



TRIZ

A Useful Tool For DFMA Innovations

Bradford L. Goldense

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Goldense Group, Inc. 1346 South Street Needham, MA 02492
Goldense Group, Inc. P. O. Box 350 Dedham, MA 02027
www.goldensgroupinc.com

Phone 781-444-5400
Fax 781-444-5475

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

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Agenda & Table of Contents

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Goldense Group, Inc. 1346 South Street Needham, MA 02492
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www.goldensgroupinc.com

Phone 781-444-5400
Fax 781-444-5475



TRIZ

Innovation Tools Landscape

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Landscape: Evolution

1970--2001--2006 **Explosion and Turnover in Available Tools**

- 1970 **4** **Readily Accessible Tools**
 - Meditation
 - Yoga
 - Six Thinking Hats®
 - Osborn's List
 - [TRIZ initially developed in 1946 in USSR
not available in US until 1992]

- 2001 **63** **Readily Accessible Tools**

- 2006 **57** **Readily Accessible Tools**

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Landscape: 2001 Master List of Tools & Software Packages

ACTA Advantage	Ideation International [TRIZ]	Serious Creativity [DeBono]
AliahThink [Math-Based DSS]	IDEGEN++	Simplex
Axon Idea Processor	In Control	Sirius
BrainStormer	InfoDepot	SmartOrg [Math-Based DSS]
Brainstorming 1.0.1	Innovation Toolbox	StoryBuilder
Brainstorming Toolbox	Inspiration	StoryCraft
CAVE [Virtual Reality]	Invention Machine [TRIZ-Like]	StoryCraftNew for Writers
CK Modeler	Max Think	SuperMemo
CM/1	MicMac	The Creativity Machine
ComedyWriter	Microsoft Word (Outlining Feature)	The Electric Brain
Corkboard/Three by Five	Microsoft Word (Thesaurus)	The Electric Mind
CreaPro	Mind Mapper	The Solution Machine
Creative Whack Pack	MindMan	Thoughtline
Decision Explorer	MoonLite	Thoughtpath
Dramatica	MORE	Turbo Thought
DynoNotePad	Paramind	Visimap / InfoMap
Genius Handbook	Personal Best 3.1	VisionQuest
GroupSystems	Plot Prompt	Visual Outliner
Grouputer	Plots Unlimited	WinGrid
Idea Generator Plus	PowerPoint	WordPerfect (Thesaurus)
IdeaFisher	Scriptware	YeahWrite

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Landscape: 2001 vs. 2006 Comparison of Tools & Software Packages

2001--2006 Significant Turnover in Available Tools

90 Total number of tools listed by combining 2001 & 2006 inventories, after eliminating duplicates

2001--2006 **36** Discontinued

40% Discontinued

2001--2006 **19** New Tools

21% New Tools

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Landscape: 2006 Master List of Tools & Software Packages

Outliners, Sketchpad and/ or Text Manipulators

Axon Idea Processor*
BrainMine*
BrainStorm*
Dramatica
MaxThink*
Microsoft Word (Outlining)
Microsoft Word (Thesaurus)
Microsoft PowerPoint
MindManager*
MINDMAP*
MindMapper*
MORE
Paramind
Plots Unlimited
Scriptware
StoryBuilder
Thoughtline
Visimap*
Visual Outliner
WordPerfect (Thesaurus)

Self Help/Group Help

**Access Your Sub-Conscious
Association Via Abstractions
of Topics & Candidate
Solutions**
Sylvia Web BrainStormer*
Brainstorming 1.0.1*
Brainstorming Toolbox*
Creative Whack Pack*
Creator Studio*
Decision Explorer*
**Creative Thinker
(formerly Idons-for-Thinking)***
Inspiration*
Meditation
Osborn's List*
Scenarios*
Six Thinking Hats*
Storyboarding*
The ah ha Discovery Deck*
Visual Concept*
Yoga

Emphasis on Sharing Knowledge

GroupSystems*
GrouputerNet*
iBank*
Idea Management*
Jenni*
wiki*

Emphasis on Sharing & Structuring Knowledge

BrainEKP*
Brightidea.com*
Compendium*
CREAX Innovation Suite*
Idea Central*
Idea Manager*
KJ Method*

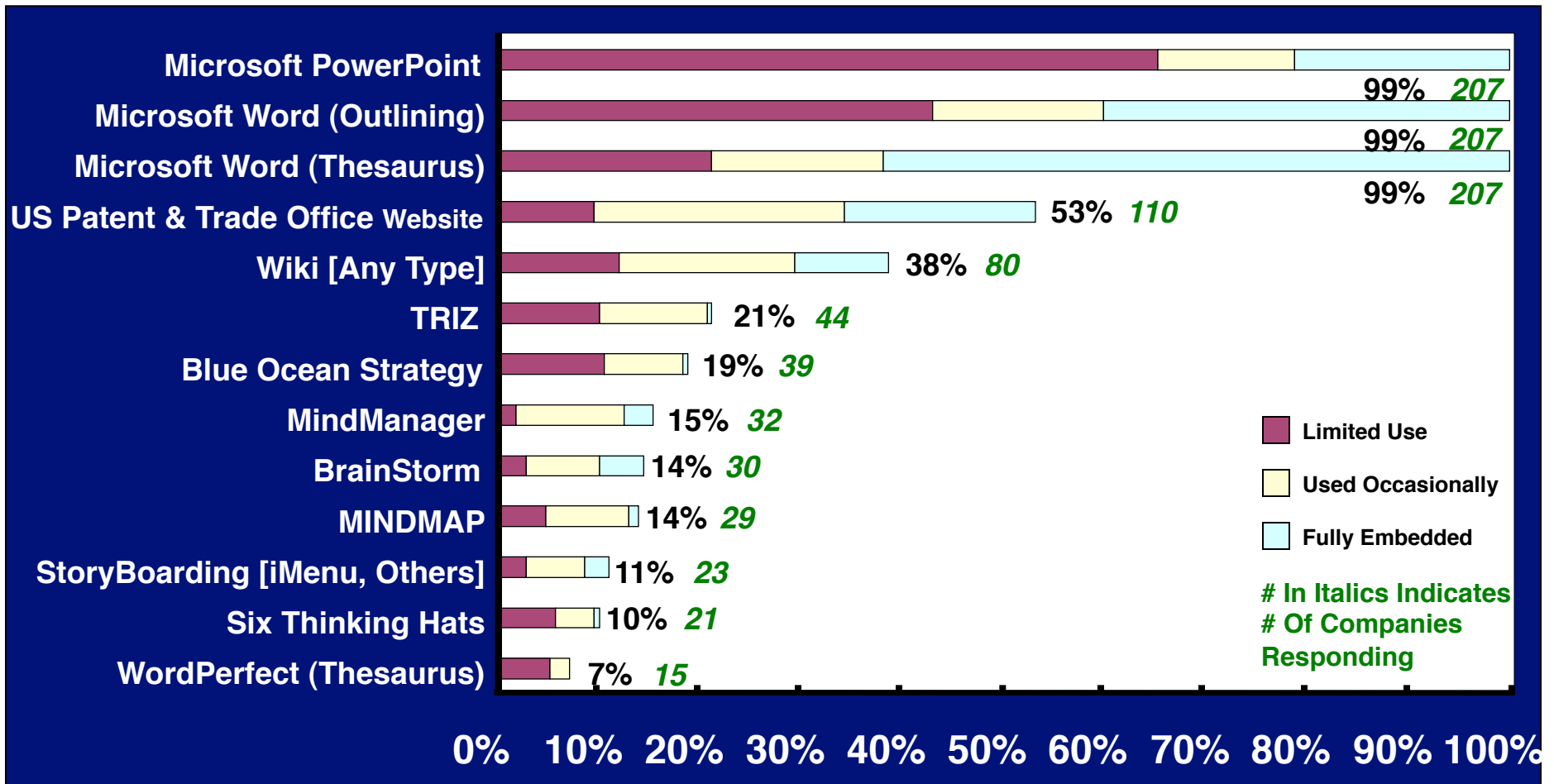
Emphasis on Sharing, Struct- uring & Increasing Knowledge

Goldfire Innovator*
Innovation Workbench*
Lead Users*
TriSolver4.net*
TRIZ*
USPTO Patent Research Tools*

Source: Goldense Group, Inc., Needham, MA, 2006.

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Landscape: Top Tools Utilized By Industry



QUESTION: E1. Are any of the tools below “currently available to employees?” If so, are they “used on occasion,” or “fully embedded in our approach” during product management, product design, product development, or project management activities at your company? [Check One Box For Each Tool ..or.. Leave Blank If Line Item Is Not Available Through Your Company]

Number of Respondents = 208, Margin of Error = +/- 6%

08PDMS-E1-E1v1

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TRIZ

TRIZ Parameters

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Parameters: Introduction

TRIZ (Theory of Inventive Problem Solving) was developed by a mechanical engineer working in the patent department of the Russian Navy, starting in the 1940s

Radical and fundamental assumption of TRIZ:

- Inventiveness and creativity can be taught

An empiricist (looked for patterns from existing practices) who searched patents for the most effective innovative principles

As an empiricist, he developed theories, but also numerous lists that summarized his findings

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

CPD-424011a

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Parameters: Origin & History

Genrich Saulovich Altshuller

10-15-26 to 9-24-98

Soviet Navy, Invention Inspections Dept.

1946: Started TRIZ.

1950: Wrote A Letter To Stalin. Arrested. 25 Year Sentence.

1953: Stalin Died

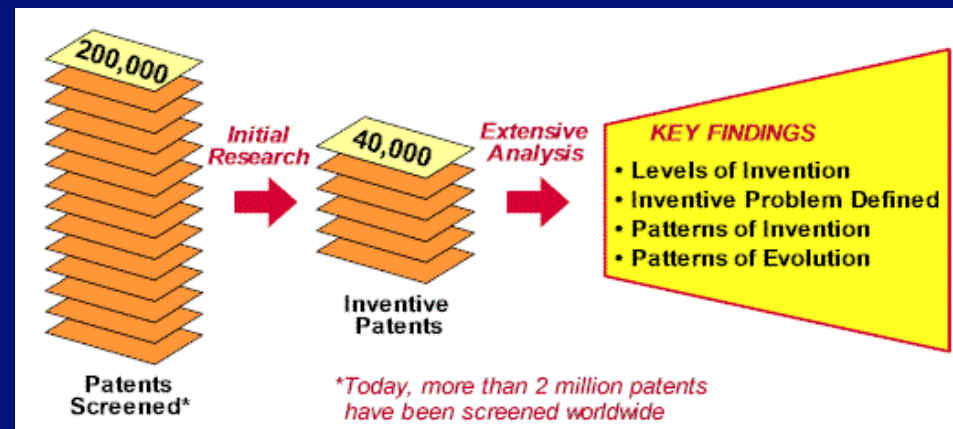
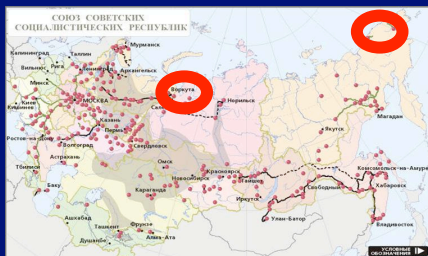
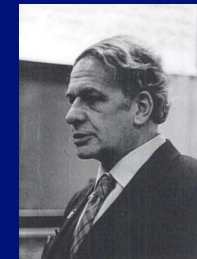
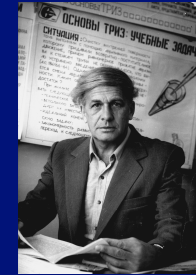
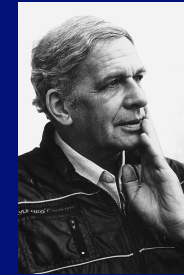
1954: Altshuller Released.

1956: First Paper Published.

1969: 40,000 Patents Reviewed.

1989: Russian TRIZ Association.

1995: Altshuller Institute, Boston.



TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Parameters: Nomenclature

acronym for

Teoriya Resheniya Izobreatatelskikh Zadatch

- a **methodical** way of examining inventive situations and developing numerous **solution concepts** by utilizing all available **solution spaces**.
- based on the study of **empirical data** from **patents**, rather than psychology.



Source: Richard Langevin, Executive Director, The Altshuller Institute For TRIZ Studies, 100 Barber Avenue, Worcester, MA, 01606, USA, 508-799-9944, richard@triz.org, "TRIZ: *Technology for Manufacturing Innovation*." GGI Innovation Summit 12, April 8, 2015, Norwood, MA.

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Parameters: Foundation Principles

**Systems evolve according to
objective patterns.**

- Evolution is not a random process.
- Recognized “Patterns” allow for the **conscious development of systems** in place of trial-and-error methods.



Source: Richard Langevin, Executive Director, The Altshuller Institute For TRIZ Studies, 100 Barber Avenue, Worcester, MA, 01606, USA, 508-799-9944, richard@triz.org, “TRIZ: *Technology for Manufacturing Innovation.*” GGI Innovation Summit 12, April 8, 2015, Norwood, MA.

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Parameters: Improve Thinking

**“TRIZ is a tool for
strong thinking but
not instead of thinking”**

Г. Алтшуллер

G. Altshuller

Thank you!



Source: Richard Langevin, Executive Director, The Altshuller Institute For TRIZ Studies, 100 Barber Avenue, Worcester, MA, 01606, USA, 508-799-9944, richard@triz.org, “TRIZ: *Technology for Manufacturing Innovation.*” GGI Innovation Summit 12, April 8, 2015, Norwood, MA.

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Parameters: Hypotheses

Hypotheses for Innovation from Genrich Altshuller

All innovations emerge from a small number of inventive principles

Technology evolutionary trends are highly predictable

Seek out conflicts and eliminate them through inventive principles

Do not accept compromise, as trade-offs produce weak solutions

Source: Systematic Innovation Using TRIZ pdf at www.creax.com

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Parameters: Trade-Offs Degrade Design Robustness

**Do Not Accept
Compromise, as
Trade-Offs
Produce Weak
Solutions**

A trade-off is a degraded adjustment of one technical characteristic to simultaneously improve another characteristic

Alternatives to trade-offs:

Use the TRIZ Contradiction Table to identify another characteristic that can be adjusted without degradation, leaving the first one unchanged

Consider a physical parameter that can be changed in time or space

Consider another technical domain

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Parameters: Outcomes

**All Innovations
Emerge From A
Small Number
Of
Inventive
Principles**

Created a list of 40 “**Inventive Principles**” from 400,000 patents

Created a list of 39 “**Characteristics**” that technologists optimize

Created a matrix, “**Contradiction Table**,” connecting principles & characteristics to summarize inventive practice

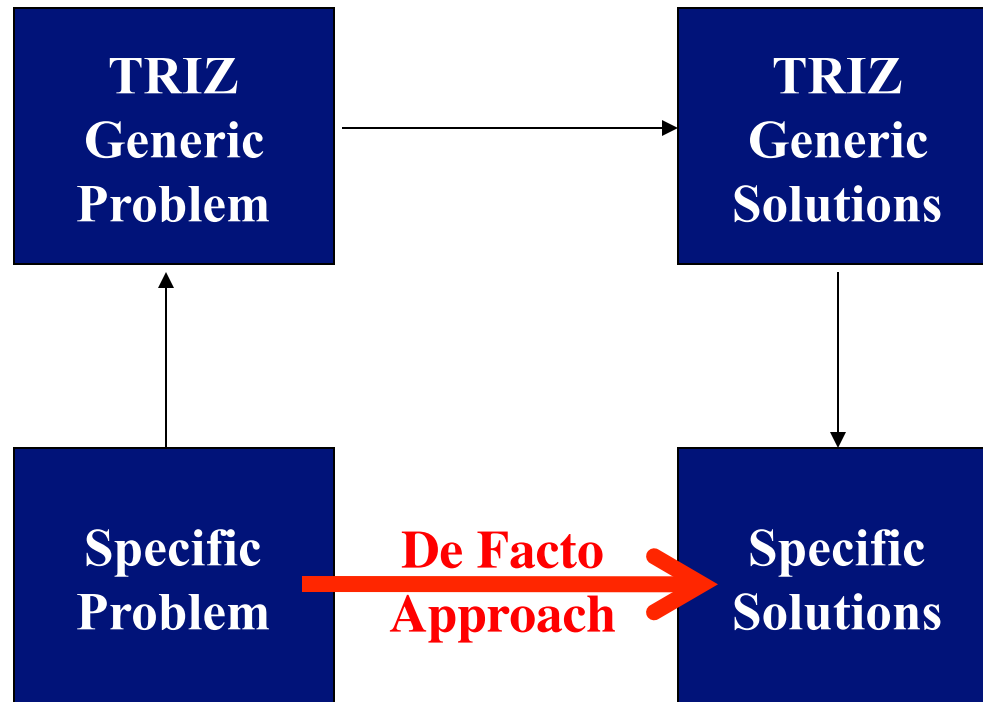
Contradiction Table summarizes a huge amount of successful innovation in a compact form

Source: Systematic Innovation Using TRIZ pdf at www.creax.com

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Parameters: Outcomes - Flowchart

Sequence of
“Specific to
Generic to
Generic to
Specific” Allows
Innovators To
Consider All
Technologies &
Physical
Changes For
Solution



TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Parameters: Outcomes - 39 Characteristics that Technologists Optimize

Based on his patent research, Genrich Altshuller identified 39 characteristics that technologists optimize.

- | | | |
|---------------------------------|--------------------------------------|---------------------------|
| 1. Weight of moving object | 16. Durability of nonmoving object | |
| 2. Weight of nonmoving object | 17. Temperature | |
| 3. Length of moving object | 18. Brightness | 31. Harmful side effects |
| 4. Length of nonmoving object | 19. Energy spent by moving object | |
| 5. Area of moving object | 20. Energy spent by nonmoving object | |
| 6. Area of nonmoving object | 21. Power | 32. Manufacturability |
| 7. Volume of moving object | 22. Waste of energy | 33. Convenience of use |
| 8. Volume of nonmoving object | 23. Waste of substance | 34. Repairability |
| 9. Speed | 24. Loss of information | 35. Adaptability |
| 10. Force | 25. Waste of time | 36. Complexity of device |
| 11. Tension, pressure | 26. Amount of substance | 37. Complexity of control |
| 12. Shape | 27. Reliability | 38. Level of automation |
| 13. Stability of object | 28. Accuracy of measurement | 39. Productivity |
| 14. Strength | 29. Accuracy of manufacturing | |
| 15. Durability of moving object | 30. Harmful factors acting on object | |

Source: James Braham, "Inventive Ideas Grow On Triz," Machine Design, October 12, 1995, Page 56

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Parameters: Outcomes - 40 Inventive Principles

Based on his patent research, Genrich Altshuller identified 40 inventive principles for eliminating technical contradictions.

- | | | |
|-------------------------|---|-----------------------------|
| 1. Segmentation | 16. Partial or overdone action | 31. Use of porous material |
| 2. Extraction | 17. Moving to a new dimension | 32. Changing the color |
| 3. Local Quality | 18. Mechanical vibration | 33. Homogeneity |
| 4. Asymmetry | 19. Periodic action | 34. Reject/regenerate parts |
| 5. Combining | 20. Continuity of useful action | 35. Transform phys./chem. |
| 6. Universality | 21. Rushing through | 36. Phase transition |
| 7. Nesting | 22. Convert harm to benefit | 37. Thermal expansion |
| 8. Counterweight | 23. Feedback | 38. Use strong oxidizers |
| 9. Prior counter-action | 24. Mediator | 39. Inert environment |
| 10. Prior action | 25. Self-service | 40. Composite materials |
| 11. Cushion in advance | 26. Copying | |
| 12. Equipotentiality | 27. Inexpensive short-lived vs. expensive durable | |
| 13. Inversion | 28. Replacement of a mechanical system | |
| 14. Spheroidality | 29. Use pneumatic or hydraulic construction | |
| 15. Dynamicity | 30. Flexible film or thin membrane | |

Source: James Braham, "Inventive Ideas Grow On Triz," Machine Design, October 12, 1995, Page 56

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Parameters: Outcomes - Contradiction Table

Contradiction Table links 39 characteristics (on axes) to the inventive principles (total of 40 in matrix) that are relevant to solve problem

*Undesired Result
Degraded Feature*

Feature To Improve

	1. Weight of Moving Object	2. Weight of NonMoving Object	...	14. Strength	...	38. Level of Automation	39. Productivity
1. Weight of Moving Object							
2. Weight of NonMoving Object							
...							
38. Level of Automation							
39. Productivity							

Proposed solution pathways:
 28. Replace a mechanical system w/ a non mech system
 27. An inexpensive short-life object instead of exp. durable
 18. Mechanical vibration
 40. Composite Materials

Source: James Braham, "Inventive Ideas Grow On Triz," Machine Design, October 12, 1995, Page 56

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Parameters: Outcomes

Technology Evolution Trends Are Highly Predictable	Engineering principles and contradictions are stable across time and across technical domains
	Technology evolution follows 8 patterns with 3 especially relevant
	Need to evaluate proposed solutions compared with the evolution of state-of-art

Source: Systematic Innovation Using TRIZ pdf at www.creax.com

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Parameters: Outcomes - 8 Patterns of Technical Evolution

Patterns Of Technical Evolution

- 1 Completeness of parts of the system
- 2 Energy conductivity of a system
- 3 Harmonizing the rhythm of the parts of the system
- 4 Increasing the idealness of the system
- 5 Uneven development of parts of the system ←
- 6 Dynamization (transition to a super-system)
- 7 Transition from macro to micro level ←
- 8 Increasing the S-Field development ←

3
**Especially
Relevant**



TRIZ

TRIZ Exercise

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EXER#275-010

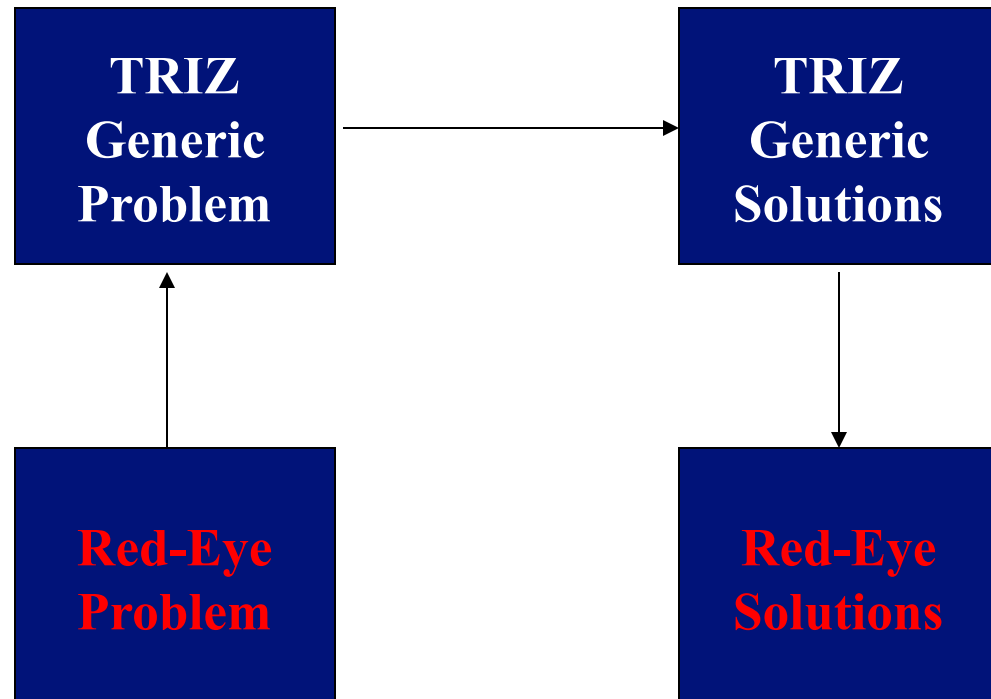
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Exercise: Framework

**E
X
E
R
C
I
S
E**

TRIZ Problem Solving Steps for Red-Eye Problem

Sequence of
“Specific to
Generic to
Generic to
Specific” Allows
Innovators To
Consider All
Technologies &
Physical
Changes For
Solution



Source: <http://208.55.133.111/archives/2001/07/f/index.htm> at www.triz-journal.com

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TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

TRIZ: Problem Definition

E
X
E
R
C
I
S
E

Case Study in TRIZ: Anti Red-Eye Flash Photography

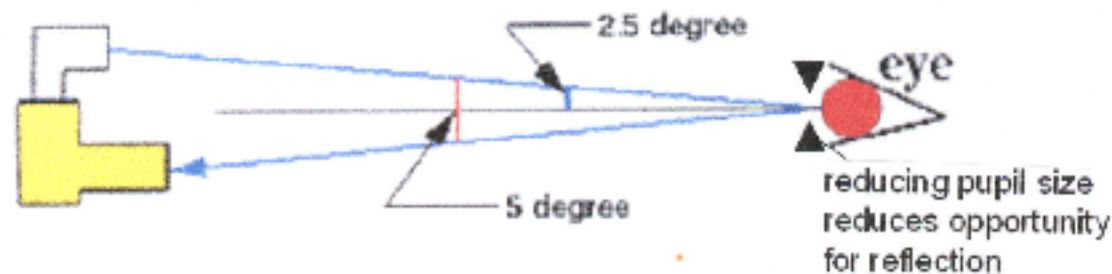


Figure 2: Red-Eye Phenomenon

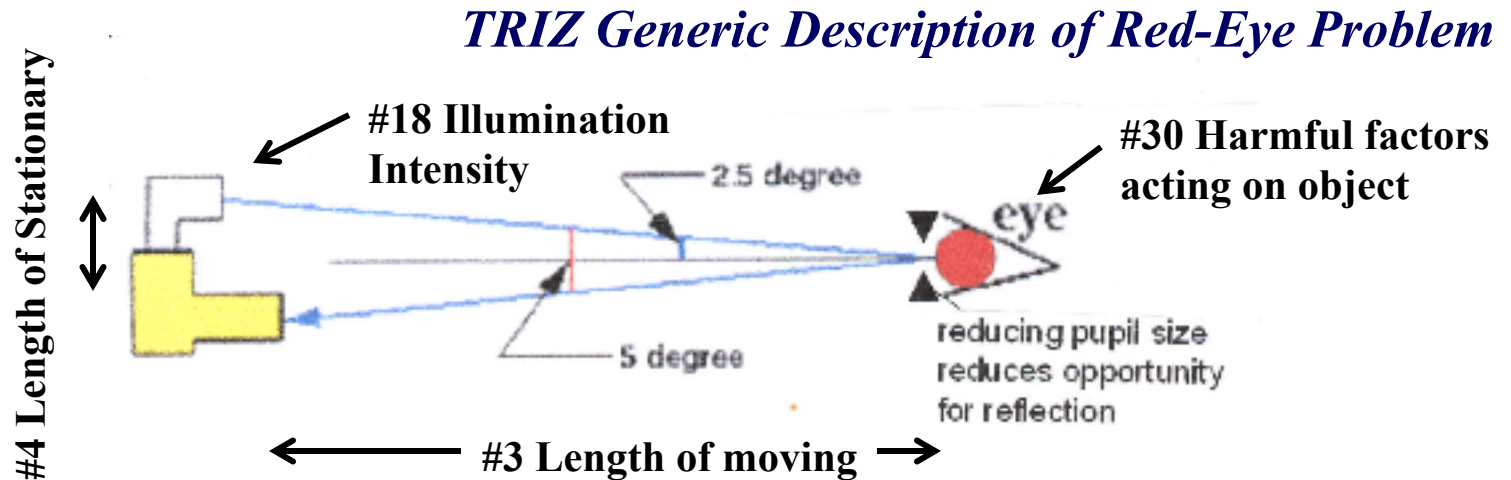
Specific Problem Parameters:

- **Element to be improved: red-eye**
- **Solution directions:**
 - **Reduce distance between subject & camera**
 - **Increase separation between flash & lens**
 - **Change the amount of light**

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

TRIZ: Generic Description

E
X
E
R
C
I
S
E



Generic Problem Characteristics that Technologists Optimize:

- Element to be improved: Harmful factors acting on object
- Solution directions:
 - Object Affected vs. Length of Moving
 - Object Affected versus Length of Stationary
 - Object Affected versus Illumination Intensity

Source: <http://208.55.133.111/archives/2001/07/f/index.htm> at www.triz-journal.com

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

TRIZ: Contradictions

**E
X
E
R
C
I
S
E**

Contradiction Table for Red-Eye Problem

*Same list of 39
Characteristics you do not
want to degrade (no
compromise accepted)*

*Same list of 39
Characteristics you
want to improve*

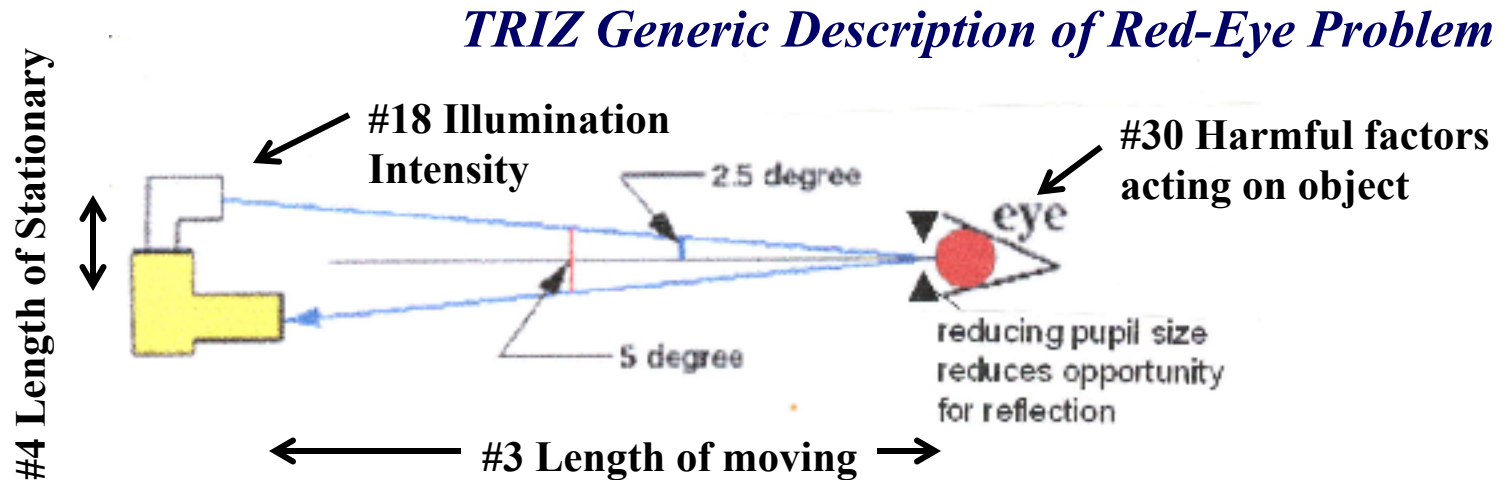
**Look here for Inventive
Principles to solve Red-
Eye Problem.**

1. ...	3. Length of Moving	4. Length of Stationary	18. Illumination	30. Harmful Factors Act Object	38. ...	39. ...
1. ...						
3. Length of Moving						
4. Length of Stationary						
18. Illumination						
30. Harmful Factors Acting on Object						

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

TRIZ: Inventive Principles

E
X
E
R
C
I
S
E



Inventive Principles from Contradiction Table:

- Element to be improved: Harmful factors acting on object
- Solution directions: (#'s below are Inventive Principles)
 - Object Affected vs. Length of Moving: 17, 1, 39, 4
 - Object Affected vs. Length of Stationary: 1, 18
 - Object Affected vs. Illumination Intensity: 1, 19, 32, 13

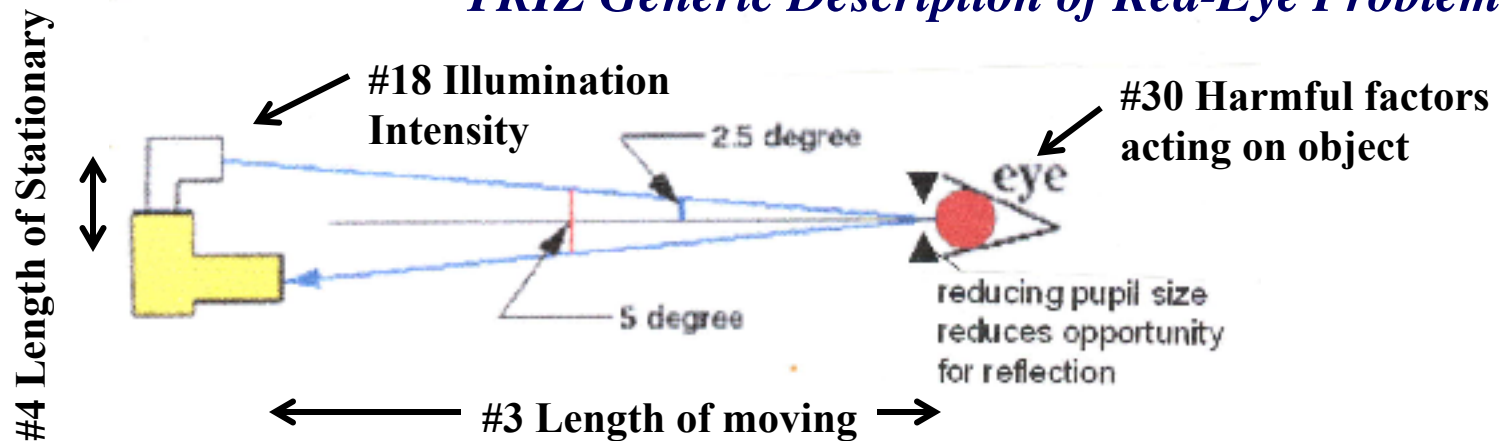
Source: <http://208.55.133.111/archives/2001/07/f/index.htm> at www.triz-journal.com

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

TRIZ: Generic Solutions

**E
X
E
R
C
I
S
E**

TRIZ Generic Description of Red-Eye Problem



Possible Generic Solutions using the Inventive Principles from the Contradiction Table:

- # 1 Segmentation (likely to be fruitful as appears 3 times)
- # 4 Asymmetry
- #13 Inversion
- #17 Moving to a new dimension
- #18 Mechanical vibration
- #19 Periodic action
- #32 Changing the color
- #39 Inert environment



TRIZ

TRIZ & Semantic Technology

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Semantic Technology: Inventory - Sharing, Structuring & Increasing Knowledge

Name of Tool Goldfire Innovator

Primary Supplier IHS [formerly Invention Machine Corporation]

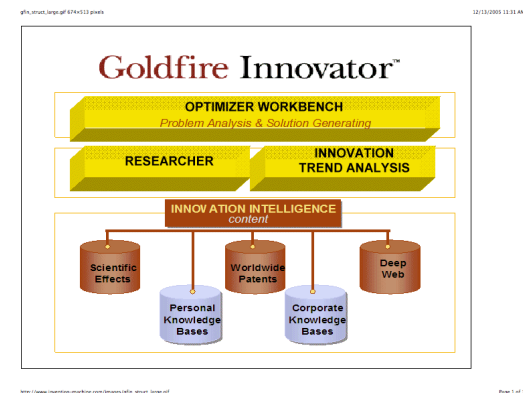
617 305-9250 www.invention-machine.com

Capability Analysis

	IDENTIFY	CAPTURE	EVAL	DOCUM'T	REGISTR	MANAGE
Manual	Yes	Yes	Yes	Yes		
Automated	Yes	Yes	Yes	Yes		

*Description

Original products were based on the principles of TRIZ. Its recent product, Goldfire Innovator, includes software support for research, analysis and synthesis, as shown in the adjacent drawing.



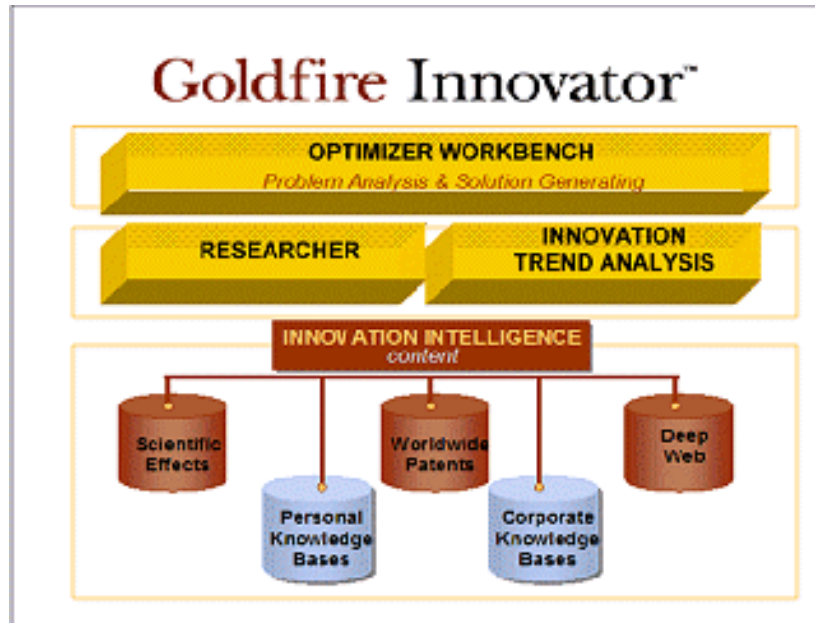
*Source: <http://www.invention-machine.com>, www.innovationtools.com/Resources/ideamgmt-details.asp?a=147

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Semantic Technology: Inventory - Sharing, Structuring & Increasing Knowledge

Goldfire Innovator

InventionMachine™



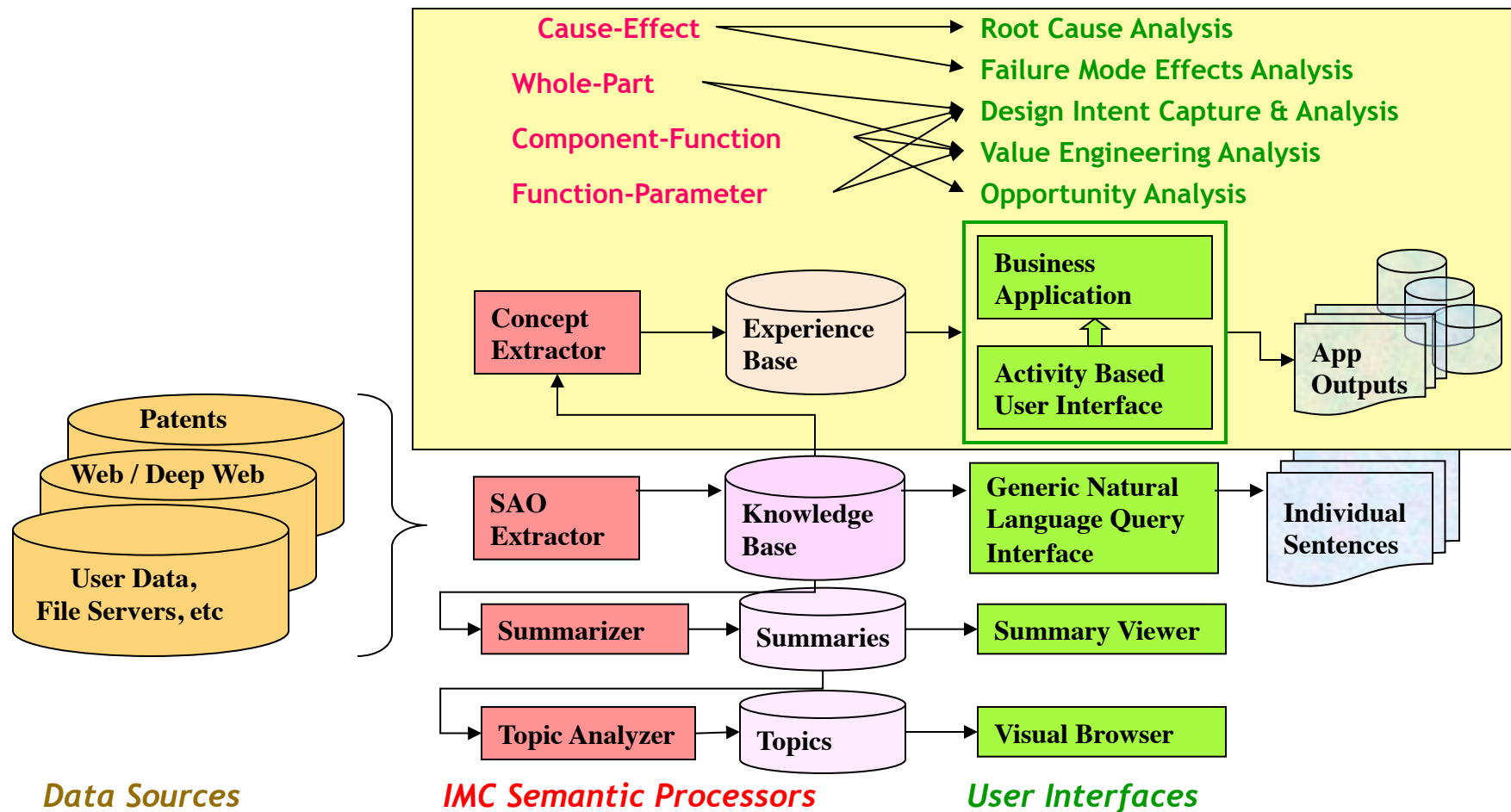
- Combination of **TRIZ & Semantic Processor**
- **TRIZ**
 - Offers generic solutions
- **Semantic Processor - Google, only better**
 - Used to search for ideas that provide specific solutions for a TRIZ generic solution
 - Searches web and databases based on understanding of subject, verb, object & other parts of speech in a query sentence.
 - Likely to return much more meaningful responses than standard search engines for queries like: “The stopper stops water from going down the drain.”

Source: <http://www.invention-machine.com>

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Semantic Technology: Problem Solving Is A Common Job - Capabilities Today

State of the Art Semantic System



Source: James W. Todhunter, EVP & CTO, Invention Machine Corporation, 28 State Street, Boston, MA, 02109, USA, 617-305-9250, jtodhunter@inventionmachine.com, "Innovation & Semantics: The Integration of Inventive Problem Solving with Semantic Concept Retrieval." GGI Innovation Summit 11, September 26, 2012, Norwood, MA.

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Semantic Technology: Problem Solving Is A Common Job - Many Facets

Knowledge Integration in Innovation Workflows

Methodologies

- Root Cause Analysis
- Function Modeling
- Value Engineering
- Predictive Analysis
 - FMEA
 - FMECA
 - HACCP
 - HAZOPS
- TRIZ
- Patent Busting

Activities

- Research
- New Product Development
- Risk Management
- Fault Diagnosis
- Product Repair
- Quality Management
- Market Analysis
- IP Leverage

Business Processes

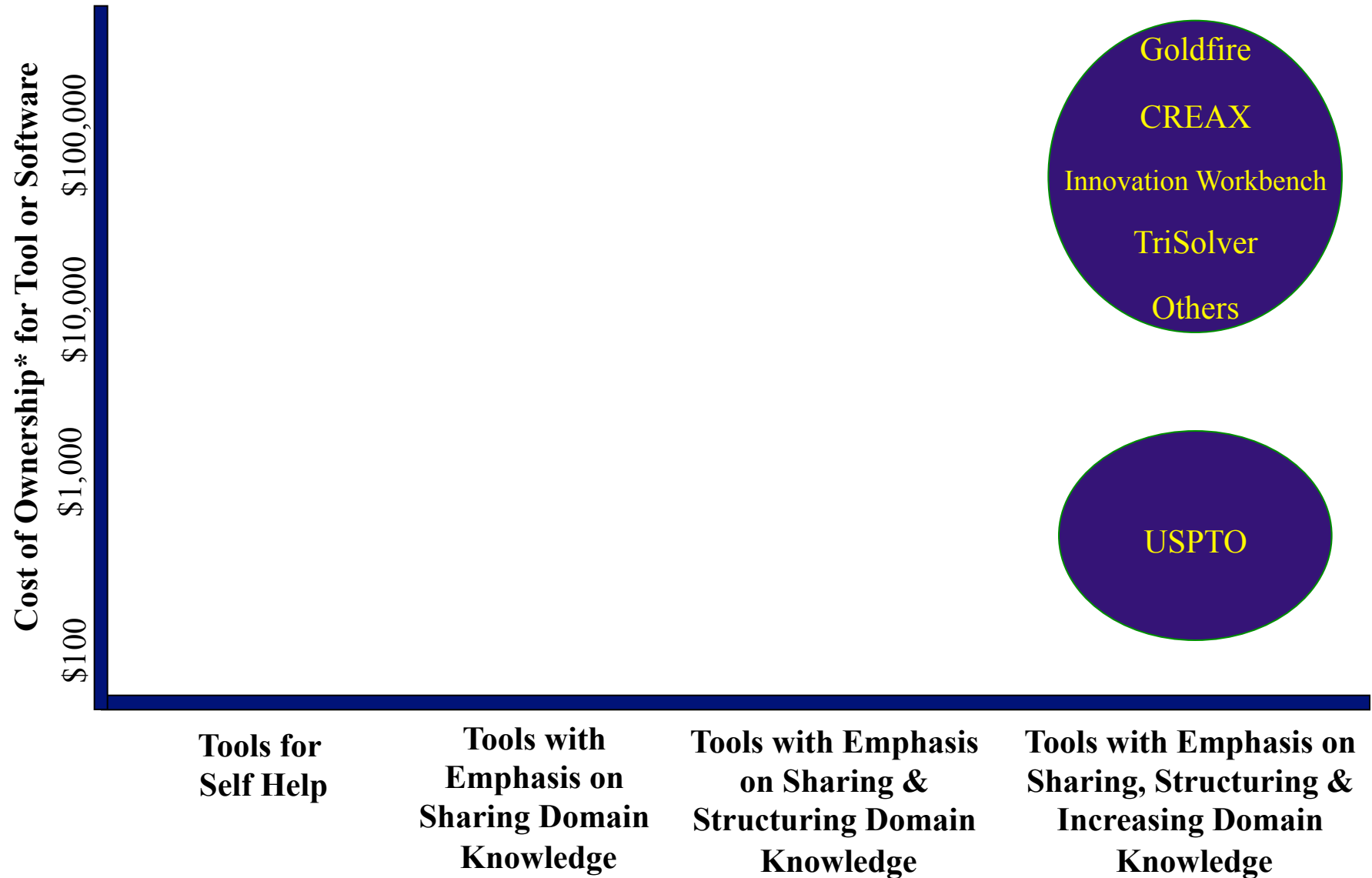
- Six Sigma
- Stage Gate
- Toyota Method
- Lean
- QFD
- FRACAS
- New Market Assessment
- IP Review
- Communities of Practice



Source: James W. Todhunter, EVP & CTO, Invention Machine Corporation, 28 State Street, Boston, MA, 02109, USA, 617-305-9250, jtodhunter@inventionmachine.com, *"Innovation & Semantics: The Integration of Inventive Problem Solving with Semantic Concept Retrieval."* GGI Innovation Summit 11, September 26, 2012, Norwood, MA.

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Semantic Technology: USPTO Search vs. Tools With TRIZ Underpinnings



*Ownership = Acquisition + System Implementation + Learning Curve



TRIZ

Summary

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Summary: Limitations of TRIZ

Training	Significant training required: Historically, several hundred hours per person, GGI now estimates at least 15 days
Problem Definition	Sensitive to accurate generic problem definition (based on the specific problem) to identify conflicts (opportunities) for innovation
Multiple Domains	Requires individuals doing data searches to collectively have technical knowledge across multiple domains, or access to technical knowledge across multiple domains
Technical Trends	Requires understanding of technical trends in multiple domains as a sanity check on proposed solutions.

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Summary: Compatible Innovative Tools

**In Principle,
Can Use Any
Innovative Tool
With Triz**

Six Thinking Hats® is useful for encouraging different points-of-view when making the TRIZ transition from specific problem to generic problem to generic solution to specific solution

DFMA is useful to give direction to which 39 characteristics to optimize for improved assembly or manufacturability

Semantic Processing is useful for rapid searching of technical data that are candidates for making the transition from generic solution to specific solutions

TRIZ: A USEFUL TOOL FOR DFMA INNOVATIONS

Summary: List of Empirical Lists

- 39 Characteristics Technologists Optimize
- 40 Inventive Principles
- 8 Fundamental Patterns of Technical Evolution
- 4 Physical Contradictions [Not Discussed Today. See Literature.]
- 4 TRIZ Analysis:
 - 3 • Function Types [Not Discussed Today. See Literature.]
 - Function Ranks [Not Discussed Today. See Literature.]
- 76 Standard Inventive Solutions [Not Discussed Today. See Literature.]

GGI Comment ***This list of lists is a major reason why software enablement is useful.***

REFERENCES

- Altshuler, Genrich. 40 Principles: Triz Key To Technical Innovation. Technical Innovation Center, 1995.
- Braham, James. Inventive Ideas Grow On Triz. Machine Design, October 12, 1995.
- De Bono, Edward. Six Thinking Hats. Little, Brown & Company, 1985.
- Goldense, Bradford L. 2008 Product Development Metrics Survey: Research Summary. Goldense Group, Inc., May 15, 2008.
- Langevin, Richard. TRIZ: Technology for Manufacturing Innovation. The Altshuller Institute For Triz Studies, April 8, 2015.
- Mann, Darrell. Case Studies In Triz: Anti Red-Eye Flash Photography. The Triz Journal, July 13, 2001.
- Osborn, Alex. Applied Imagination: Principles and Procedures of Creative Thinking. Scribners, 1985.
- Rantanen, Kalevi and Domb, Ellen. Simplified: Triz - New Problem-Solving Applications For Engineers And Manufacturing Professionals. St. Lucie Press, 2002.
- Todhunter, James W. Innovation & Semantics: The Integration of Inventive Problem Solving with Semantic Concept Retrieval. Invention Machine Corp., September 26, 2012.
- Von Oech, Roger. Creative Whack Pack. Roger Von Oech, 1989.