

TRIZ SUMMIT 2024



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“Inventive Problem-Solving in the Age of AI: Integrating TRIZ

Название доклада and Generative AI”

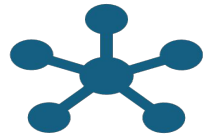


Introduction

- Invention as the cornerstone of human progress
- Challenges in the invention process:
 - Psychological barriers
 - Technical complexities
- TRIZ: A systematic approach to problem-solving and fostering creativity
- Generative AI: The emergence of a powerful tool to augment human invention



TRIZ: A Systematic Approach to Invention



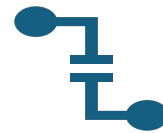
Core Principles:

Ideality

Contradictions

Resources

Patterns of Evolution



Tools and Techniques:

Contradiction Matrix

ARIZ

Substance-Field

Analysis

40 Inventive

Principles

The Role of Generative AI in Invention



Potential in
Invention:



Augmenting
human
creativity



Overcoming
psychological
inertia



Integrating
with TRIZ
tool

The Human-TRIZ-Generative AI Triad: A Collaborative Framework



Human Role:

Domain
expertise

Critical
thinking

Contextual
understanding



TRIZ Role:

Structured
methodology

Problem
analysis

Contradiction
resolution



Generative AI

Computational
power

Data-driven
insights

Exploration of
vast solution
space

The Human and AI Roles in Each Phase of Problem Solving

Aspect	Before AI Integration	With AI Integration
Problem Analysis and Definition	Human Role: Solely responsible for identifying and defining problems based on domain expertise, experience, and intuition. Time-consuming and prone to biases.	AI Role: Assists in processing large datasets, identifying patterns, and suggesting problem areas. Human Role: Refines problem definitions, ensures AI's understanding aligns with real-world issues.
Application of TRIZ Tools	Human Role: Manually applies TRIZ tools like the Contradiction Matrix and 40 Inventive Principles. Requires deep TRIZ knowledge, limiting non-experts.	AI Role: Automates TRIZ tools application, making them accessible to non-experts. Analyzes contradictions, suggests principles, and generates solutions. Human Role: Evaluates and refines AI suggestions.
Idea Generation and Evaluation	Human Role: Generates ideas based on problem understanding and TRIZ principles. Limited by individual creativity and resources. Evaluation is subjective.	AI Role: Uses generative models to propose novel solutions, expanding the solution space. Human Role: Evaluates feasibility, practicality and relevance of AI-generated

Collaborative Advantage



- Enhanced problem analysis
- Wider range of creative solutions
- Objective evaluation process
- Examples of AI-powered TRIZ tools:
 - Root Causes Analysis
 - Mechanism Oriented Search (MOS)
 - Resource Innovator for Non-Engineering
 - Systematic Idea Generation

Practical Examples and Prompts

- Integration of generative AI with traditional TRIZ tools.
- Use of generative AI prompts for enhanced idea generation.

Root Causes Analysis



Root Cause Analysis V 1.2

By Tanasak Pheunghua 

Interactive RCA Process with User Input (TRIZ)

<https://chatgpt.com/g/g-6UYeHZuzn-root-cause-analysis-v-1-2>

Root Causes Analysis

Example:

A leak was detected in the aluminum heat exchanger (condenser) component of an automotive air conditioning system. This defect was identified during the inspection process following the brazing operation.



Root Cause Analysis V 1.2

By Tanasak Pheunghua 

Interactive RCA Process with User Input (TRIZ)

Identify root causes of a system failure

Analyze an Engineering Problem

Root Causes Analysis

Step 1: Identifying Relevant Scientific or Engineering Principles

- 1. Heat Transfer and Thermal Expansion:**
- 2. Material Properties of Aluminum:**
- 3. Brazing Process:**
- 4. Fluid Dynamics:**
- 5. Metallurgical Factors:**
- 6. Leak Detection Methods:**

Root Causes Analysis

Step 3: Analyzing Potential Root Causes

- 1. Inadequate Brazing Process:**
- 2. Contamination in Brazing Area:**
- 3. Aluminum Alloy Defects:**
- 4. Thermal Stress Cracks:**
- 5. Design Flaws:**
- 6. Improper Assembly:**
- 7. Faulty Leak Detection Method:**

Root Causes Analysis

Step 4: Investigation Guidelines

- 1. Inspect Brazing Process Parameters:**
- 2. Contamination Check:**
- 3. Material Quality Assessment:**
- 4. Thermal Stress Analysis:**
- 5. Design Review:**
- 6. Assembly Verification:**
- 7. Leak Detection Test Review:**

Root Causes Analysis

Benefit	How to Work Together with Human
Enhanced Accuracy	Interactively identify scientific or engineering principles relevant to the problem. GPT will ask Human for additional details.
Comprehensive Analysis	Determine the expertise required and confirm with the Human for completeness.
Clear Presentation of Findings	GPT will present potential root causes in a tabulated format for clarity and comprehensiveness.
Guided Investigation	Provide guidelines for detailed investigations, including methods, tools, and procedures, and seek Human input for additional suggestions.
Effective Containment Actions	GPT will propose containment, corrective, and preventive actions in a structured format.
Collaborative Problem Solving	Engage the Human at each step to gather insights and confirmations, ensuring a thorough RCA.

Mechanism Oriented Search (MOS)



Mechanism Oriented Search (MOS)

By Tanasak Pheunghua 

A modified tool from FOS for TRIZ problem solving that identifies similar mechanism of the problem

<https://chatgpt.com/g/g-oRs08uWkd-mechanism-oriented-search-mos>

Mechanism Oriented Search (MOS)

Example:

Detecting signs of wear and tear in machinery to perform maintenance before a failure occurs. This involves monitoring various parameters such as vibration, temperature, and noise.



Mechanism Oriented Search (MOS)

By Tanasak Pheunghua

A modified tool from FOS for TRIZ problem solving that identifies similar mechanism of the problem

Find similar
Problem
mechanisms in...

Can you analyze
the mechanism
of my system?

What is the
abstract
mechanism here?

How does this
technology
compare across...



Message Mechanism Oriented Search (MOS)



Mechanism Oriented Search (MOS)

Industrial Domain	Similar Mechanism of the Problem	Key Technologies	Action Principle
Automotive	Detecting early signs of engine or transmission issues	OBD-II systems, vibration sensors, thermography	Monitoring engine parameters and predicting failures
Aerospace	Monitoring aircraft component health	Acoustic emission sensors, thermal imaging	Identifying deviations in aircraft component performance
Healthcare	Early detection of health issues in patients	Wearable sensors, MRI, ECG	Monitoring vital signs and predicting health problems
Power Generation	Identifying wear in turbine blades or generator components	Vibration analysis, thermal cameras	Continuous monitoring and predictive maintenance

Mechanism Oriented Search (MOS)

Benefit	How to Work Together with Human
Identifies Cross-Industry Solutions	Human provides the initial problem from a specific system.
Provides Mechanism Analysis	GPT analyzes the mechanism of the problem in the initial system.
Facilitates Creative Problem-Solving	Human collaborates by reviewing and refining the analysis.
Offers Abstract Mechanism Statements	GPT formulates a generic mechanism statement for broader use.
Presents Diverse Industry Comparisons	Human suggests additional industries or provides feedback.
Enhances Technological Insight	GPT searches for similar mechanisms in different industries.
Organizes Information Clearly	Human evaluates the presented information for practicality.
Saves Time in Research	GPT compiles detailed and organized data in tabular format.
Promotes Innovation	Human applies insights to develop innovative solutions.

Resource Innovator for Non-Engineering



Resource Innovator for Non-Engineering

By Tanasak Pheunghua 

Help users from non-engineering backgrounds apply TRIZ's resource-focused approach to innovation and problem-solving in their respective fields.

<https://chatgpt.com/g/g-Udg48kK2r-resource-innovator-for-non-engineering>

Resource Innovator for Non-Engineering

Example:

Community nurses: Elderly
Health Promotion



Resource Innovator for Non-Engineering

By Tanasak Pheunghua

Help users from non-engineering backgrounds apply TRIZ's resource-focused approach to innovation and problem-solving in their respective fields.

How can I apply TRIZ in education?

What are some non-engineering resources in TRIZ?

How does TRIZ apply to nursing?

Can you explain TRIZ principles for communication?



Message Resource Innovator for Non-Engineering



Resource Innovator for Non-Engineering

Type of Resource	Definition	Examples
Human Resources	Nurses, caregivers, volunteers, and other personnel who provide care and support.	Trained community nurses, family caregivers, volunteers from local organizations.
Knowledge Resources	Information and expertise relevant to elderly care, health conditions, and preventive measures.	Guidelines for managing chronic diseases, nutrition plans, exercise routines tailored for the elderly.
Technological Resources	Tools and devices that aid in monitoring, diagnosing, and treating health conditions.	Wearable health monitors, telehealth platforms, mobility aids like walkers and wheelchairs.
Community Resources	Local organizations, social groups, and community services that support elderly health and well-being.	Senior centers, community exercise programs, support groups for chronic illness.
Environmental Resources	Physical spaces and environmental conditions that affect elderly health.	Safe walking paths, parks, accessible public transportation, home modifications for safety.

Resource Innovator for Non-Engineering

Benefit

How to Work Together with Human

Adaptation of TRIZ to
Non-Engineering Domains

GPT collaborates with **Human** to identify the domain of interest.

Enhanced Problem-Solving
Techniques

Human provide specific problems or contexts for targeted solutions.

Discovery of Overlooked
Resources

Human describe their processes and environments for resource identification.

Clear and Organized
Information Presentation

GPT structures information in a table format for clarity.

Domain-Specific Definitions
and Examples

Human share relevant details and scenarios for accurate examples.

Versatility Across Various
Fields

Human specify the field (e.g., nursing, education) for tailored application.

Accessibility of TRIZ
Principles

Human provide feedback to refine and improve the application of TRIZ.

Facilitated Innovation

Human implement the suggestions and monitor outcomes for further refinement.

Systematic Idea Generation



Systematic Idea Generation V 1.0A

By Tanasak Pheunghua 

Guides in systematic idea generation and TRIZ-based modifications

<https://chatgpt.com/g/g-j2tSiD3AR-systematic-idea-generation-v-1-0a>

Systematic Idea Generation

Example:

System: Meat Shop

Goal: Make soft, easy-to-eat meals for older people



Systematic Idea Generation V 1.0A

By Tanasak Pheunghua 

Guides in systematic idea generation and TRIZ-based modifications

Describe the system you're interested in...

What modification goal do you have in mind?



Message Systematic Idea Generation V 1.0A



Systematic Idea Generation

Resource Categories	Resources/Component or Parameters	TRIZ Principle	Modified Result
Substance Resources	Meat (Beef, Chicken, Pork)	Principle 35: Parameter changes	Use meat tenderizers and enzymatic marinades to break down protein fibers, making the meat softer.
Field Resources	Heat energy	Principle 18: Mechanical vibration	Use low-frequency mechanical vibrations during cooking to help break down meat fibers.
Time Resources	Cooking time	Principle 10: Preliminary action	Pre-cook the meat by slow cooking or sous-vide to ensure tenderness before final preparation.
Space Resources	Cooking area	Principle 1: Segmentation	Create dedicated areas for slow cooking and tenderizing processes.

Systematic Idea Generation

Benefit

Provides systematic idea generation

Utilizes structured resource analysis

Applies TRIZ principles for innovation

Enhances problem-solving efficiency

Offers visual representation of ideas

Encourages creative solutions

Streamlines innovation

How to Work Together with Human

Human provides input on existing system

GPT performs detailed resource analysis

Human specifies modification goals

GPT suggests modifications using TRIZ principles

Human selects and refines generated ideas

GPT creates images based on modified results

Continuous interaction with **Human** to

Implications for the Future of Invention

- The TRIZ, Generative AI , Human are like a turbo boost for engineers and scientists. It helps them tackle really tough problems faster and come up with more creative solutions.
- The TRIZ, Generative AI , Human aren't just for professionals – it's also a great tool for students. It helps them learn how to think outside the box and come up with their own innovative ideas.

Ethical Considerations

- As with any powerful tool, we need to use The TRIZ, Generative AI , Human responsibly.
- We need to think about who owns the ideas that AI helps create.
- We also need to make sure that AI is used for good and not for harm.
- These are important questions that we need to answer together as a society

Conclusion

- The TRIZ-Generative AI as a powerful framework for innovation
- Need for further research, empirical studies, and ethical guidelines
- Embracing collaboration between humans and AI to drive progress

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Q&A SESSION



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THANK YOU!
Спасибо!

