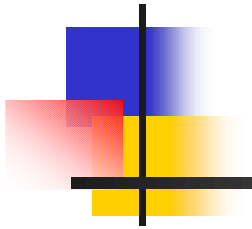


Facilitating Innovation

Structuring Knowledge

Identifying the Real Problem

Systematically Developing Inventive Ideas

Turning them into Implementable Concepts

Problem Solving: Mathematics

Analogue for innovation.

A Science for Measuring, Analyzing and Solving Problems

Calculators & Computers

Theoretical Foundation, Algorithms, Operators, etc.

$$\text{Results} = P_c \times P_{kn} \times \mathbf{(1+M) \times (1+T)}$$

P_c = Personal Capabilities

P_{kn} = Personal Knowledge

M= Methodology

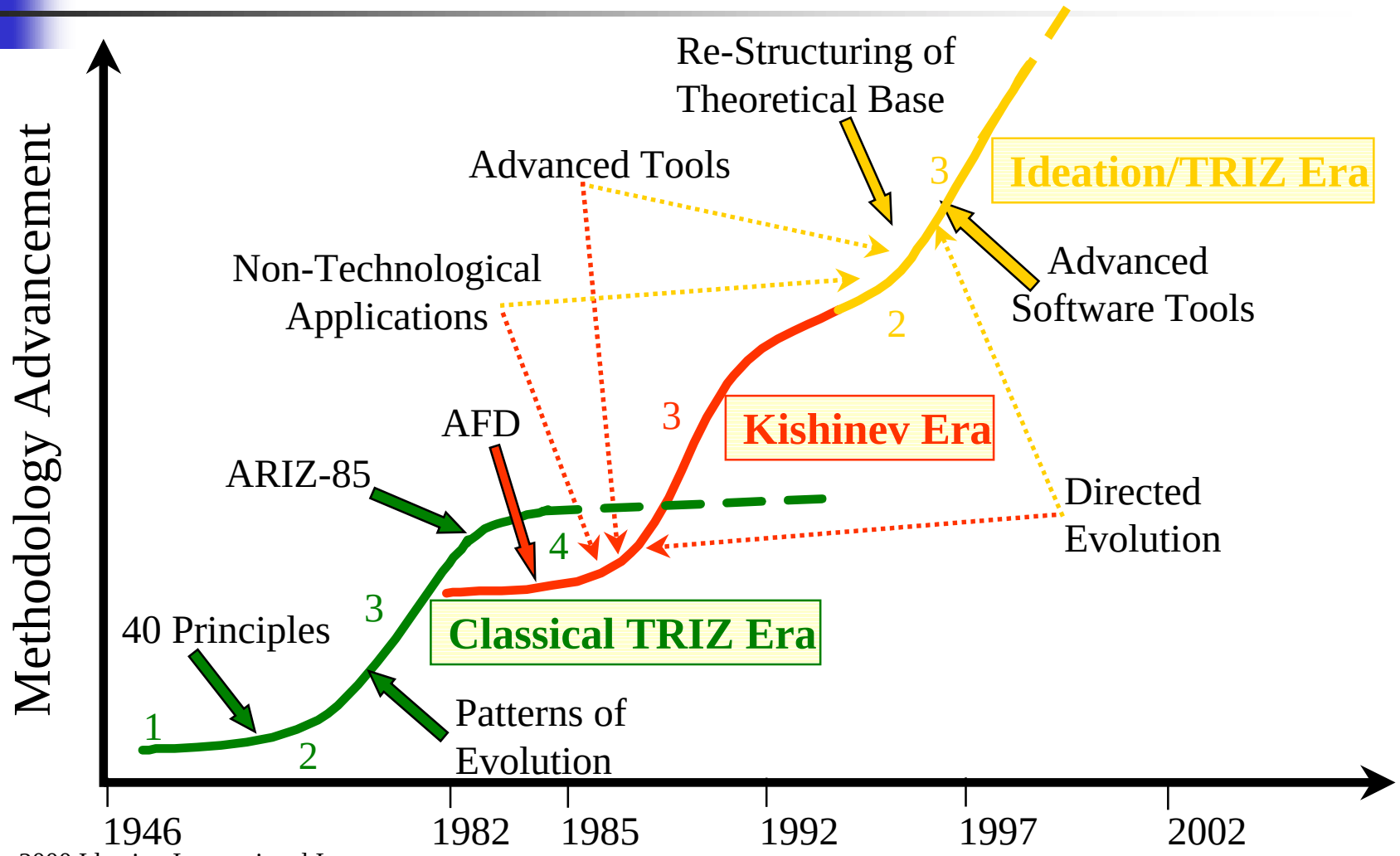
T = Tools

Foundation: TRIZ, the Theory of Inventive Problem Solving

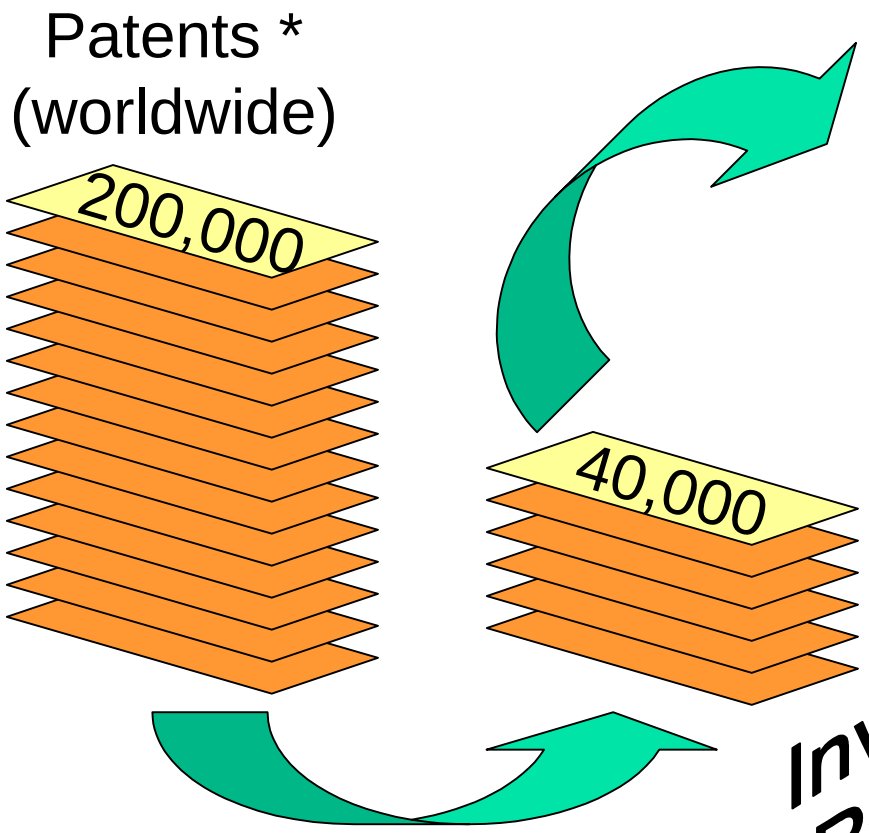
- Russian acronym for the Theory of Inventive Problem Solving
- Systematic, structured way of thinking
- Science
- Results of over 50 years of research analyzing over 2 million worldwide patents within all engineering disciplines

I-TRIZ: The practical application of TRIZ.

Evolution of TRIZ Methodology



TRIZ is Based on Abstraction of Knowledge Rather than Guesswork



Key Findings

- Definition of inventive problem
- Levels of invention
- Patterns of evolution
- Patterns of invention

* Today over 2,500,000 patents have been investigated.

Approach:
Leveraging Existing Knowledge

Abstraction of knowledge from the human experience and structuring of that knowledge for efficient and effective use.

54 years of research: Abstraction of knowledge from worldwide patents, history of technology, markets and society.

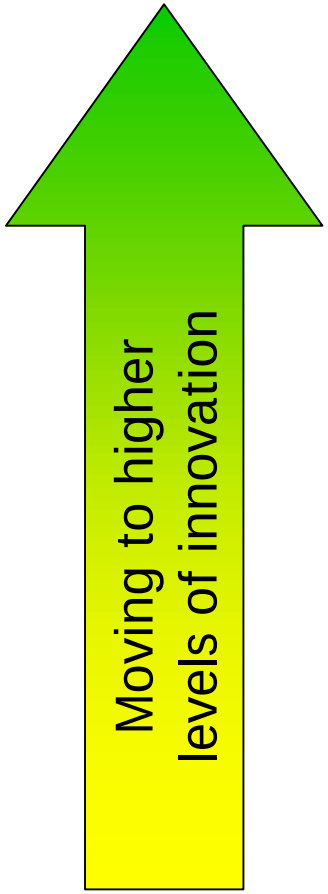
Discovery: Common thread between great innovations.

What is an Inventive Problem?

- Involves one or more contradictions
- Suggests no known ways or means of solution

Classification of Solutions:
We need to raise innovation skills via methods and tools.

Levels of Invention (Solution)



- **Level 5: Discovery**
  - Pioneering of an essentially new system
    - Laser, radio, airplane
- **Level 4: Invention outside the paradigm**
  - A concept for a new generation of an existing system, based on changing the principle by which the primary function is performed
    - Jet aircraft, integrated circuit
- **Level 3: Invention inside the paradigm**
  - Essential improvement of an existing system
    - Automatic transmission, radio telephone
- **Level 2: Improvement**
  - Small improvements of an existing system, usually with compromise
    - Bifocal glasses, beeper
- **Level 1: Apparent solution (no invention)**
  - Established solutions; well-known and readily accessible

Discovery: There is repetition in the way people solve creative problems.

Patterns of Invention

- Altshuller recognized that the same fundamental problem (contradiction) had been addressed by a number of inventions in different areas of technology
- He also observed that the same fundamental solutions were used over and over again, often separated by many years
- He reasoned that if the latter inventor had had knowledge of the earlier solution, their task would have been straightforward
- He sought to extract, compile, and organize such information

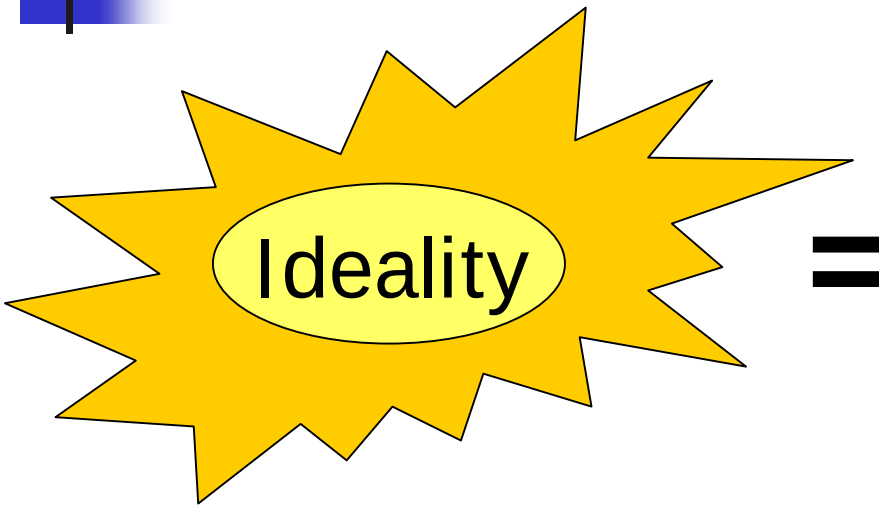
Patterns of Evolution: The Primary TRIZ Postulate

- Systems evolve not randomly, but according to objective patterns
- These patterns can be revealed from the patent fund and purposefully used for systems development without numerous blind trials

Patterns of Evolution: Common threads between evolving systems.

I-TRIZ Thinking: Ideality Approach

Think of the end before the beginning.
Leonardo da Vinci



$$\text{Ideality} = \frac{\text{All } \textbf{\textit{Useful}} \text{ Functions}}{\text{All } \textbf{\textit{Harmful}} \text{ Functions}}$$

- The ideal system performs a required function without actually existing. The function is often performed using existing resources.
- Nothing changes; everything remains the same and the problem is resolved.

Ideality Approach:
A Different Set of Opportunities

Strategic understanding is valuable

The Objective of Inventive Problem Solving: Striving for ---------> Ideality

Zone of Incremental or Continuous Improvement

Zone of Near Ideality

(High-Level Innovation)

Contradiction

One of the basic premises of the Ideation/TRIZ Methodology

There are two types of contradictions: technical and physical

Technical Contradiction

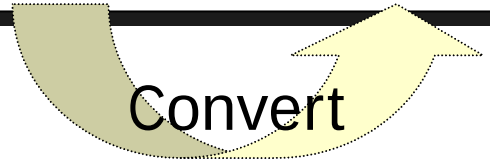
- An improvement in one system characteristic results in the deterioration of another
  - Example: Cost of service vs. accuracy of work
  - Example: Size of company and ease of change
- Traditionally, technical contradictions are resolved by trade-off or compromise
- TRIZ seeks to eliminate the contradiction without the use of trade-offs

Discovery: Common thread between great innovations.

What is an Inventive Problem?

- Involves one or more contradictions
- Suggests no known ways or means of solution

There are two types of contradictions: technical and physical



Physical Contradiction

- A characteristic must be higher and lower (self-opposing)
  - Example: An organization must be large so it has resources but must be small so it has agility.
- A characteristic must be present and absent
  - Example: A purchasing department must be present to provide a function that is vital to the company but should not be present because it increases the cost of overhead.

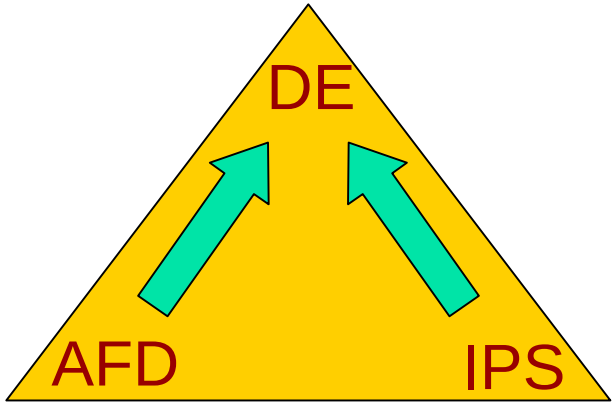
Movement Beyond the Theory: Evolution of TRIZ to I-TRIZ

- Structured Ideation, Invention and Innovation
  - Development of Analytical and Knowledge Base Tools
- Expansion of Research
  - Inclusion of Market and Society
- Development of New Applications
  - Enhancement of Inventive Problem Solving
  - Anticipatory Failure Determination (Failure Analysis and Prediction)
  - Directed Evolution of Technological Systems

I-TRIZ today.

Scientifically-Based Applications: Systematic, Structured Innovation

Directed Evolution → Strategically Evolving Future Generations of Technological Systems



Anticipatory Failure Determination

- Failure Analysis
- Failure Prediction

Invention of Failure Modes

Inventive Problem Solving

Surgical removal of tough technological problems

Elimination of contradictions

Enhancement:
Structured methods and tools.

Structured Process: Inventive Problem Solving

Step	Action	Contents	Software Supported
1	Document the problem	Complete and analyze the Innovation Situation Questionnaire (ISQ)	✓
2	Formulate the problem	Develop exhaustive set of Directions for Innovation	✓
3	Prioritize Directions for Innovation		✓
4	Develop Concepts	Develop an exhaustive set of Solution Concepts utilizing various knowledge-base tools	✓
5	Evaluate Results & Plan Implementation	Select Solution Concepts and develop an implementation plan	✓

Knowledge Wizard™ Software What Does It Do?

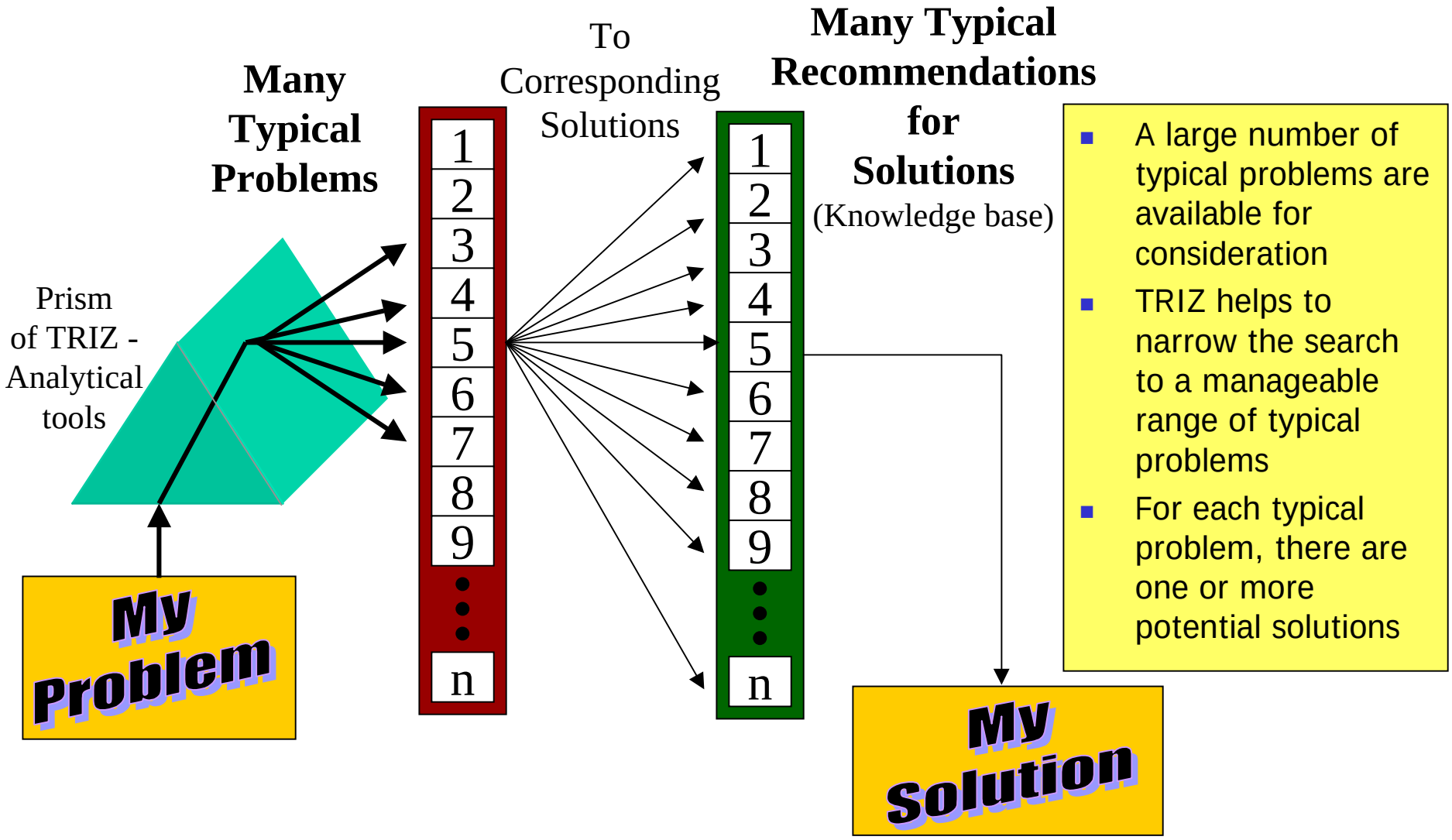
- Directs the user through the Ideation Process
- Models the successful techniques of experienced innovators
- Stimulates and directs your thinking in solving inventive problems
- Allows you to synthesize your own unique solutions

Knowledge Wizard™: How Does It Do It?

- Ideation Process
  - Analytical Tools
    - Innovation Situation Questionnaire (ISQ)
    - Problem Formulator
  - Knowledge Base Tools
    - Operators
      - Principles, Methods, Standard Solutions
    - Algorithm of Inventive Problem Solving

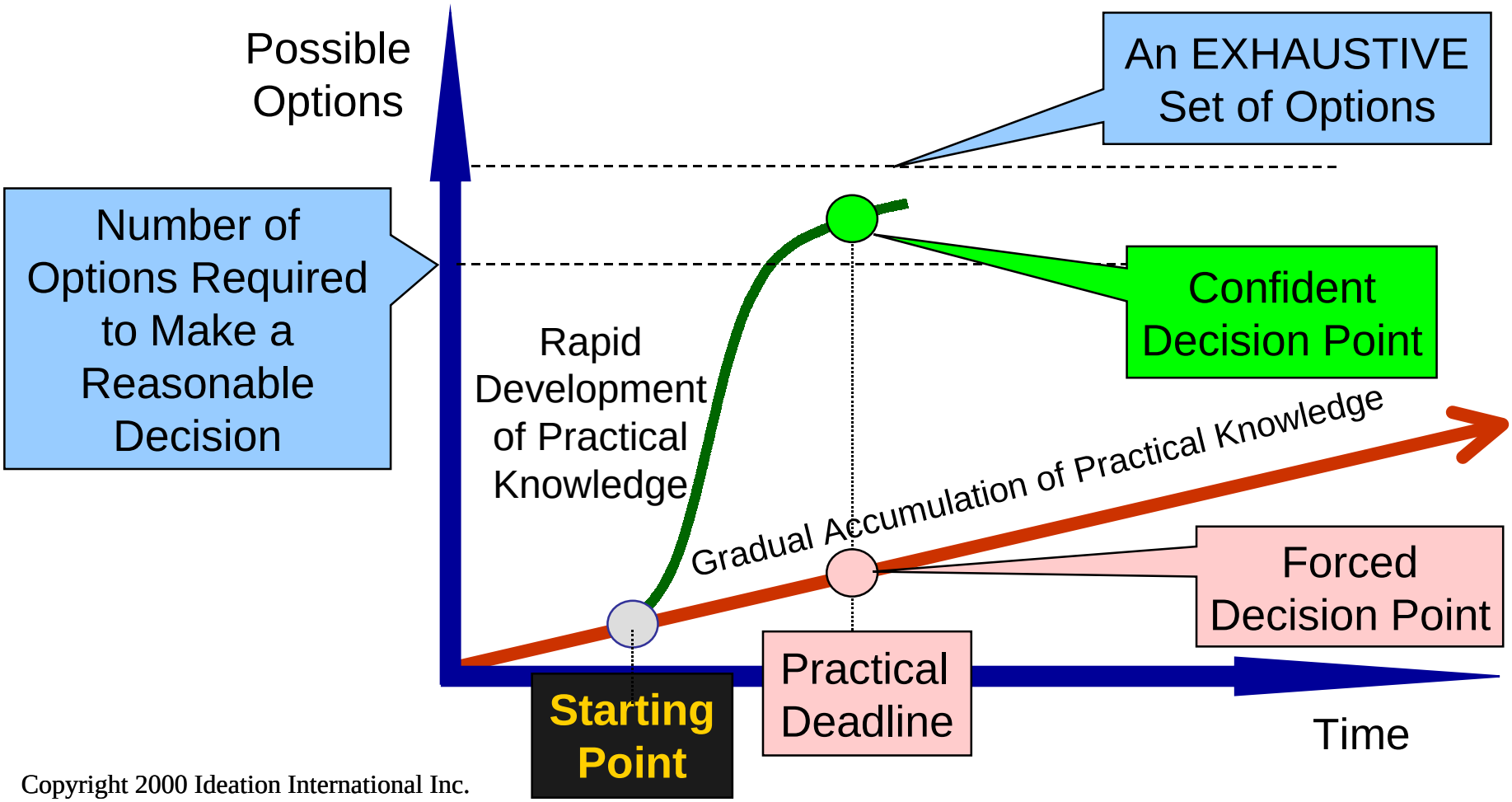
Guided Step-by-Step

How the Knowledge Wizard™ Works



- A large number of typical problems are available for consideration
- TRIZ helps to narrow the search to a manageable range of typical problems
- For each typical problem, there are one or more potential solutions

Achieving the Ideal Vision: Accelerating Innovation via Structure



Problem Solving: I-TRIZ

The Science of Innovation: Structured like mathematics with methods and tools.

Computers & Software

Theoretical Foundation, Algorithms, Operators, etc.

$$\text{Results} = P_c \times P_{kn} \times \mathbf{(1+M) \times (1+T)}$$

P_c = Personal Capabilities

P_{kn} = Personal Knowledge

M= Methodology

T = Tools

Where has it been used?

Industries

- Automotive
- Food
- Agriculture
- Electronics
- Chemical
- Oil
- Aviation/Aerospace

Industries

- Paper
- Ship Building
- Medical Instrumentation
- Software
- Communications
- Other

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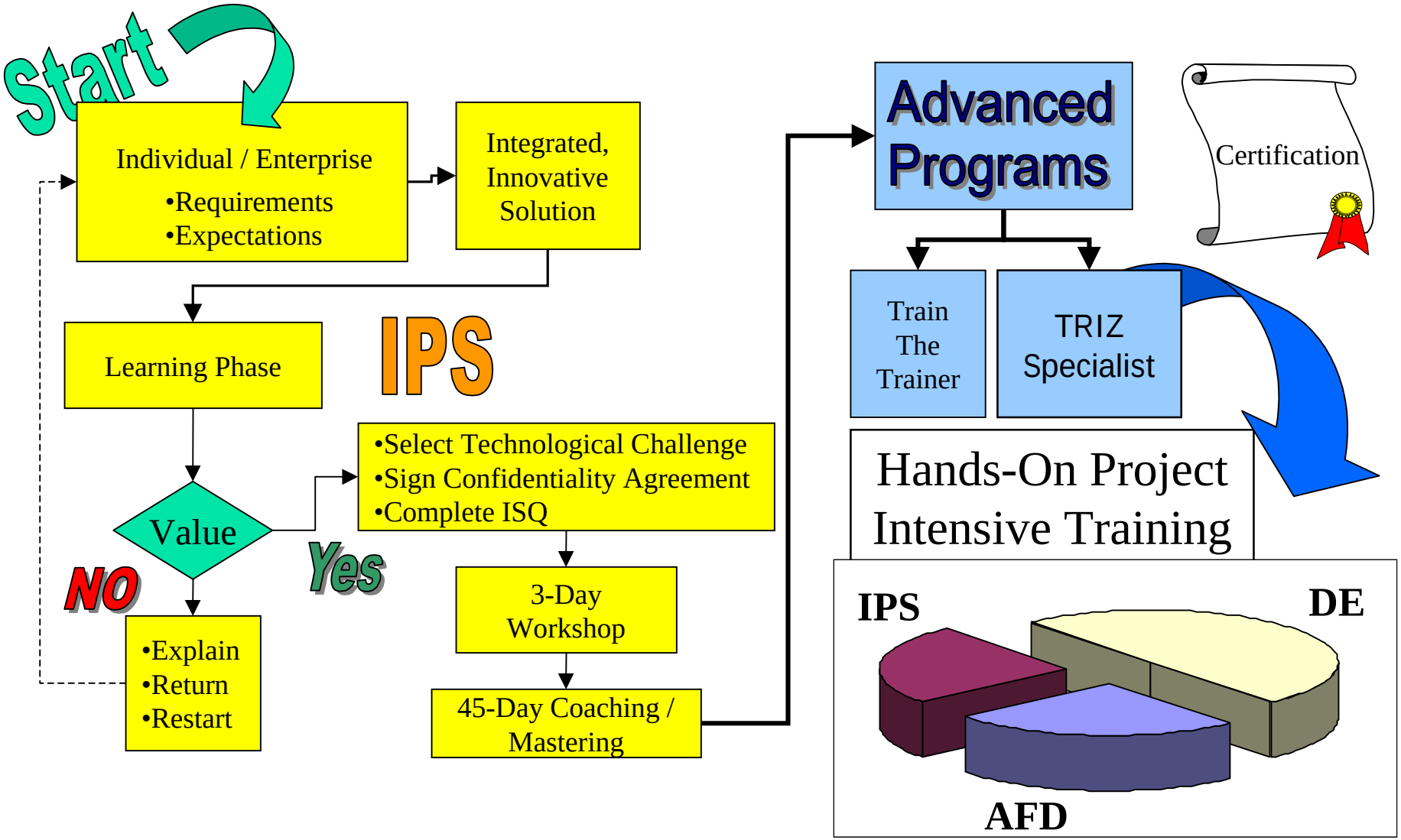
Mastering The Ideation/TRIZ Methodology & TRIZSoft™



Summary

- While techniques like right-brain exercises and ‘trial and error’ are good for solving simple problems (picking the low hanging fruit) are not adequate for solving today’s tough technological and business problems
- The Innovation Process has changed – it is now structured and based on extensive research – combines right-brain and left-brain techniques

I-TRIZ is 'Whole Brain' Innovation

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