Daughters
Cypress, California

Hobby Related

Photography
Woodworking
Reading
Judo / Jiujutsu / Kali

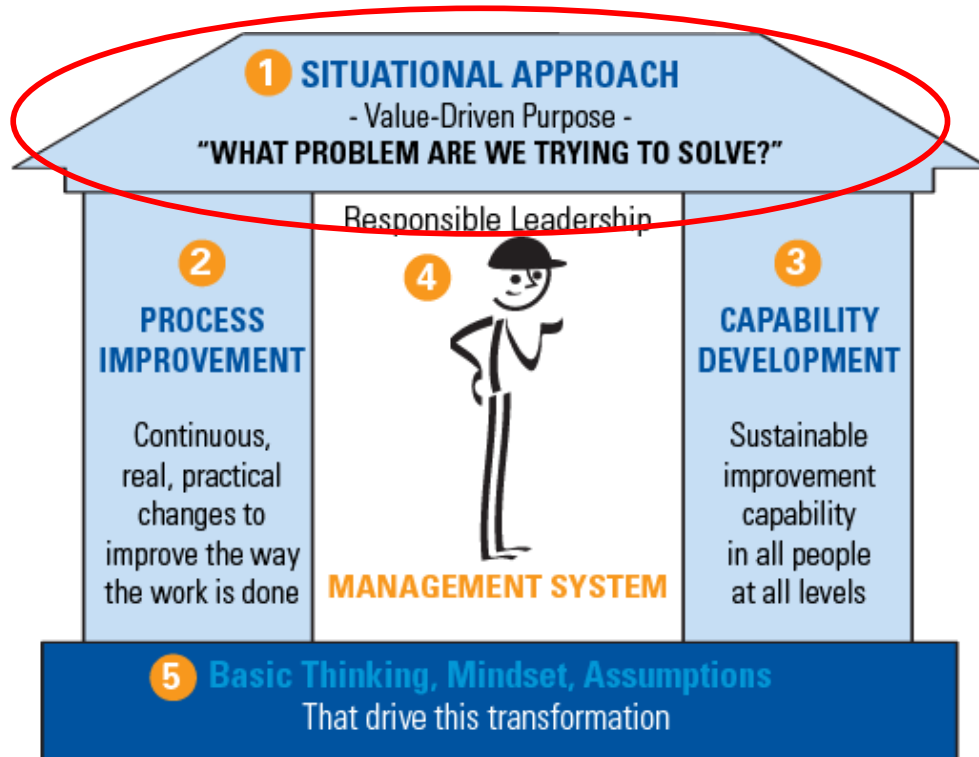




Questions / Outline

- How does this link to the LEI Transformation Model
- What are the 4 Types?
- Why propose 4 Types?
- What type of situations does each one best address?
 - Type 1 Troubleshooting / Abnormality
 - Type 2 Gap from Standard
 - Type 3 Target State
 - Type 4 Open Ended / Innovation

LEI Transformation Model



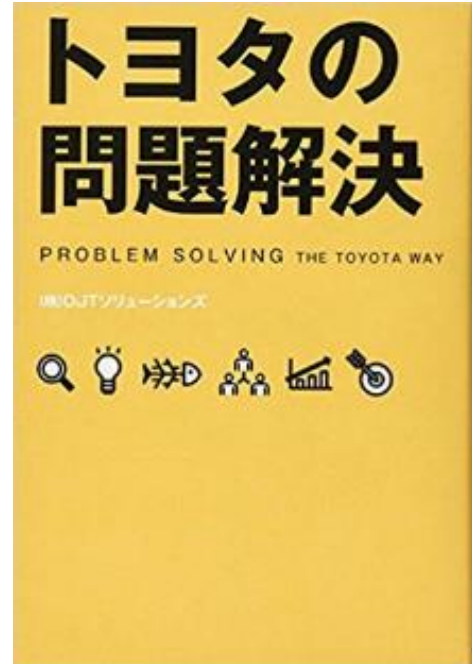
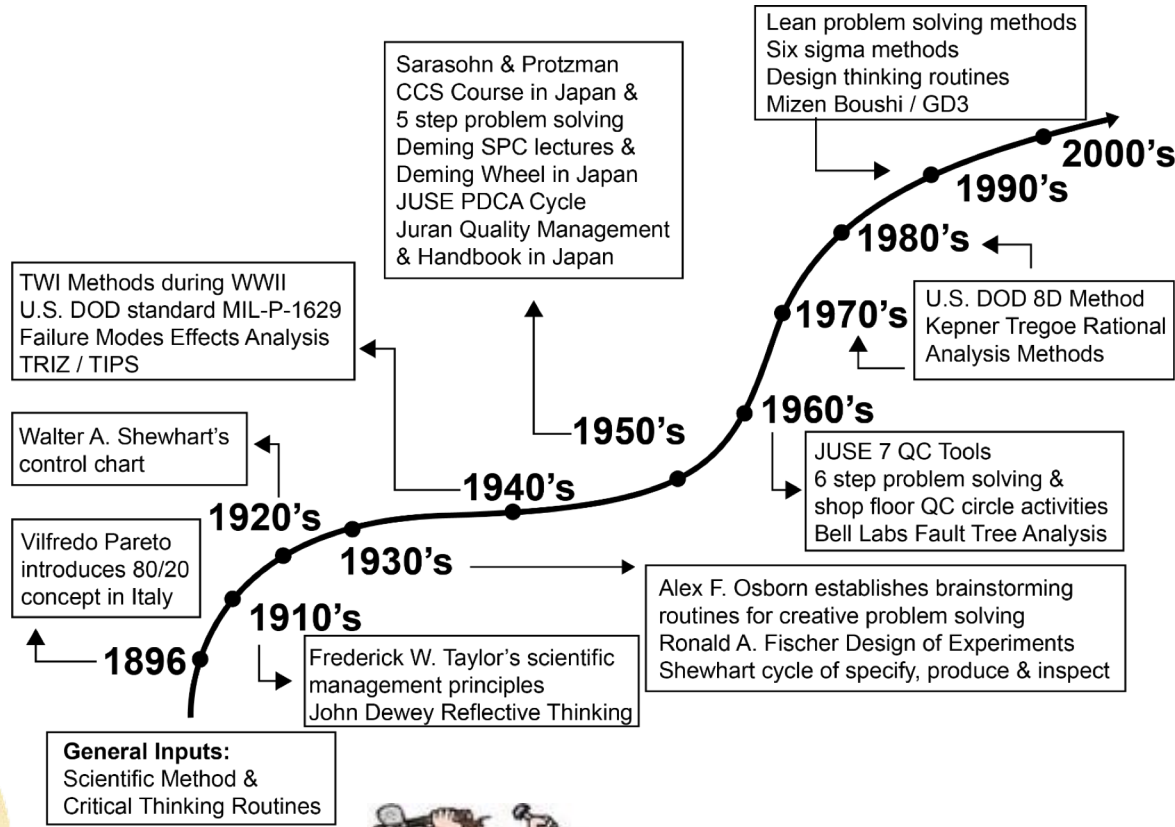
Not just what lean tool
can I use?

Nor how many kaizen
events do I conduct...

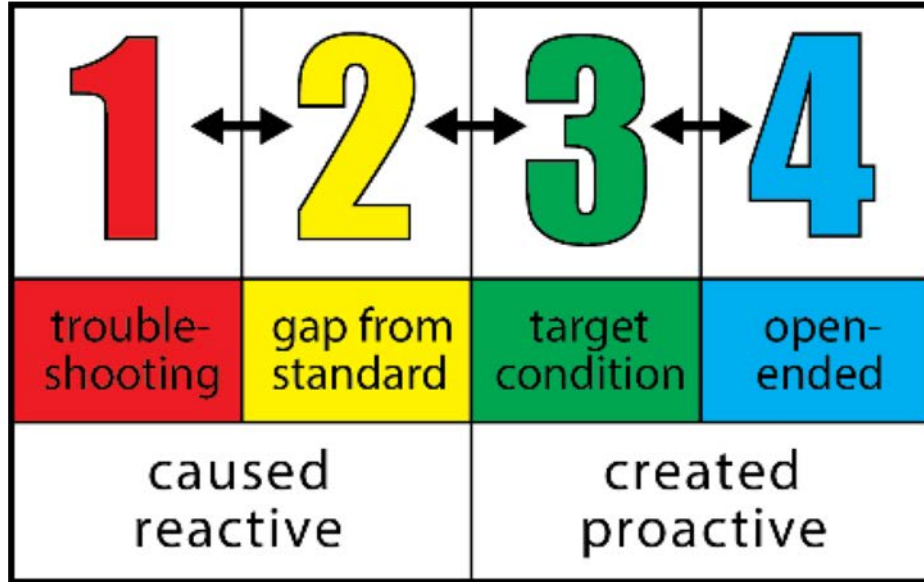
Nor how much training
do I need...

Etc...

20th Century and Problem Solving



4 Types of Problems & Approaches



Why 4 Types??

Only the scientific method!!!

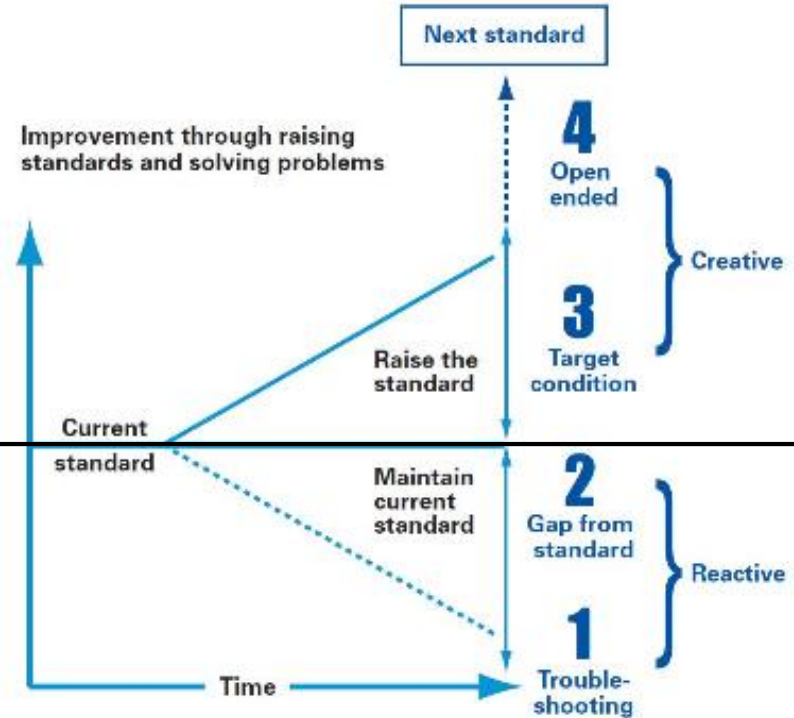
Just Do It!!

Kaizen!!

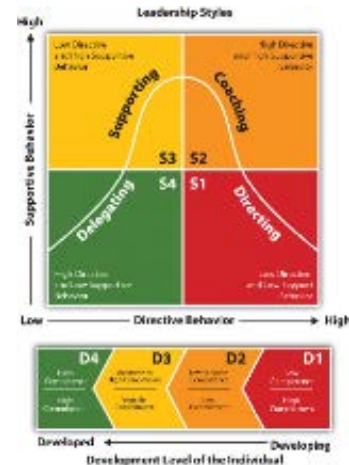
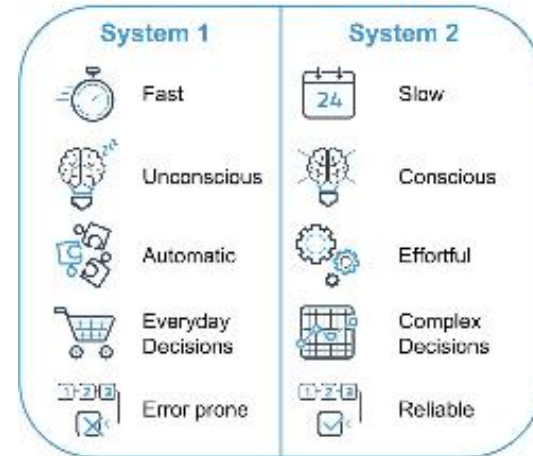
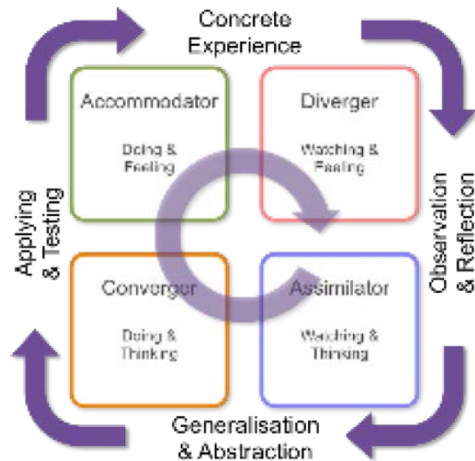
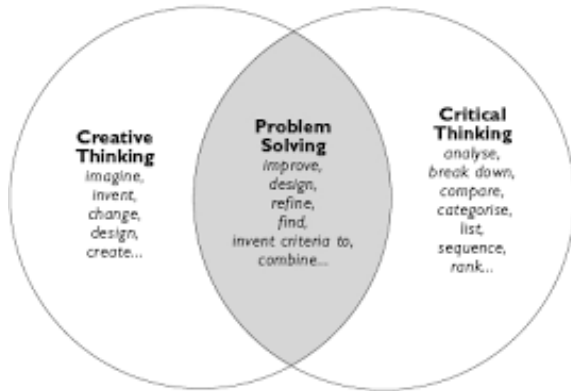
PDCA!! Kata!!

Six-Sigma!!

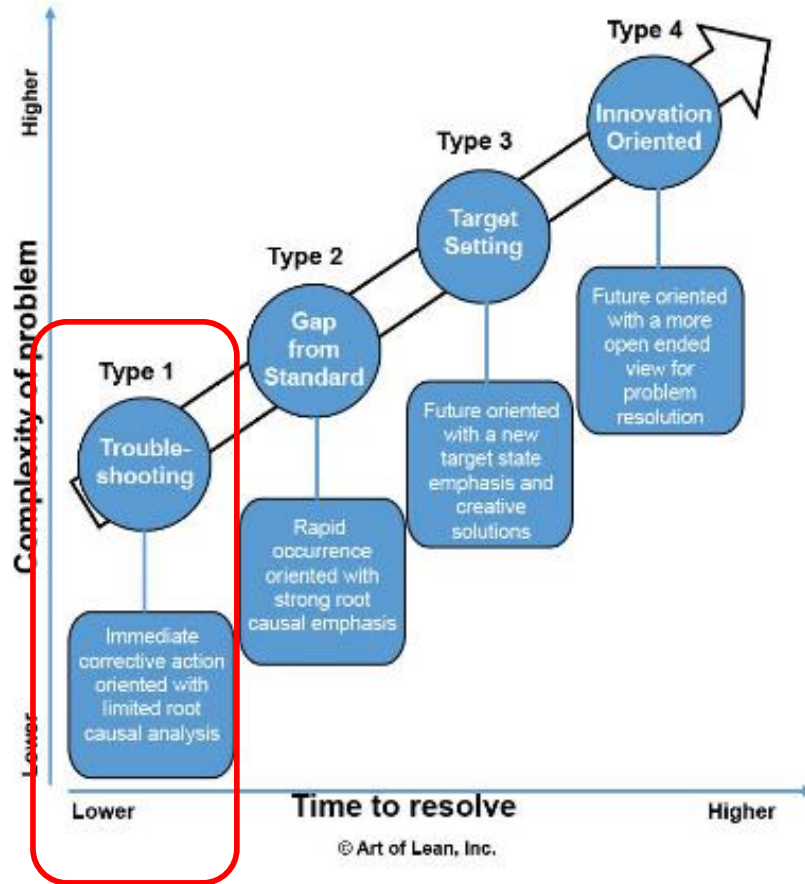
Why 4 Types?



External Consideration Factors



4 Types of Problems & Approaches



Type 1 Problem Approach

- Concept of fixing problems now
- First responder mentality
- Protect the customer
- Engage the workforce RFP
- Makes for a better day
- Displaying courage, creativity, and the spirit of challenge

What Do These Have in Common?



Yahoo breaks its own record with new announcement that 1 billion accounts were hacked in 2013

What's known so far about the worst breach on record



Details of the breach

- Yahoo recently discovered a record setting breach of 1 billion user accounts, compromising names, e-mail addresses, telephone numbers, dates of birth and passwords
- The incident, which occurred in August 2013, was discovered when, last month, law enforcement presented the company with data that according to a third party belonged to Yahoo. A subsequent investigation confirmed this claim

YAHOO!

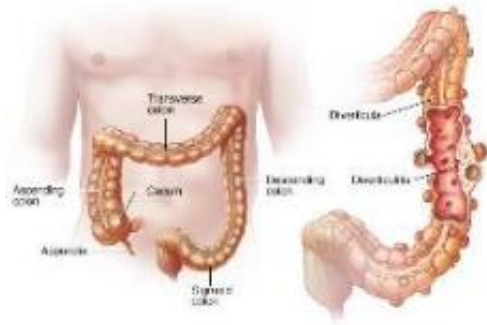
From bad to worse

- In search for the so-called firm announced that a state-sponsored actor hacked 500 million accounts in late 2014, the largest known breach until Yahoo broke its own record with yesterday's disclosure
- Though the 2013 and 2014 incidents are likely unrelated, the 2014 state-sponsored actor is suspected in connection with a separate security issue in which Yahoo's source code was hacked and used to forge cookies, which provide a way for users' accounts without passwords

verizon

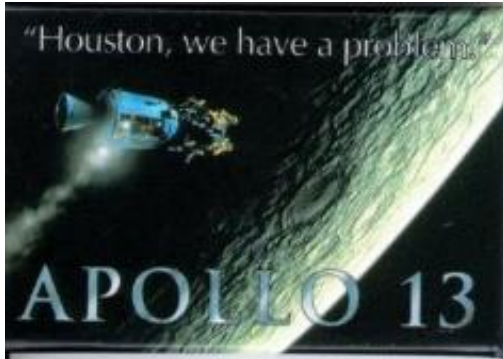
Verizon "we will evaluate"

- The latest revelation casts more doubt on Verizon's planned acquisition of Yahoo, a \$4.83 billion deal finalized in July
- Verizon had already voiced concern in the aftermath of September's disclosure, noting that the 2014 hack could be a material event
- After news of the third figure surfaced, Verizon stated "we will evaluate the situation as Yahoo continues its investigation. We will review the impact of this new development before reaching any final conclusions"



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Troubleshooting vs. Root Cause



Rupture of oxygen tank #2 in the service module.

Damaged to a valve in the #1 oxygen tank, causing it to lose oxygen rapidly.

Oxygen stores, water, electrical power, and use of the propulsion system were lost inside of 3 hours.

Type 1 Focus

How to get home safely?

- Primary navigation impaired in the damaged Service Module. Abort moon landing. Move to LEM.
- Decision to return to Earth using Lunar Module for thrust
- Internal environment fell to 39° F
- Lack of potable water and food
- Dangerous CO₂ build up
- Free return trajectory around moon using its gravity to return to earth
- Power up of command module from shut down state
- Manual vital burn adjustments

Type 2 Focus

Why did the tanks rupture?

- Oxygen tank dropped in assembly possibly causing some damage
- Tank drain tube misalignment factor
- Thermostat 28 volt vs. 65 volt design spec issue
- High tank temps 1000° & wire insulation came off
- Two of the now-bare wires arced, caught fire, pressure rose, and the tank ruptured.

Apollo 13 Examples

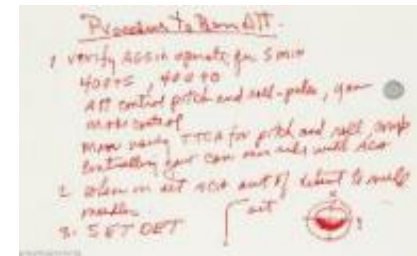


Troubleshooting CO2 build up using only what material was available to establish a temporary countermeasure

Using the Lunar module to slingshot around the moon and plot a trajectory home.

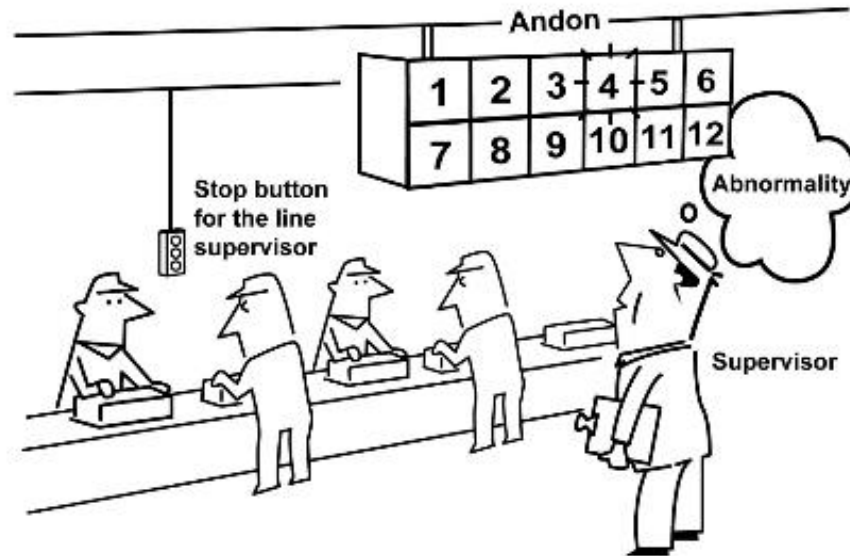


Commander Jim Lovell re-writing work instructions on the fly in the module for various tasks



Type 1 – Troubleshooting at Toyota

異常処置 / Ijō Shochi



Abnormality Management System

Condition based trigger

Time Constraint

Human based call for help

or

Machine based abnormality

**10,000 Andon calls – Not all are equal in terms of impact.
What do you do as an organization?**

Time & Quantity Trigger Based

Production Analysis Board

| Line Fuel Line Cell | | | | Team Leader Barb Smith | | |
|------------------------------------|------|--------|------|---------------------------|--------------------|----------|
| Quantity Required 690 | | | | Takt Time 40 sec. | | |
| Time | Plan | Actual | Plan | Actual | Problems/Causes | Sign-off |
| 6-7 | 90 | 90 | 90 | 90 | | GL |
| 7-8 | 90 | 88 | 180 | 178 | tester failure | GL |
| 8-9 ¹⁰ | 90 | 90 | 270 | 268 | | GL |
| 9 ¹⁰ -10 ¹⁰ | 90 | 85 | 360 | 353 | tester failure | GL |
| 10 ¹⁰ -11 ¹⁰ | 90 | 90 | 450 | 443 | | GL |
| 11 ⁴⁰ -12 ⁴⁰ | 90 | 90 | 540 | 533 | | GL |
| 12 ⁴⁰ -1 ⁴⁰ | 90 | 86 | 630 | 619 | bad parts (valves) | GL |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

hourly cumulative

Plan Versus Actual
Time & quantity based triggers

Rapid Problem Solving

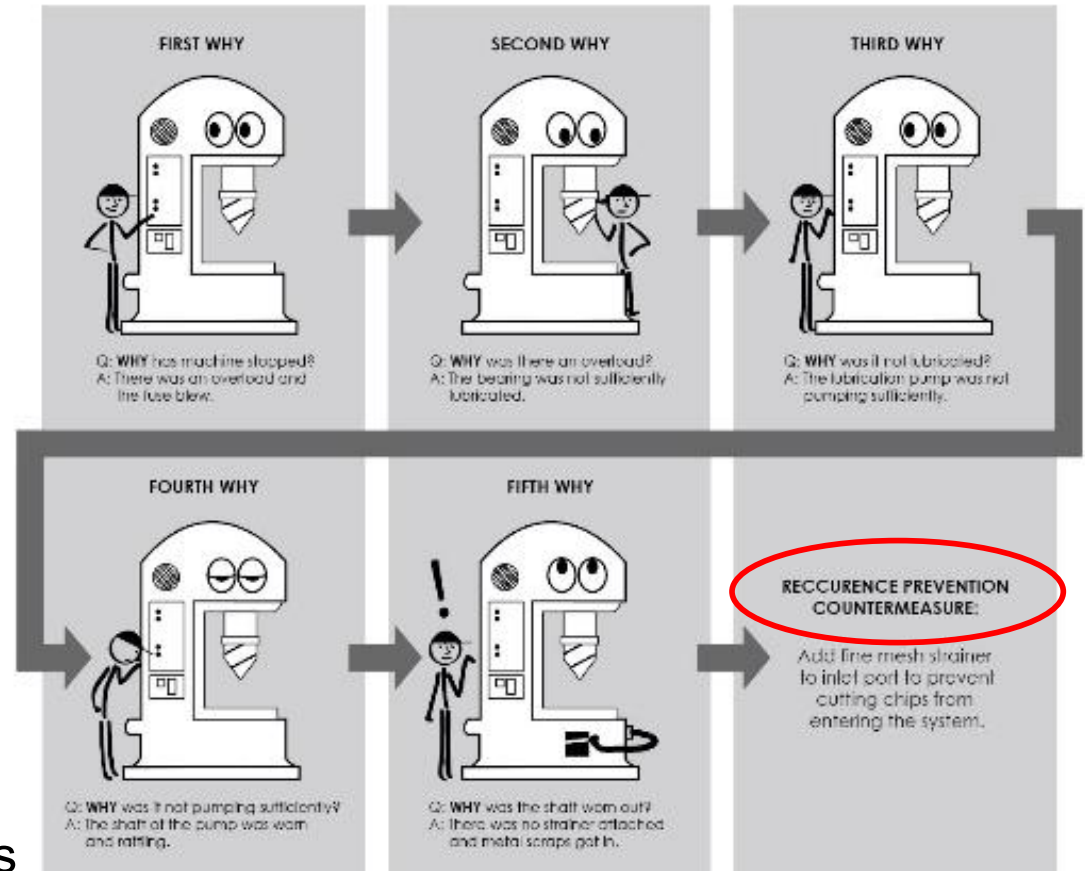
- Concern
- Cause
- Countermeasure
- Check

Birth of the 5 Why's

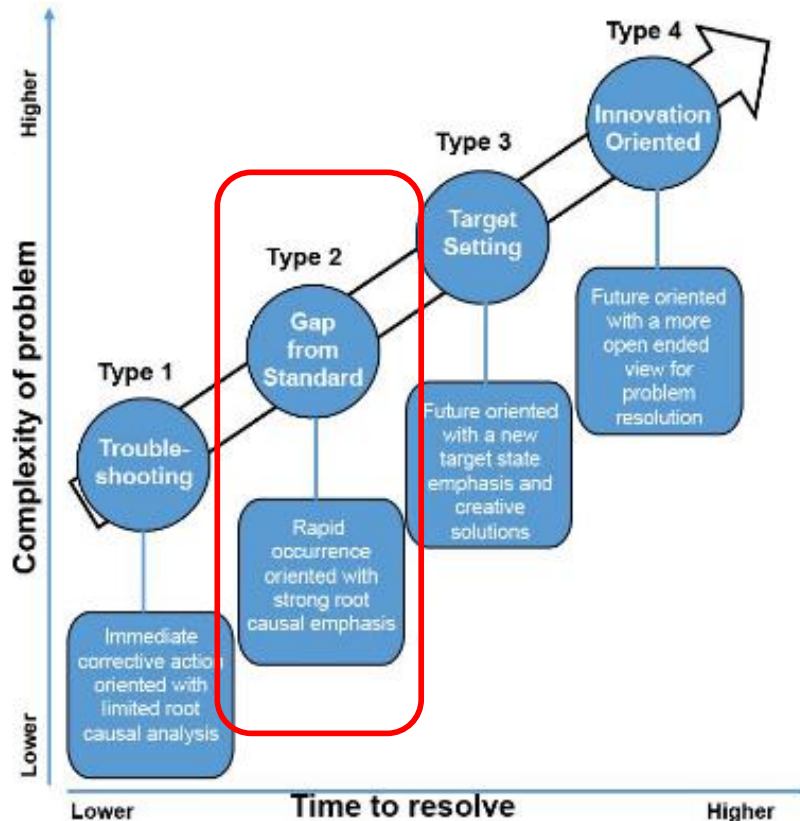


3G's

- Go and See
- Get the Facts
- Grasp the Situation Details



4 Types of Problems



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Some problems are severe, or recurring, or hindering progress...troubleshooting alone won't solve these.

Convergent
Deeper Dive / Detailed
Analytic / Quantitative
C&E Relationship (RCA)
Types of Countermeasures
System of Checks
Standardized & Sustain

Type 2 – Gap from Standard

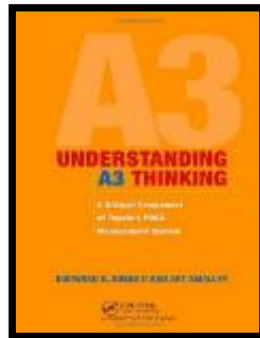
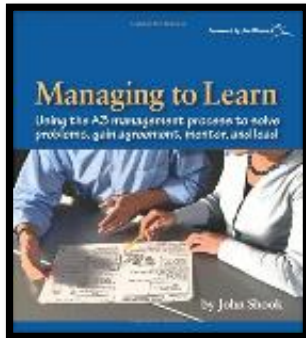
Monthly



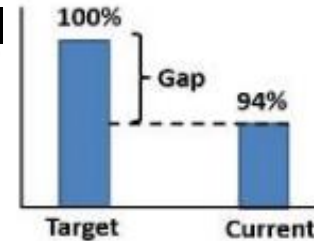
Weekly



Daily

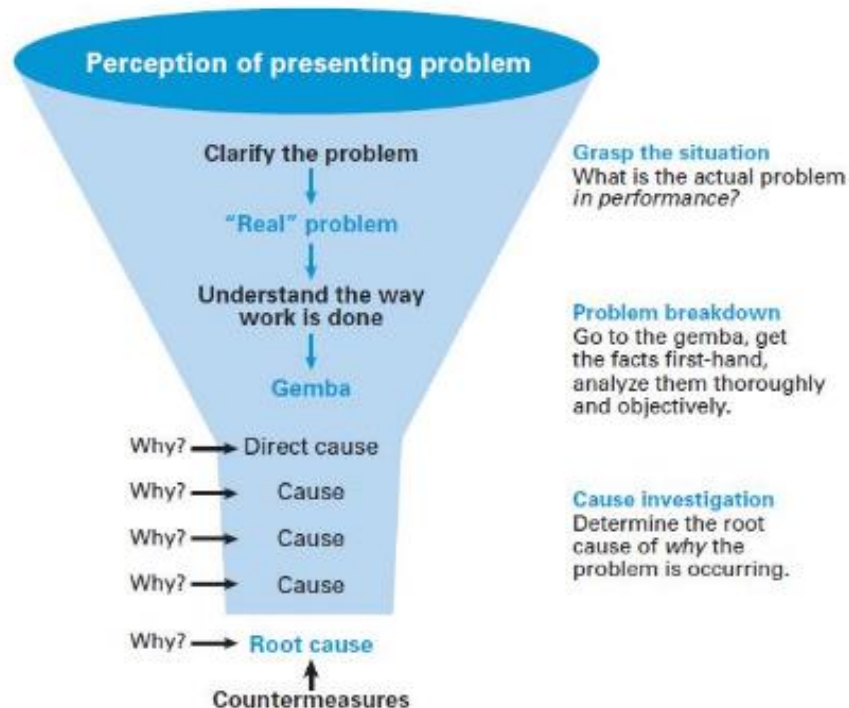


KPI



Why???

Emphasis on Step by Step



Why is this such a big issue???

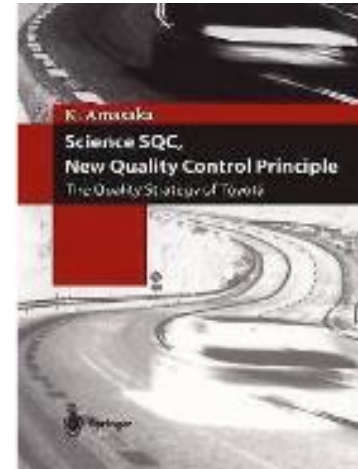
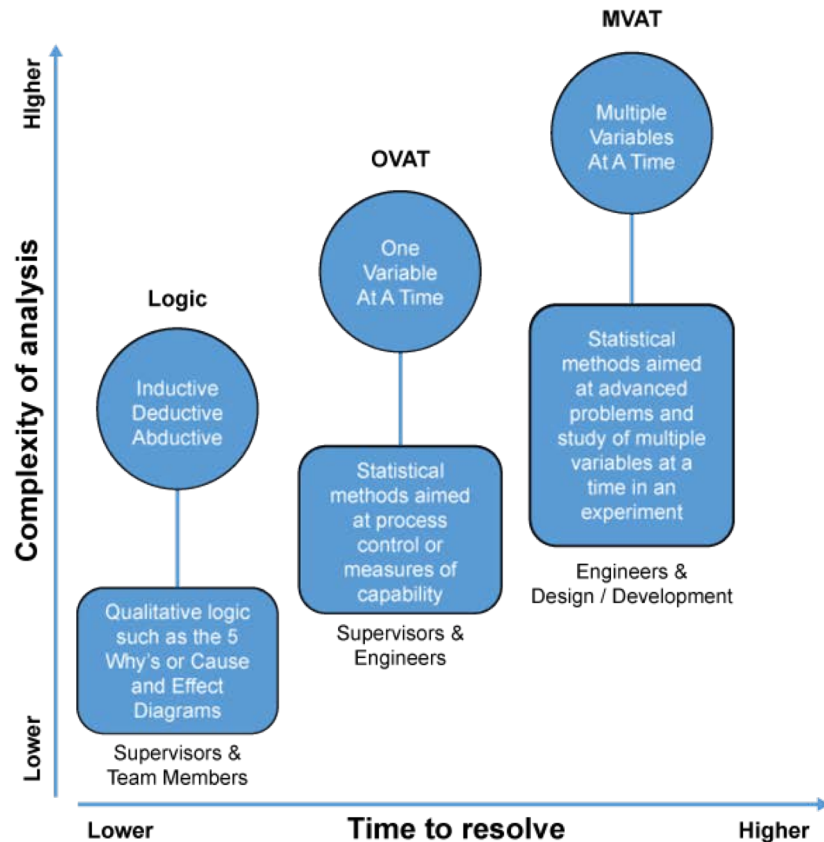


What really is the true problem???



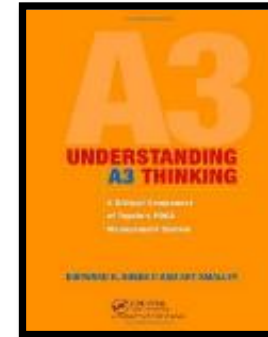
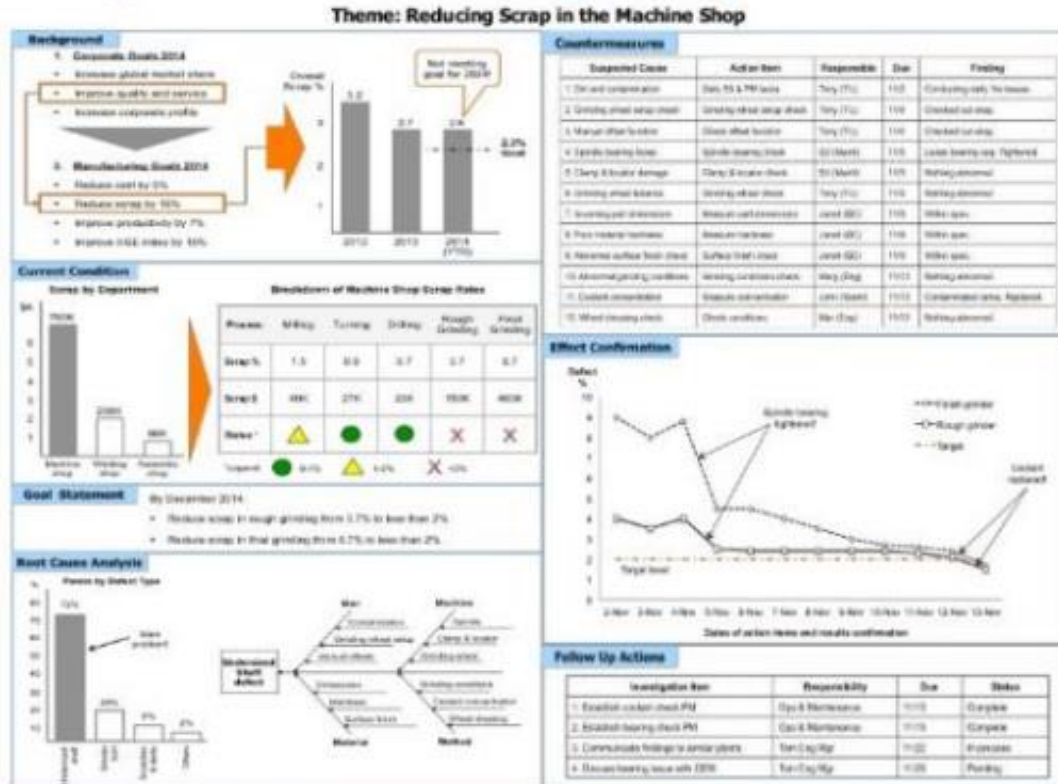
What really is the true cause???

Type 2 Analysis Patterns



Convergent
Disciplined
Focused
Analytic / Quantitative
C&E Relationship
Standard attainment
Results emphasis

Type 2 Example in A3 Format



A3 is simply a tool for aiding the problem solving process, showing your thinking, communicating and reporting progress

Problem Investigation - OVAT

TPS

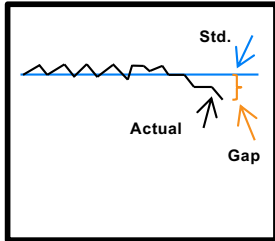
TPS



A. Immediate abnormality signal



B. Go to actual machine and see status

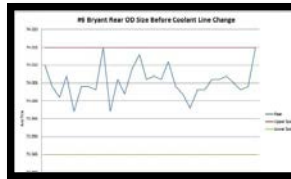


C. Ascertain actual problem situation

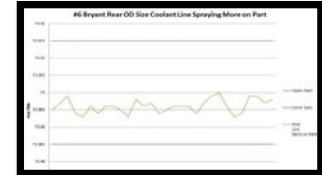
TPS

Structured Investigation Sequence

1. Measure actual dimensional extent of problem
2. Look for obvious contamination or abnormalities
3. True and re-dress grinding wheel and observe status
4. Check actual grinding wheel (check "pores")
5. Confirm actual (not theoretical) stock removal
6. Send part to QC Mat'l lab for hardness and HT depth check
7. Check actual cutting conditions
 - Wheel RPM
 - Feed Rate, Depth of Cut, etc.
 - SFPM
8. Confirm status of datum features
9. Measure spindle run out
10. Coolant check
 - Flow rate / pressure
 - Nozzle condition and direction
 - Temperature
 - Concentration

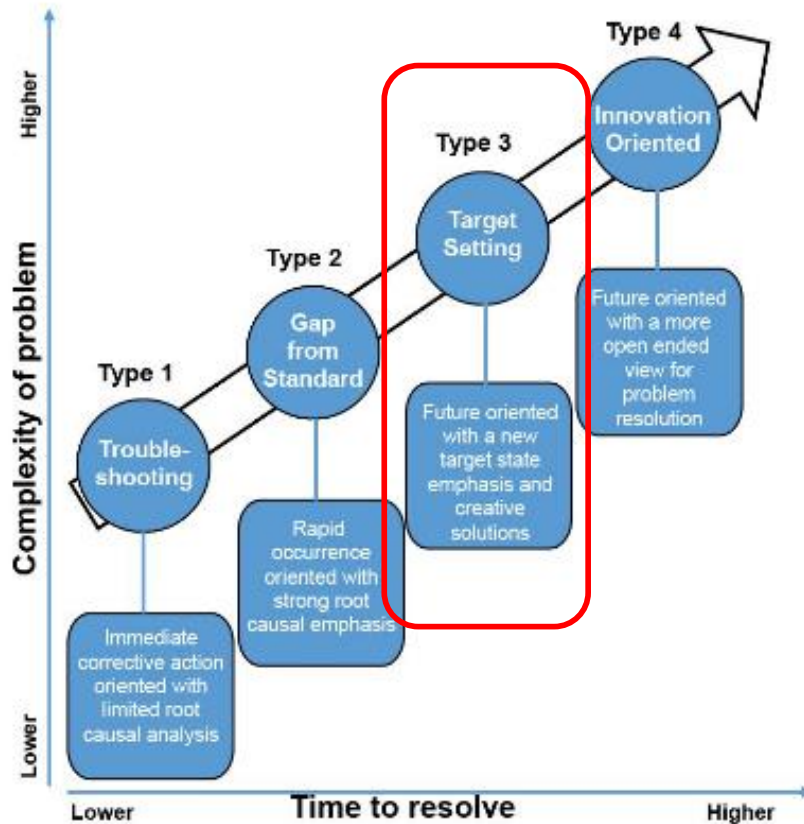


Cpk 1.15



Cpk 2.33

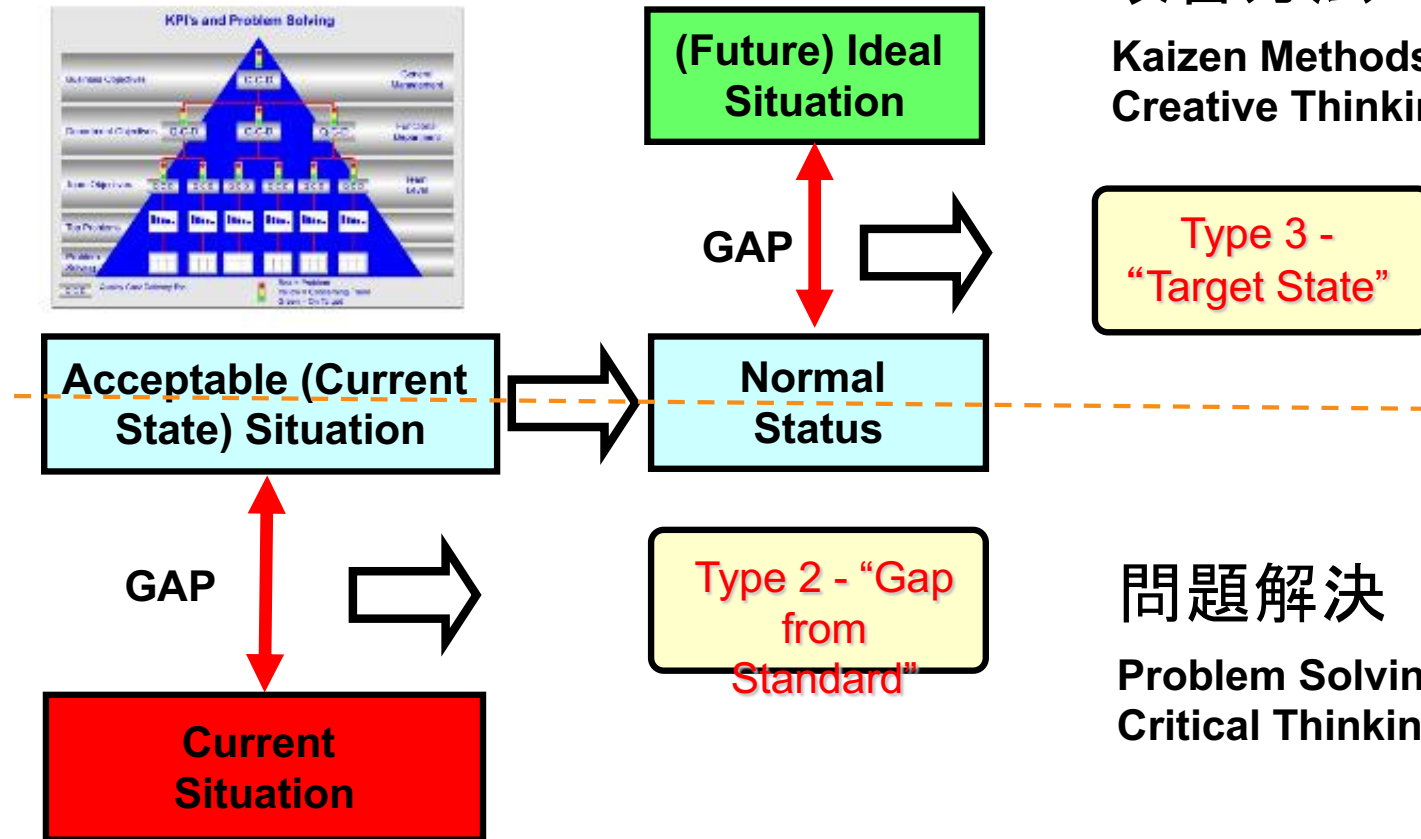
4 Types of Problems



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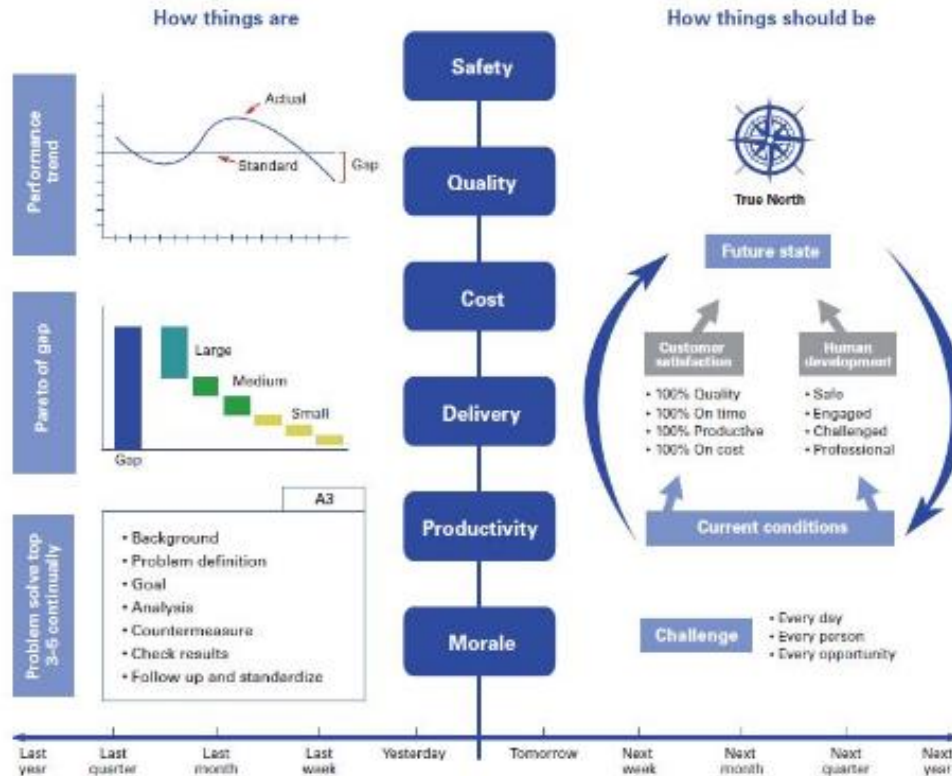
Divergent / Lateral Thinking
Focus is less clear initially
Analysis / Synthesis
Creativity emphasis
Improvement over existing standards
Scope is usually larger

Type 3 Target State



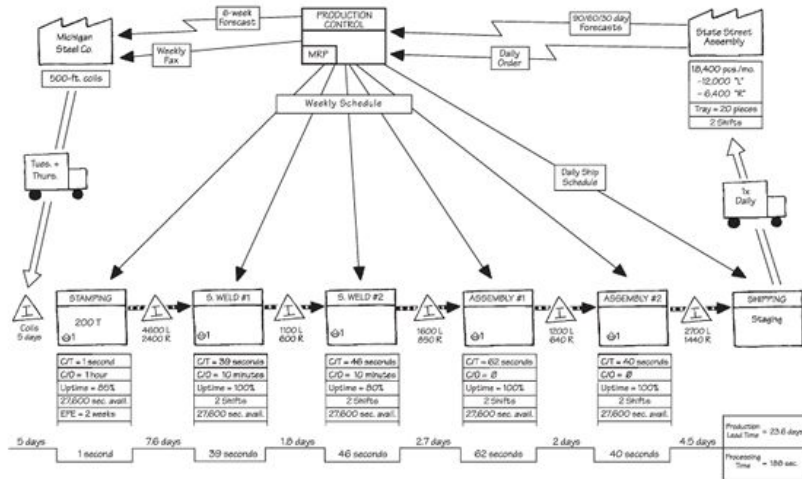
Target State Concept (Future)

Type 2 vs. Type 3



Value Stream Example

Current-State Value-Stream Map



- Long lead-time
- Excess inventory
- Poor quality
- Low flexibility
- Poor responsiveness
- Customer complaints
- Some Type 2 “Gaps” & Type 3 “System”



- Many problems / opportunities
- 7 Wastes everywhere
- Not generally a single root cause
- Systemic issues
- Creativity over Capital

Process Level Example (SMED)



Dedicated Press
Part A

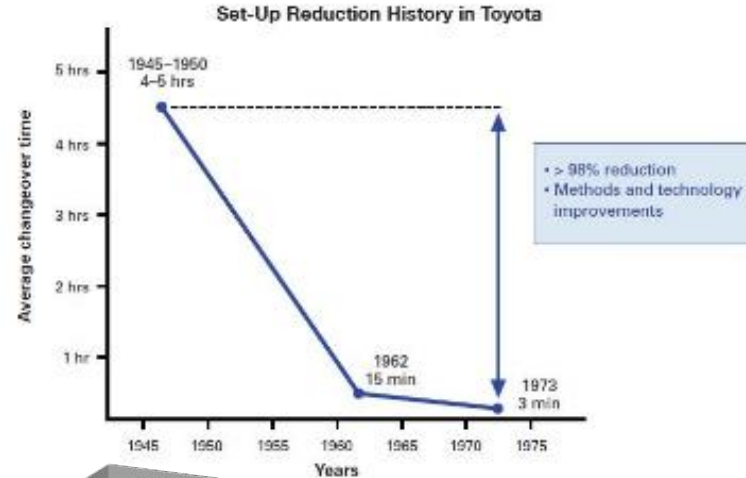


Dedicated Press
Part B



Dedicated Press
Part C

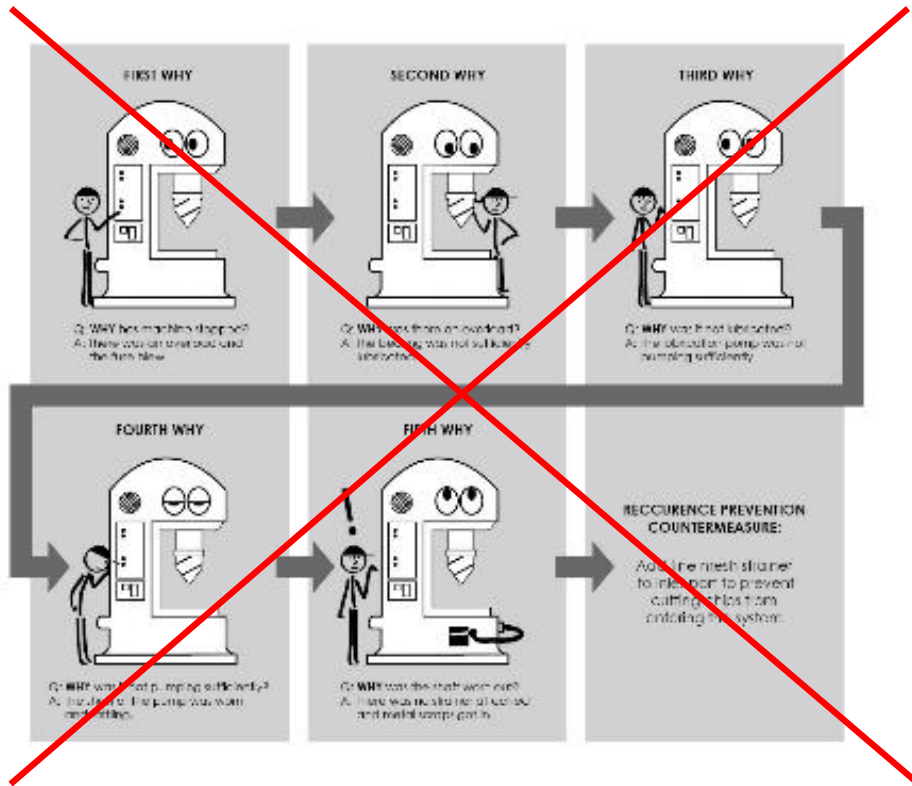
3 Dedicated Machines
No Flexibility
Each 30% Utilization



Flexible Press
Parts A, B, & C

1 Machine / 3+ Tools
Change Over Flexibility
90% Utilization

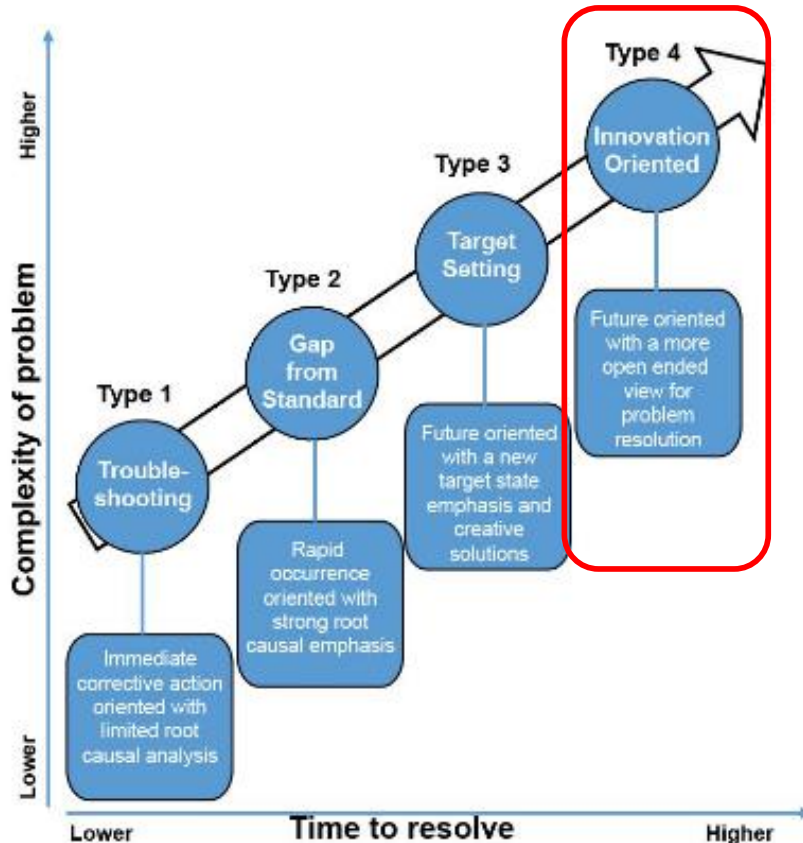
Target State and Root Cause



There is no single root cause:

- **Make a smaller cutting chip**
- **Contain the chip inside the machine**
- **Create proper coolant flow**
- **Flush the chip out properly**
- **Avoid the problem in the first place**

4 Types of Problems



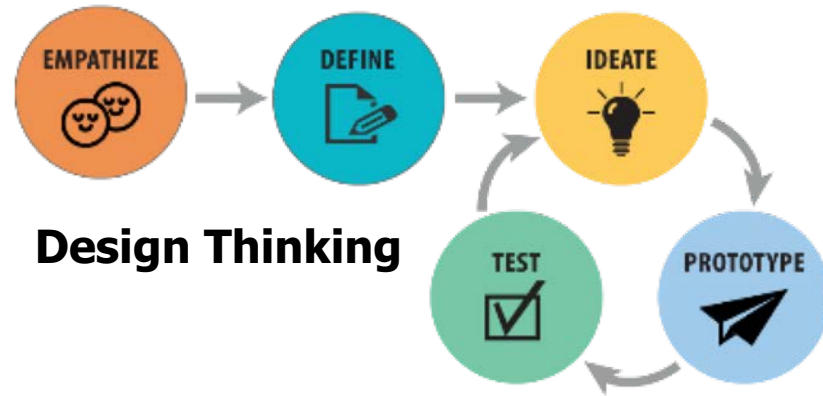
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Small, medium, & large
Open ended
Divergent / Lateral Thinking
Focus is less clear initially
Analysis / Synthesis
Creativity emphasis
Breakthrough concept

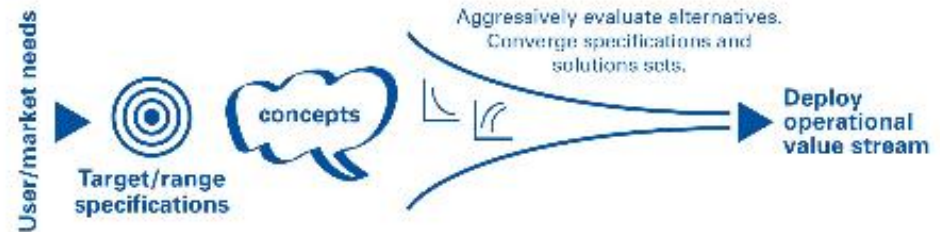
Type 4 Open Ended / Innovation

Ten Types of Innovation

| | HOW YOU... | SUCH AS... |
|---------------|---------------------|---|
| CONFIGURATION | Profit Model | make money <i>Gillette</i> |
| | Network | connect with others to create value <i>TARGET</i> |
| | Structure | align your talent and assets <i>WHOLE FOODS</i> |
| | Process | use signature or superior methods to do your work <i>ZARA</i> |
| OFFERING | Product Performance | employ distinguishing features and functionality <i>OXO</i> |
| | Product System | create complementary products and services <i>SEAGRAM</i> |
| EXPERIENCE | Service | support and enhance the value of your offerings <i>Zappos</i> |
| | Channel | deliver your offerings to customers and users <i>NESPRESSO</i> |
| | Brand | represent your offerings and business <i>Virgin</i> |
| | Customer Engagement | foster distinctive interactions <i>Wii</i> |



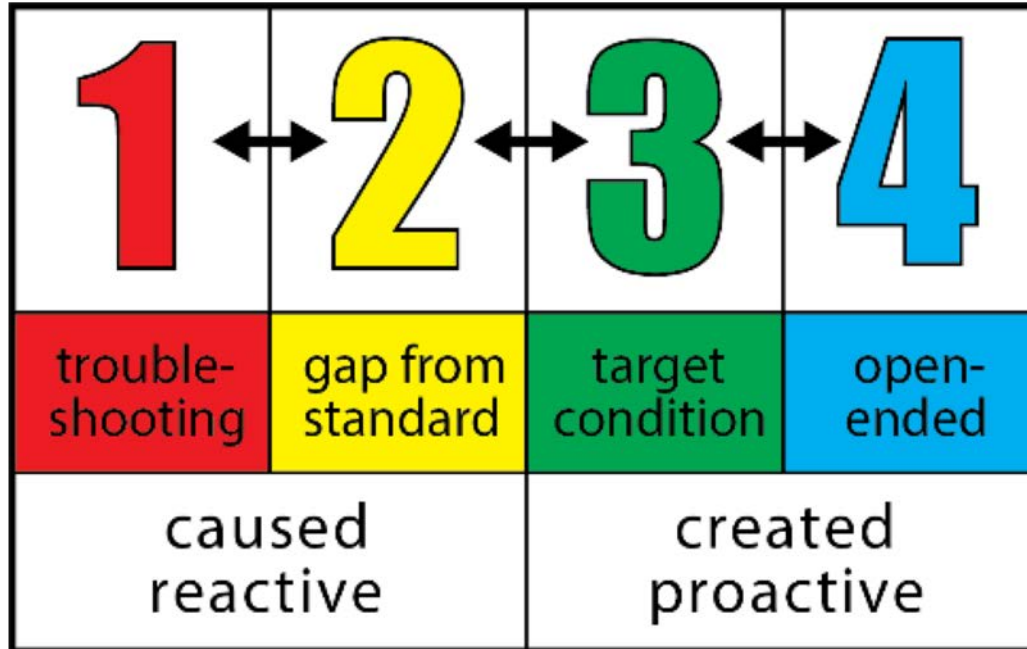
Set Based Design



Product Offering Example



4 Types of Problems & Approaches



Where are you?

What next?

Good luck on your improvement journey!

Questions?

Questions and Answers

Type your questions for Art Smalley

2019 Lean Summit, March 27-28



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