Case Study of INTEL: Double Stack Prevention Thru TRIZ Methodology

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Intel Malaysia

TRIZ In INTEL

Driven by manufacturing groups

- ❑ Fab/Sort Manufacturing
- ❑ Assembly/Test Manufacturing (ATM)
  - One of the area: Improve equipment performance
  - Boundary conditions for equipment solutions: Effective & low cost (small changes due to large equipment base

INTRODUCTION: TEST

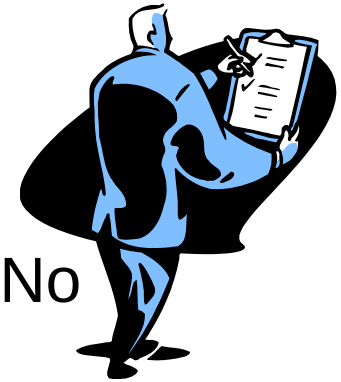
- Class Test (CT) - measurement of assembled device performance. Products categorized by speed/power/performance.

- Product testing is identified to specific type of equipment (tester/handler)

- CT consist of 3 sub modules; tester; handler; TIU (tester interface unit).

- Presentation discusses a case study of how double stack prevention on a legacy handler being approached thru TRIZ methodology

OVERVIEW

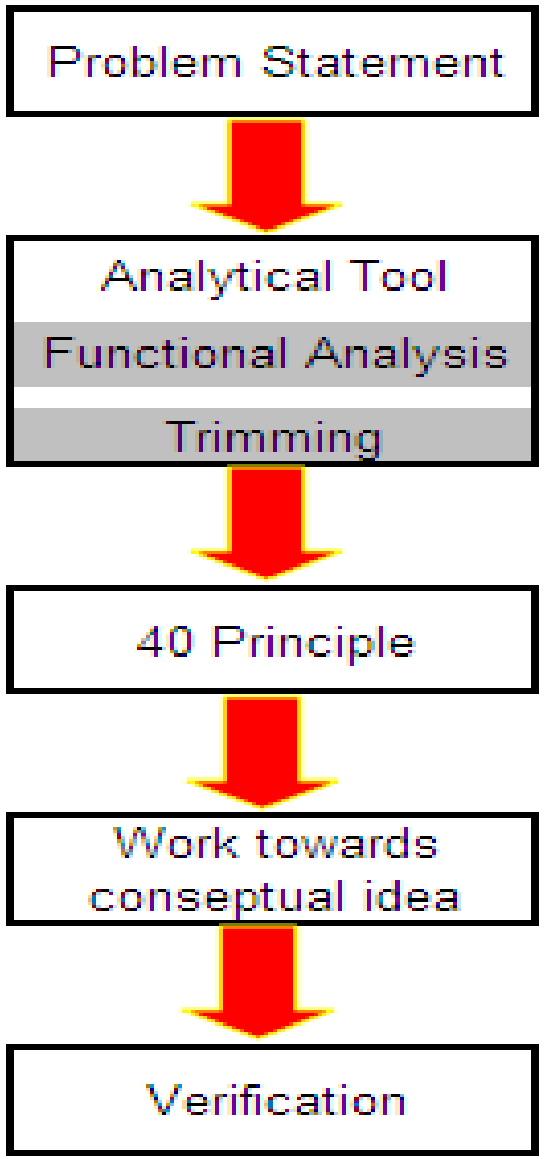


- Quality is key in factor in any industries
- Legacy tools does not have poka yoke futures. No prevention system.
- Available system are more on post occurrence detection.
- The equipment will damage the device/product, leads to painful rescreening and scrapping

TRIZ FLOW

4 Important Function Analysis

1. **Productive – irreversible chg of object parameter**
2. **Providing – temporary chg**
3. **Corrective – chg parameter to eliminate unwanted char.**
4. **Harmful – function that worsen the parameter**



Identifies core issues "CEC"

3 rules:

1. **You don't need the function anymore**
2. **The object performs the function itself**
3. **Other component does the function**

PROBLEM STATEMENT

- High BDO on double stack (DS) jam clearance (alarm)
- Detection upon post incident
- Non value add time spent on screening and scrapping when there is an occurrence.
- No poka yoke system

Double Stack

PROCESS ANALYSIS APPROACH

- Process Analysis (PA) – an analytical method used to analyze the manufacturing process, defining operation functions and propose a way to improve the system by improving/simplifying

- PA helps to identify disadvantages connected (waste elimination) with numbers of unnecessary process steps or frequencies

- Analyzing a process thoroughly has led towards enhancing a process through innovative solutions

- Process improvement:
  - a. change process parameter
  - b. eliminate function where possible
  - c. perform steps which shorten the tpt

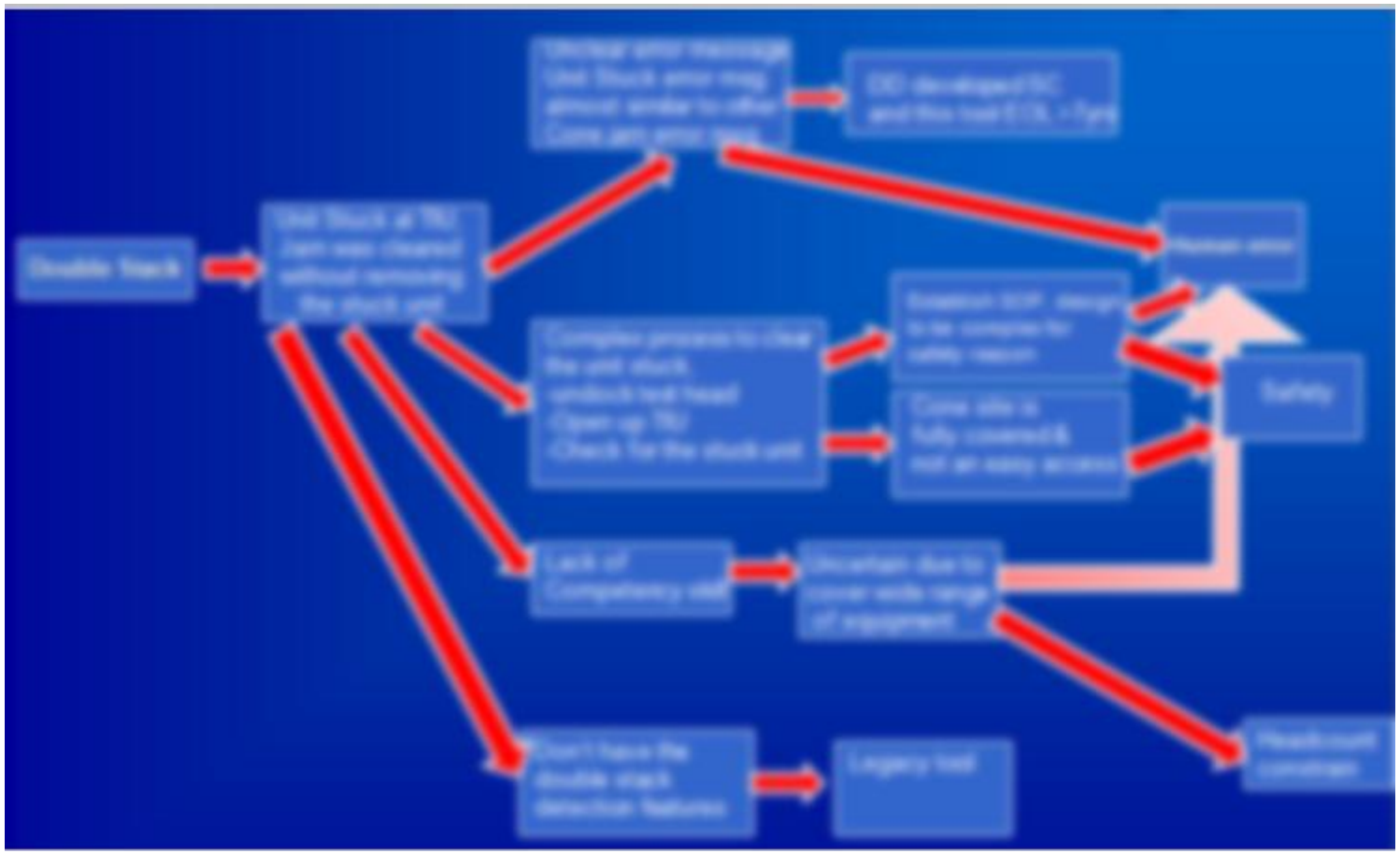
PROCESS ANALYSIS & DIRECT OBSERVATION

➢ Both are analytical method used to analyze the manufacturing process, and interpret current reality through result of process

➢ Deep dive into detail process steps and look for opportunity through direct observation to improve (eliminate waste):

- trim redundant steps
- long hour activities, frequency etc
- identify disadvantages connected

Cause Effect Chain (CEC)

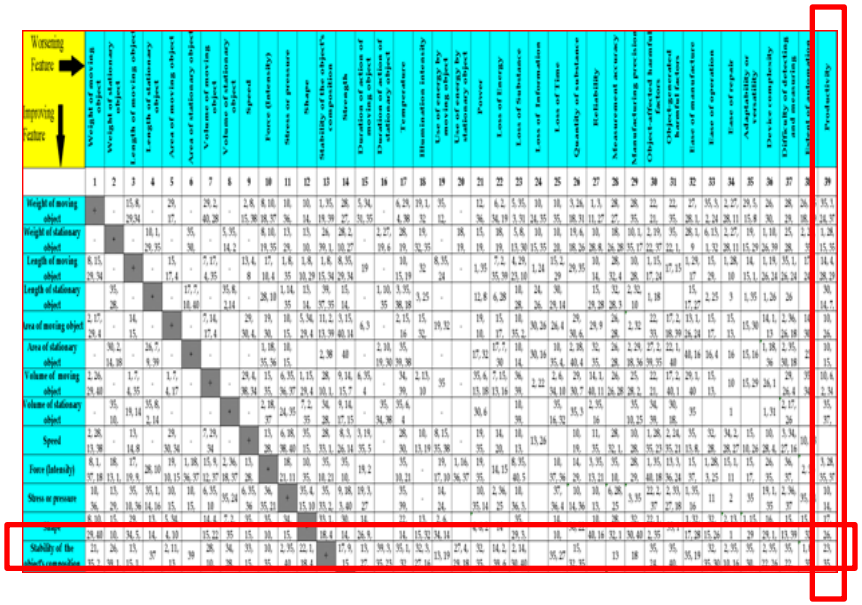


- CEC is important, prior generating solution on conceptual ideas
- It review on each fundamental root cause (RC) which are then;
  (1) Discarded if not plausible or
  (2) Considered potential (RC) to original problem.

SOLUTION APPROACH

Here are some LEAN approaches through direct observation applying TRIZ process analysis and innovation through Inventive Principle to develop ideas for systematic improvement and waste elimination.

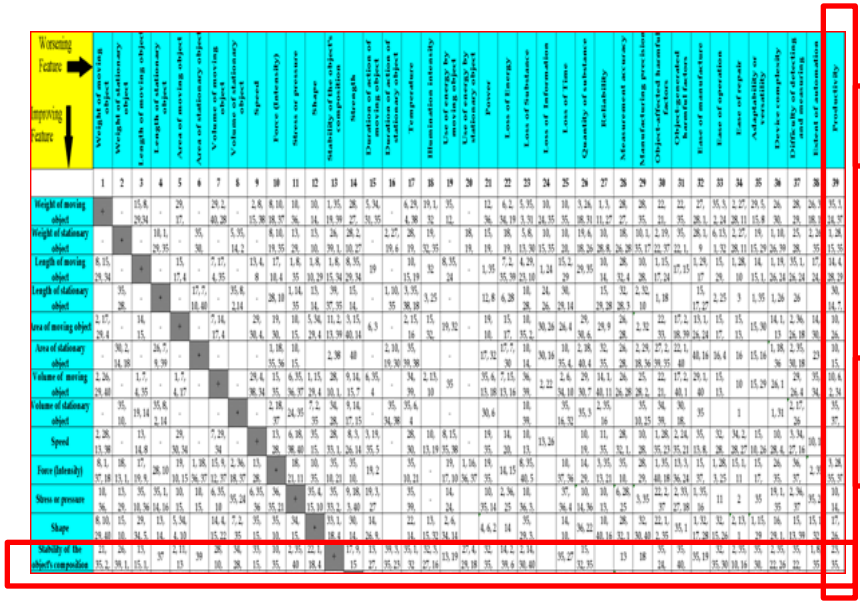
(1) Process Analysis + DO + CEC
(2) Derive Engineering Contradiction
(3) Review potential solution thru 40 Inventive Principles
(4) Define Innovative Solution



Solution Approach

Engineering Contradiction

IF the double stack detected THEN no quality issue BUT it will slow down the equipment process tpt



The TRIZ Matrix proposes the following Principles to solve this contradiction:
improving 13: Stability of the object without damaging 39: Productivity

23. Feedback
- Introduce feedback (referring back, cross-checking) to improve a process or action.
- If feedback is already used, change its magnitude or influence.

35. Parameter changes
- Change an object's physical state (e.g. to a gas, liquid, or solid.)
- Change the concentration or consistency.
- Change the degree of flexibility.
- Change the temperature.

40. Composite materials
- Change from uniform to composite (multiple) materials.

3. Local quality
- Change an object's structure from uniform to non-uniform, change an external environment (or external influence) from uniform to non-uniform.
- Make each part of an object function in conditions most suitable for its operation.
- Make each part of an object fulfill a different and useful function.

- 39 interactive TRIZ matrix
- closest solution achieved thru Principle#23 (Feedback) & Principle#3 (Local Quality)

40 Inventive Principles

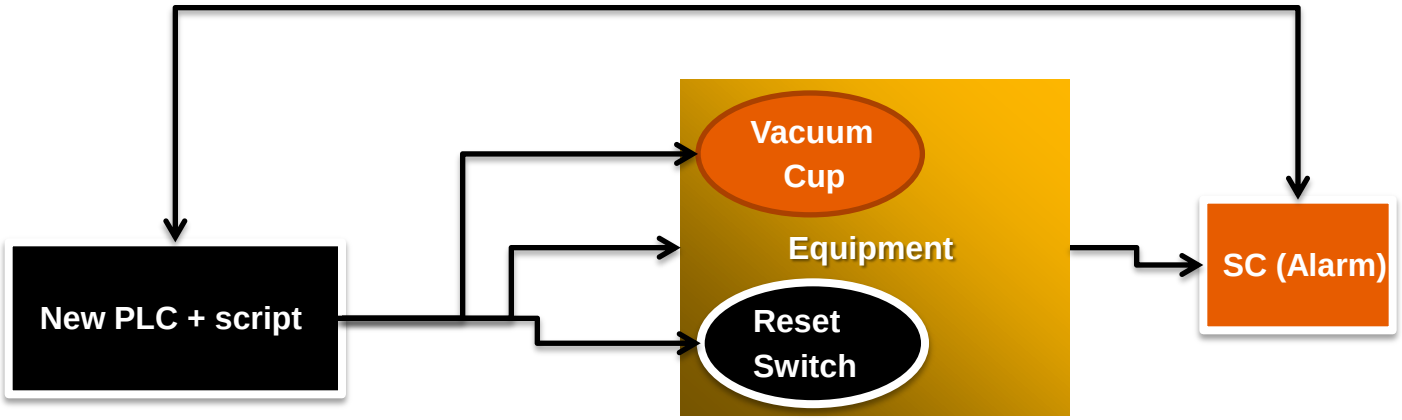
- Using TRIZ methodology – 40 Inventive Principle (solution)

1. Segmentation
2. Taking out / Extraction
3. Local Quality
4. Asymmetry
5. Merging / Combination
6. Universality
7. "Nested Doll"
8. Anti-weight / Counter-weight
9. Preliminary anti action / Prior counter-action
10. Preliminary action / Prior action
11. Beforehand cushioning / Prior cushioning
12. Equi-potentiality / Remove tension
13. 'The other way round'
14. Spheroidality-Curvature
15. Dynamics
16. Partial or excessive actions
17. Another dimension
18. Mechanical Vibration
19. Periodic action
20. Continuity of useful action
21. Skipping / Hurrying
22. 'Blessing in Disguise'
23. Feedback
24. Intermediary
25. Self- Service
26. Copying
27. Cheap / short Living
28. Mechanics substitution / Another sense
29. Pneumatics and hydraulics / Fluidity
30. Flexible shells and thin films / Thin & flexible
31. Porous Materials / Holes
32. Color changes
33. Homogeneity
34. Discarding and recovering
35. Parameter changes
36. Phase transitions
37. Thermal expansion / Relative change
38. Strong oxidants / Enriched atmosphere
39. Inert atmosphere / Calmed atmosphere
40. Composite materials / Composite structures

Solution Approach

Principle#23: Feedback
Generate a feedback solution thru a sensor and loopback to the system (alarm) before issue occurrence (prevention).

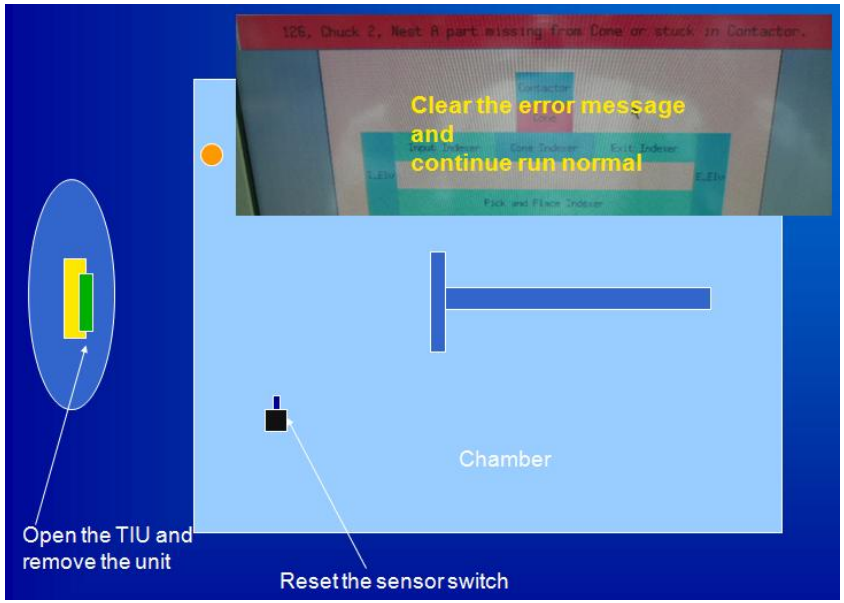
Principle#3: Local Quality
Explore on system hardware to be able detect and prevent from occurrence. Vacuum suction cup as a present sensor.

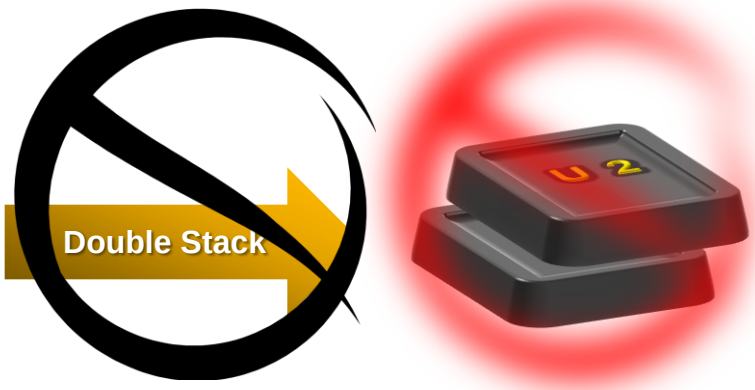


New Invention

➢Generate a feedback solution using handler pick and place vacuum suction cup as present sensor and loopback to the system (generate alarm).

➢ If there is a missing unit from the suction cup, alarm generated (prevention) and system halt. Remove the physical unit (stuck) before being DS else the system not able to continue process (new script programmed)





Key Learning

- DO & Analyzing a process thoroughly has led towards enhancing a process through innovative solutions
- Breakdown operation in depth, to ease on function and interaction details
- Always look into opportunity to reduce process steps by change frequency, waste elimination where possible

- Give way for creative thoughts

SUMMARY

- LEAN approach through TRIZ solution has helped through trimming by process analysis conceptual idea to look into innovative solution on double stack prevention .
- The discovery of innovative solution led to ZERO quality issue thru DS issue and enabled a poka yoke system
- Methodologies relate to specific examples but the concepts are equally applicable to other industries.