

TRIZ for Total Quality Management : Overview

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Abstract

This paper presents 40 inventive principles with applications in total quality management. We also propose how to integrate TRIZ tools into global problem-solving steps.

1. TRIZ [2]

1) Ideality

- IFR(Idea Final Result) : Limit of Ideality
- $Ideality = \frac{\sum benefits}{(\sum Costs + \sum Hacm)}$

2) Functional Analysis

- Tool(Subject) Acts on Object
- Su-Field Model : Subject Field, Pictorial Analysis, 76 Standard Solutions

3) Physical Contradictions

- I want X and I want anti-X and exaggerations of that statement.
- Inherent Contradictions
- Separation Principles

4) Technical Contradictions

- When X gets better, Y gets worse.
- 39 Parameter Features : Table 1
- 40 Inventive Principles : Table 2

5) DTC Operator

- Dimensions
- Time
- Cost

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Table 1. List of Altshuller 39 Parameter Features [3]

<ol style="list-style-type: none"> 1. Weight of moving object 2. Weight of stationary object 3. Length of moving object 4. Length of stationary object 5. Area of moving object 6. Area of stationary object 7. Volume of moving object 8. Volume of stationary object 9. Velocity 10. Force 11. Stress or pressure 12. Shape 13. Stability of object's composition 	<ol style="list-style-type: none"> 14. Strength 15. Duration of action generalized by moving object 16. Duration of action generalized by stationary object 17. Temperature 18. Brightness 19. Energy consumed by moving object 20. Energy consumed by stationary object 21. Power 22. Energy loss 23. Substance loss 24. Information loss 25. Waste of time 26. Quantity of a substance 27. Reliability 	<ol style="list-style-type: none"> 28. Accuracy of measurement 29. Manufacturing precision 30. Harmful actions affecting the design object 31. Harmful actions generated by the design object 32. Manufacturability 33. User friendliness 34. Repairability 35. Flexibility 36. Complexity of design object 37. Difficulty to control or measure 38. Level of automation 39. Productivity
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Table 2. List of Alcsuller 40 Inventive Principles [3]

<ol style="list-style-type: none"> 1. Segmentation 2. Removal 3. Local quality 4. Asymmetry 5. joining 6. Universality 7. The nesting principle 8. Counterweight 9. Preliminary counteraction 10. Preliminary action 11. Introducing protection in advance 12. Equipotentiality 13. Opposite solution 14. Spheroidality 15. Dynamism 	<ol style="list-style-type: none"> 16. Partial or excessive action 17. Moving into a new dimension 18. Use of mechanical vibrations 19. Periodic action 20. Uninterrupted useful effect 21. Rushing through 22. Turning harm into good 23. The feedback principle 24. The go between principle 25. The self service principle 26. The copying principle 27. Cheap short life instead of expensive longevity 28. Replacement of a mechanical pattern 	<ol style="list-style-type: none"> 29. Use of pneumatic or hydraulic solutions 30. Using flexible membranes and fine membranes 31. Using porous materials 32. Using color 33. Homogeneity 34. Discarding and regenerating parts 35. Changing the aggregate state of an object 36. The use of phase changes 37. Application of thermal expansion 38. Using strong oxidation agents 39. Using an inert atmosphere 40. Using composite materials
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2. 40 Principles with TQM Examples [4, 6, 7]

- 1) Principle 1: Customized Marketing - Complete Market Segmentation
- 2) Principle 2: Supplier Selection
- 3) Principle 3: Vital Few and Trivial Many
- 4) Principle 4: Asymmetrical Statistical Distributions; Customer Differentiation
- 5) Principle 5: Concurrent Engineering; Toyota JIT
- 6) Principle 6: International Standards; Multi - skilling of Work-Force
- 7) Principle 7: Organization Structure
- 8) Principle 8: Company Wide Quality Effort
- 9) Principle 9: Robust Design; APQP
- 10) Principle 10: Preventive Maintenance
- 11) Principle 11: Redundancy
- 12) Principle 12: Homogeneous Customer Sectors
- 13) Principle 13: Overcome Reluctance of Dissatisfied Customers to Complain;
MBWA
- 14) Principle 14: Quality Circle
- 15) Principle 15: Quality is a Moving Target
- 16) Principle 16: AQL
- 17) Principle 17: Multi-Disciplinary Cross-Functional Teams
- 18) Principle 18: Bring New-Blood / New Challenge into a Team; JIT Inventory in
SCM
- 19) Principle 19: Periodical Quality Auditing, Metrics, Reporting
- 20) Principle 20: QC; Kaizen
- 21) Principle 21: Promptly Remove Unvalid or Obsolete Documents; Rapid
Prototyping
- 22) Principle 22: Use Customer Complaints as Opportunities for Improvement
- 23) Principle 23: Corrective Actions and Follow-up
- 24) Principle 24: Third-Party External Quality Auditing
- 25) Principle 25: Self-Inspection
- 26) Principle 26: Use MBNQA as a Best Practice
- 27) Principle 27: Hire Temporary Employees for Non-Critical Positions
- 28) Principle 28: Electronic Communication
- 29) Principle 29: Introduction of Breathing Spaces into Contracts
- 30) Principle 30: Flat Organization Structure Advantage
- 31) Principle 31: Encourage Open-Mindedness of Employees to New Ideas
- 32) Principle 32: Brand Image
- 33) Principle 33: Hire Local People to Acquire Cultural Knowledge of Local
Customers

- 34) Principle 34: Downsizing
- 35) Principle 35: Team Structure Change
- 36) Principle 36: Phases of PERT-Planning, Scheduling, Improvement, Controlling
- 37) Principle 37: Empowerment
- 38) Principle 38: Reengineering
- 39) Principle 39: Nominal Group Technigue
- 40) Principle 40: Mix of Thinking in a Team

3. Implementation TRIZ Tools into Global Problem-Solving Steps

DMAIC Steps: Six Sigma	8-D Steps : Ford Motor Company	TRIZ Tools [1]
1. Define	0. Prepare for 8D Steps. 1. Establish a Team.	
	2. Describe the Problem.	1. Ideality 2. Resources 3. Smart Little People
2. Measure	3. Develop Interim Containment Action.	
3. Analysis	4. Define and Verify Root Cause and Escape Point. 5. Choose and Verify Permanent Corrective Action for Root Cause and Escape Point.	1. Ideality 2. Resources 3. Contradiction 4. Smart Little People 5. Su-Field
4. Improve	6. Implement and Validate Permanent Corrective Actions.	
5. Control	7. Prevent Recurrence.	
	8. Recognize Team and Individual Contributions	

Table 3. TRIZ into DMAIC and 8-D steps

4. Summary

· Putting TRIZ into QM Methodologies

- 1) TOC
- 2) Taguchi Methodology , Robust Design
- 3) QFD, Kano Model
- 4) VA/ VE [5]
- 5) FMEA [5]
- 6) Six Sigma
- 7) SE
- 8) Lean Thinking

- 9) Axiomatic Design
- 10) Eco-Innovation, Sustainable Service & Systems, Green Service
- 11) DOE
- 12) Machine Maintenance, TPM
- 13) Service Design
- 14) TPS
- 15) Motion & Time Study
- 16) E, M, U-Commerce
- 17) Software Process Improvement
- 18) SPC

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