

C-TRIZ原理及应用

檀润华

国家技术创新方法与实施工具工程技术研究中心

rhtan@hebut.edu.cn

<http://www.triz.com.cn>



国家技术创新方法
与实施工具工程技术研究中心
National Engineering Research Center for
Technological Innovation Method and Tool



河北工业大学
HEBEI UNIVERSITY OF TECHNOLOGY

1. 在工业界推广应用TRIZ的挑战

2. 本中心推广应用TRIZ实践

3. C-TRIZ 基本原理

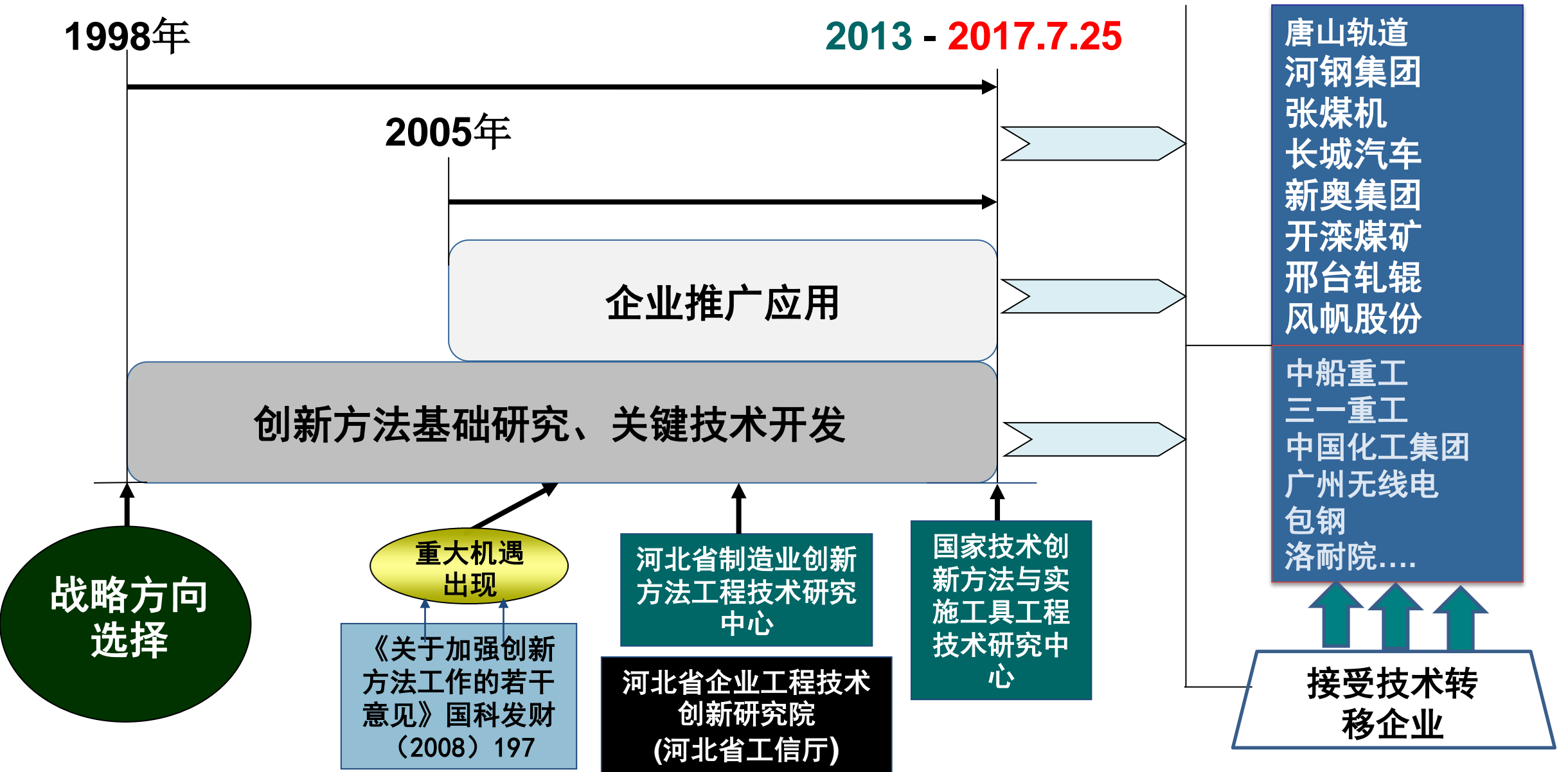
4. C-TRIZ结构

5. C-TRIZ推广应用

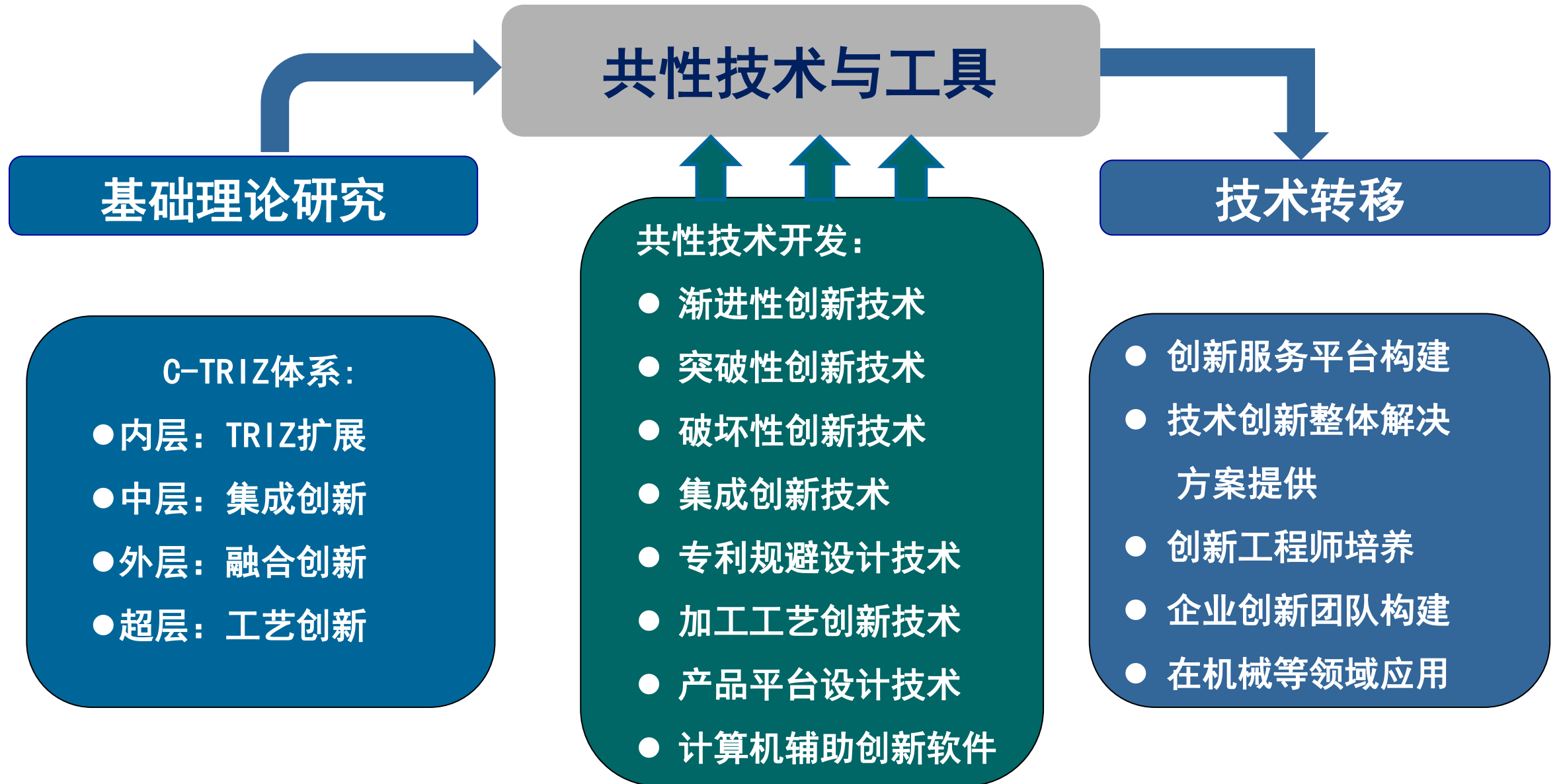
6. 结论

国家技术创新方法与实施工具工 程技术研究中心简介

国家工程技术研究中心简介：发展轨迹

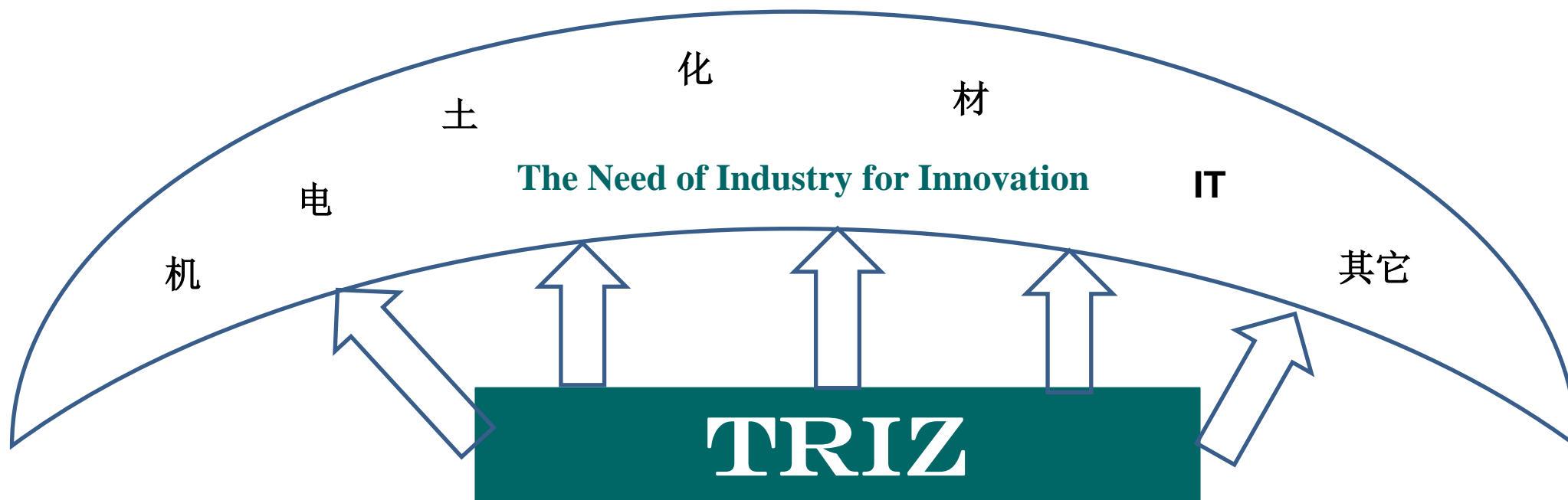


中心技术创新方法研究与技术转移



1. 在工业界推广应用TRIZ的挑战

——以国家中心的实践为基础



中国直20历时10年才赶上的黑鹰直升机 却要被美淘汰

直升机的发明，使飞机到处能飞，到处能落变成了现实。我国2008年汶川大地震抢险，动员了全国90架直升机救援，效果良好，但是数量太少，杯水车薪，从此国家痛下决心，大力发展直升机，10年过去了，国产黑鹰直升机出来了，这就是直20通用直升机，陆地能飞，海上能降落，将成为我国直升机未来30年的主力。



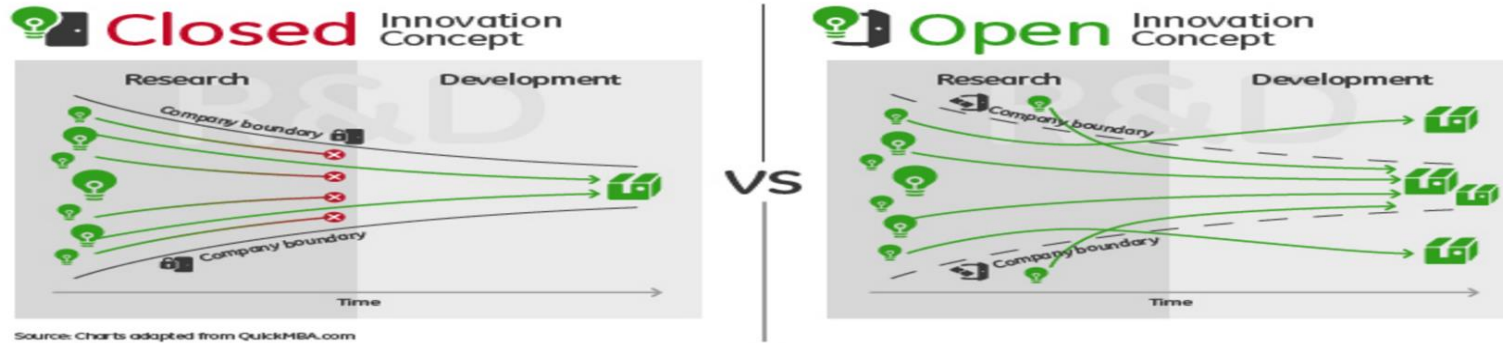
从技术层面来说，我国直20水平不错，但是美国人已经想办法开始淘汰黑鹰了！

用谁来淘汰，这就是V280倾转旋翼机，V22鱼鹰的迷你版本。

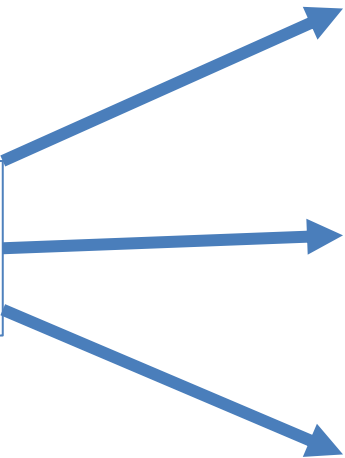


<http://mil.news.sina.com.cn/jssd/2018-05-17/doc-iharvfhu4916203.shtml>, 2018-5-18

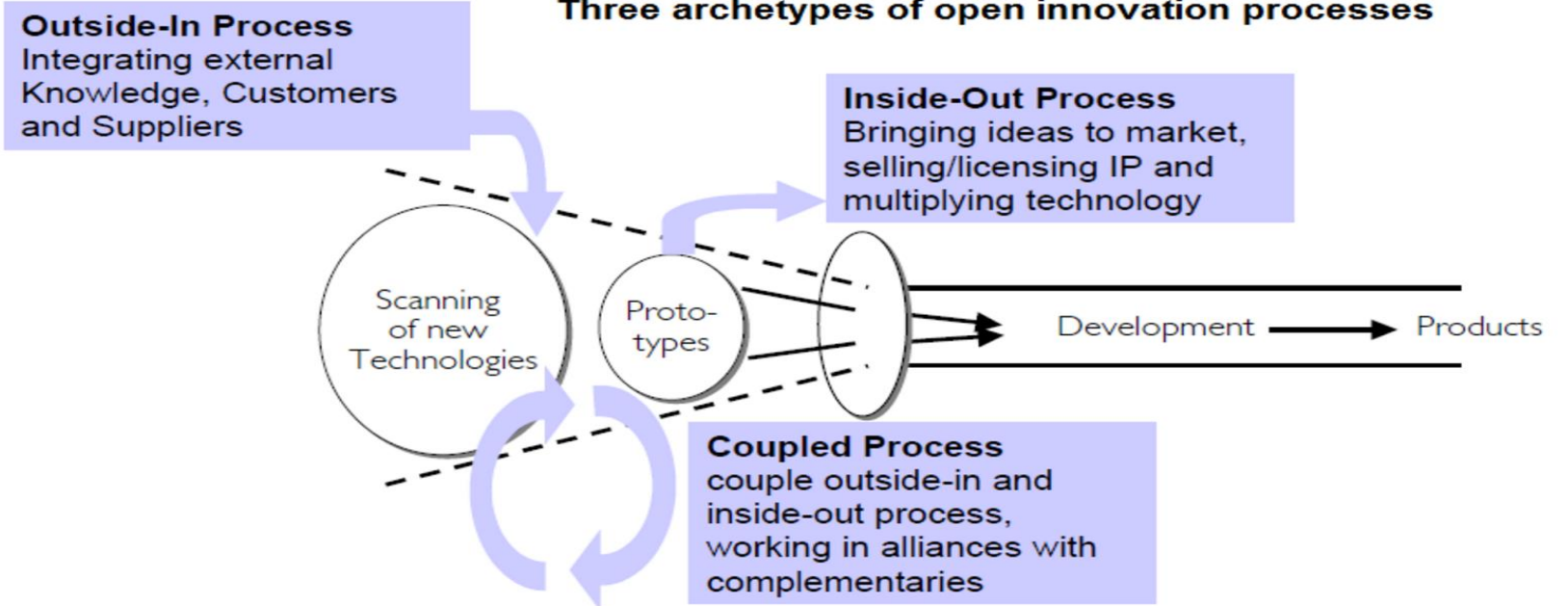
挑战 1: TRIZ能否作为一种外部资源引入企业? 如何引入?



TRIZ 及跨
学科知识



Three archetypes of open innovation processes

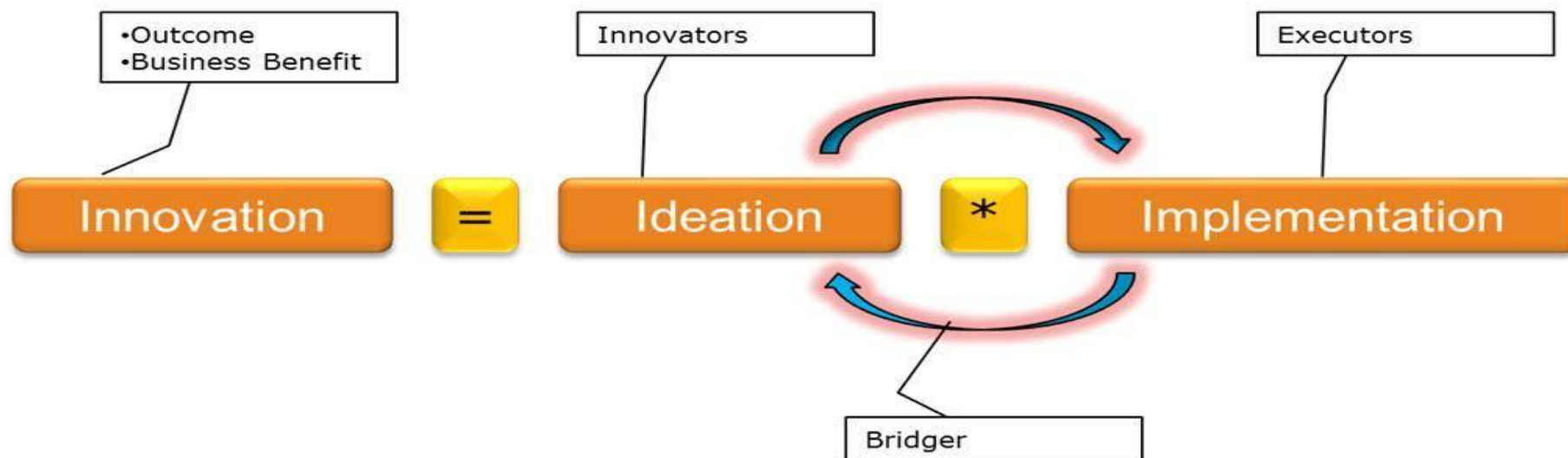


Source: Towards a Theory of Open Innovation: Three Core Process Archetypes, by Oliver Gassmann, Ellen Enkel (2004)

挑战 2: 工业界谁是学习应用TRIZ的人群? 如何训练这部分关键人群?

关键人群?

Innovation is **people** creating **value** by implementing **new ideas**



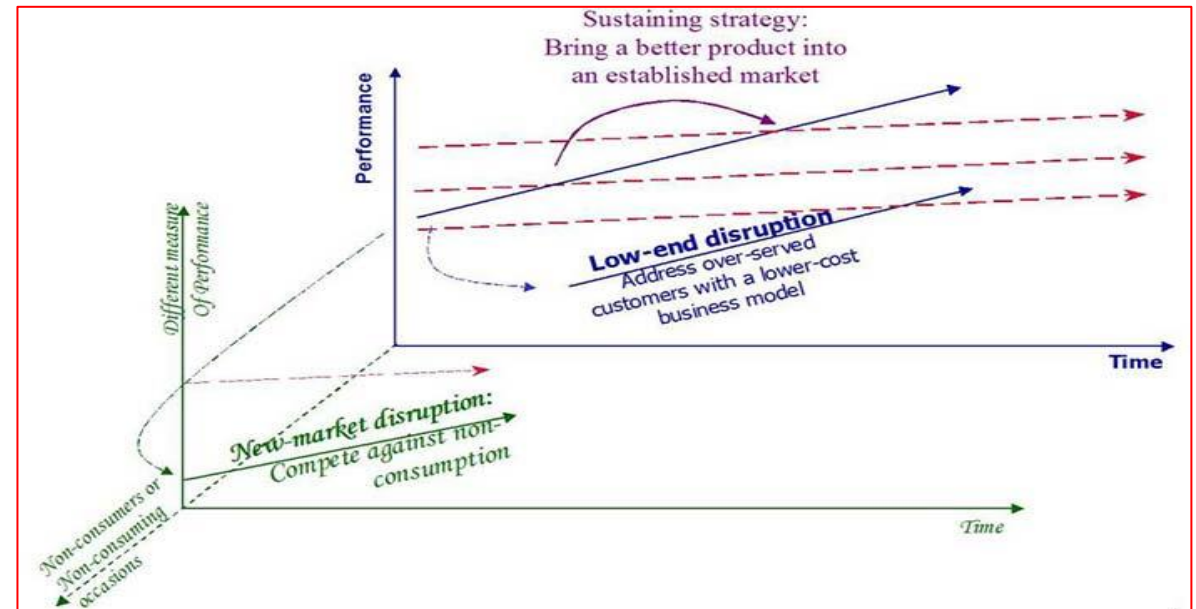
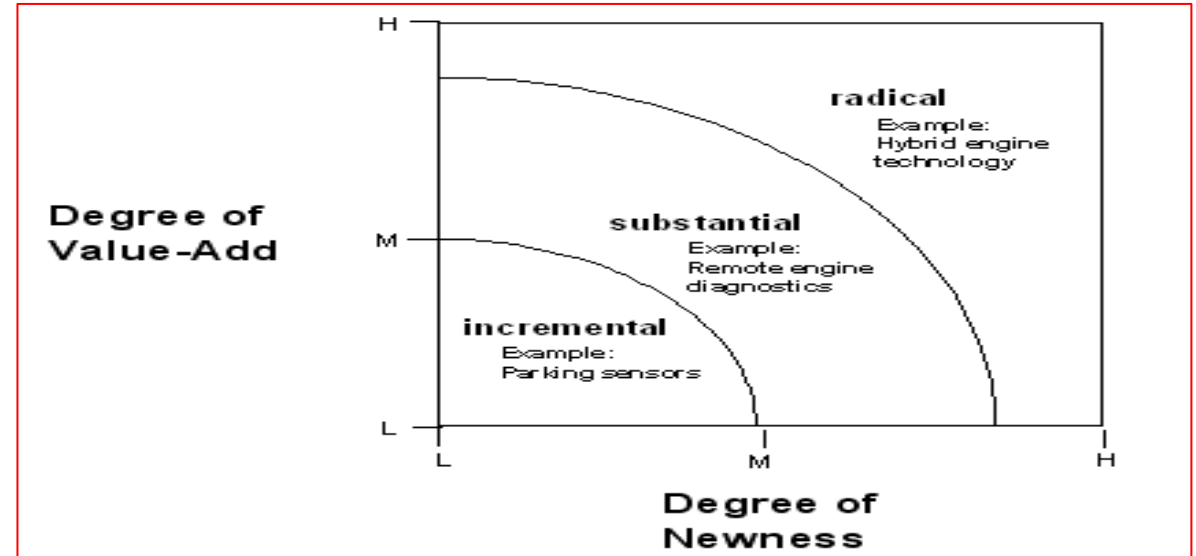
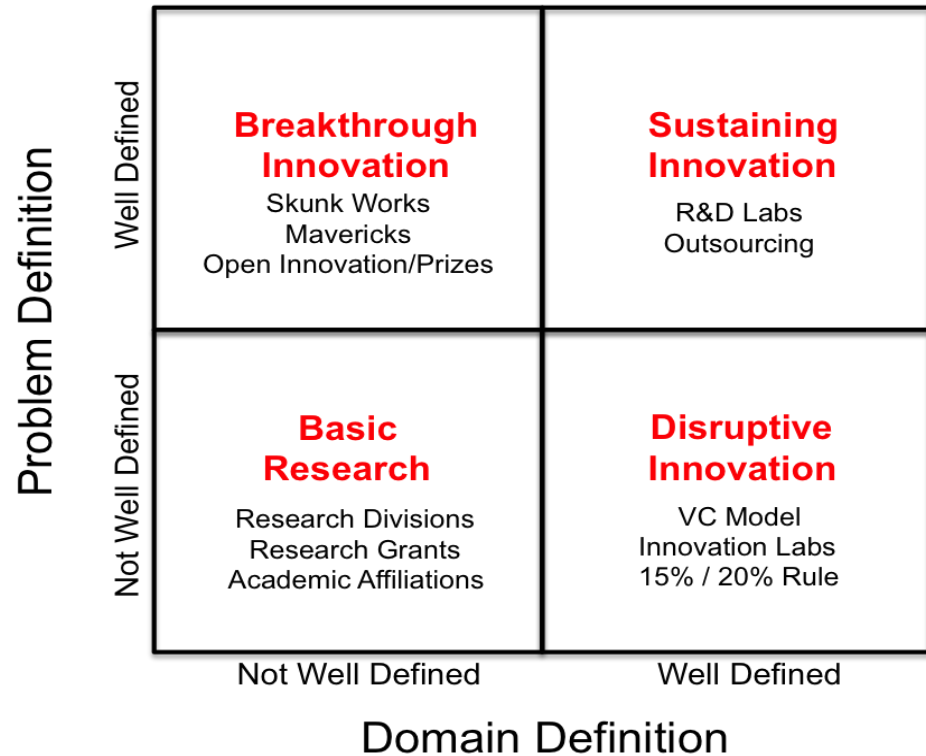
Innovation is 1% ideation, 9% evaluation & polishing and 90% implementation

Our first Definition of Innovation

Source: Internet

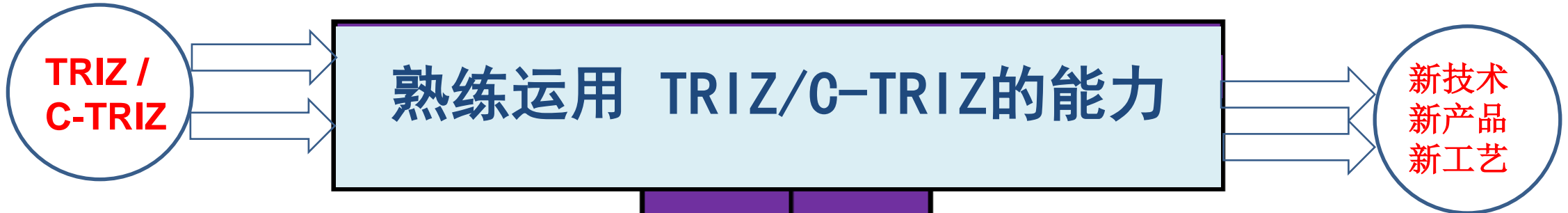
挑战 3: TRIZ能否用于颠覆性创新? 整体或部分? 如何运用?

Innovation Matrix



工业界对创新工程师的需求：创新的“T”型人才

T-Shaped Professionals (Both Deep and Broad)



in 2015 *The Future of Jobs*

1. Complex Problem Solving
2. Coordinating with Others
3. People Management
4. Critical Thinking
5. Negotiation
6. Quality Control
7. Service Orientation
8. Judgment and Decision Making
9. Active Listening
10. Creativity

Developing T-shaped water professionals

International Water Centre,
Water Policy 15 (2013) 42–60

The 21st-Century T-Shaped Lawyer



Top 10 skills *The Future of Jobs*

in 2020

1. Complex Problem Solving
2. Critical Thinking
3. Creativity
4. People Management
5. Coordinating with Others
6. Emotional Intelligence
7. Judgment and Decision Making
8. Service Orientation
9. Negotiation
10. Cognitive Flexibility

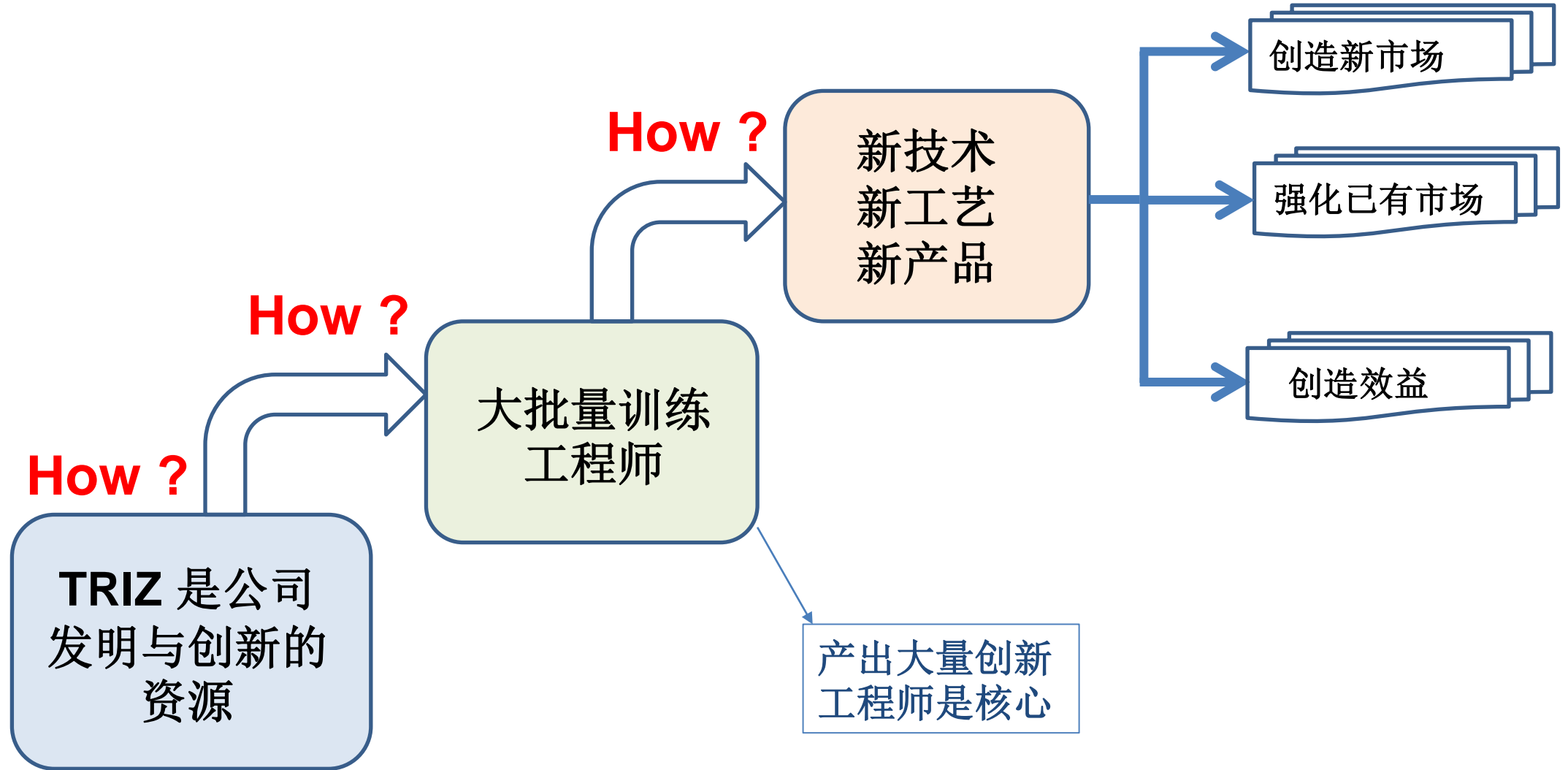


Jim Spohrer, IBM Labs

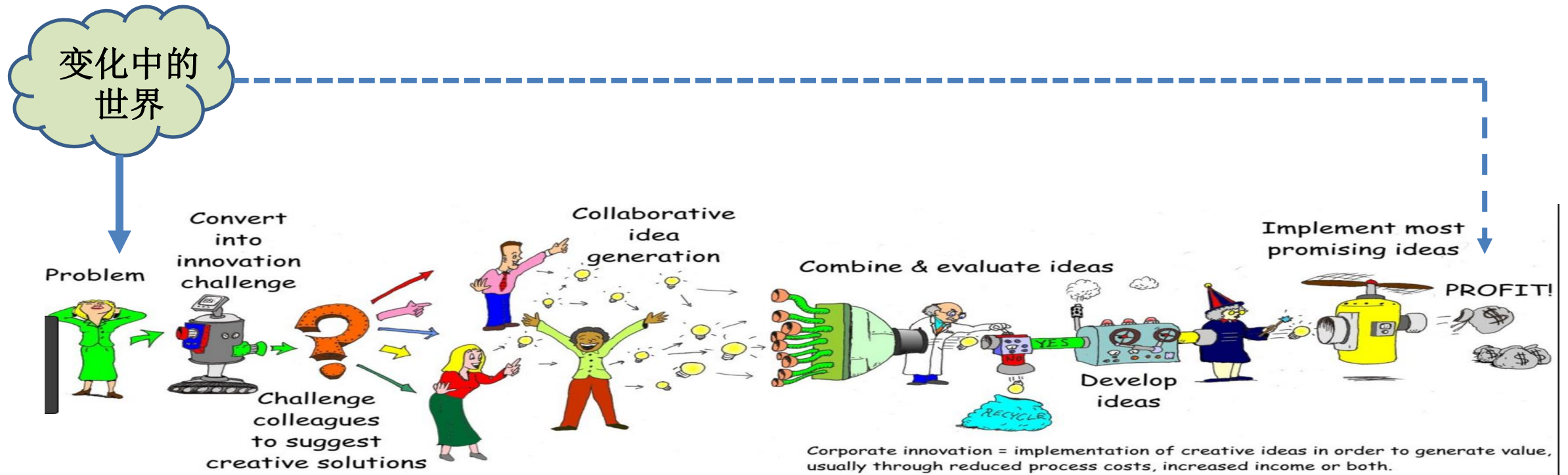
T-Shaped: The New Breed of IT Professional

by Yassi Moghaddam, Charles Bess, Haluk Demirkan, and Jim Spohrer

将TRIZ变成工业界的创新竞争力是研究与推广应用的目标！

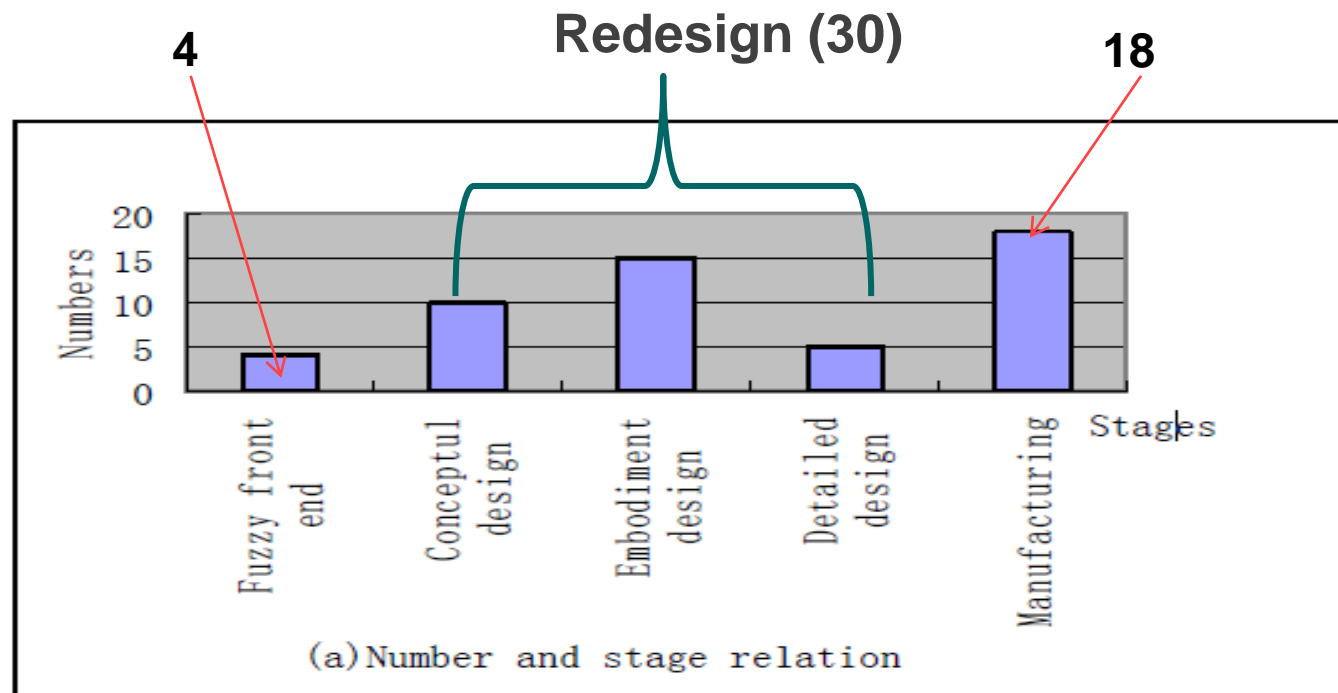


2. 本中心推广应用TRIZ实践



案例：广东省第一期东TRIZ培训班 2010.8-2011.3

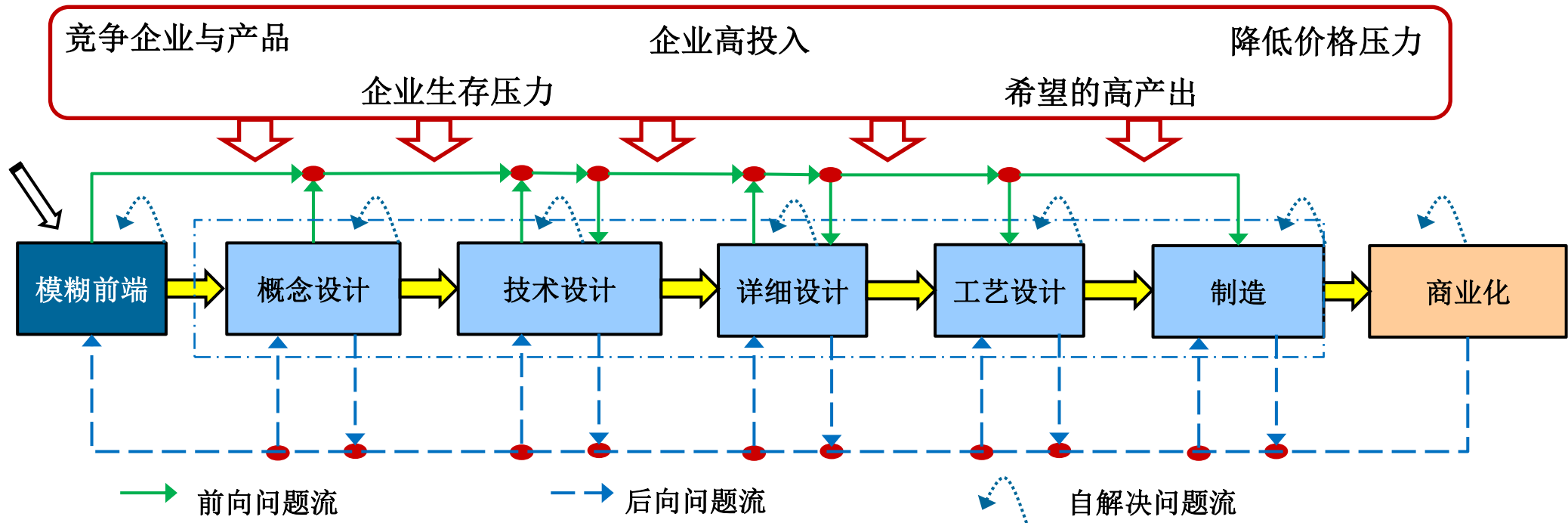
- GD-1 was a class organized by Guangdong Science and Technology Department from August of 2010 to March of 2011. Our center carried out the training process.
- 75 engineers were selected from 19 companies in Guangdong province. 52 engineers did pass the final examination.
- **All the 52 engineers found out 52 inventive problems from the innovation processes and solved them and formed 52 inventions.**



工程师们的项目类型及数量

- 制造： 18
- 模糊前端： 4
- 设计： 30
 - 概念设计： 10
 - 技术设计： 15
 - 详细设计： 5

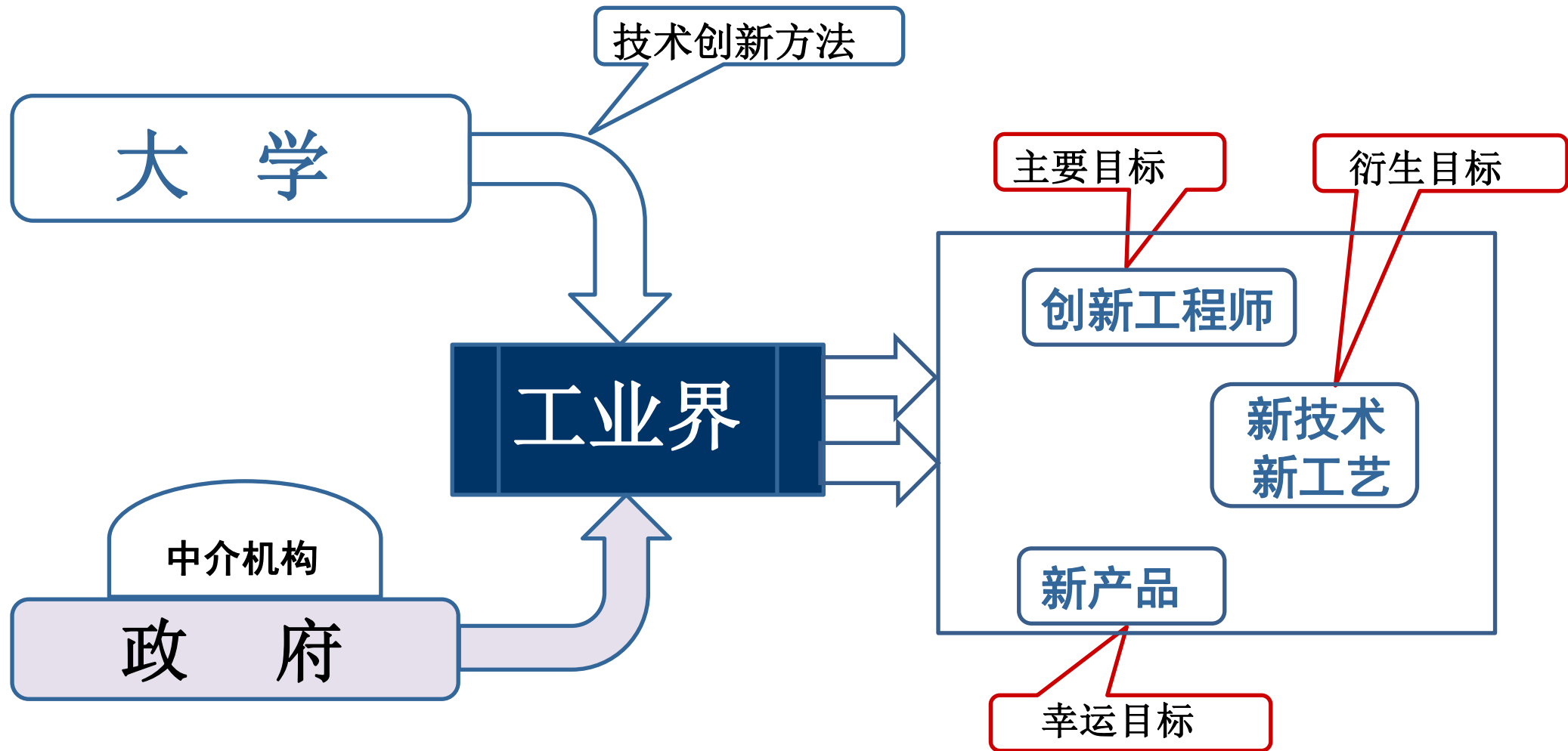
创新过程中的问题流



需要解决的问题:

1. 如何将培训过程与创新过程紧密结合, 以帮助参训工程师产生更多的创新成果?

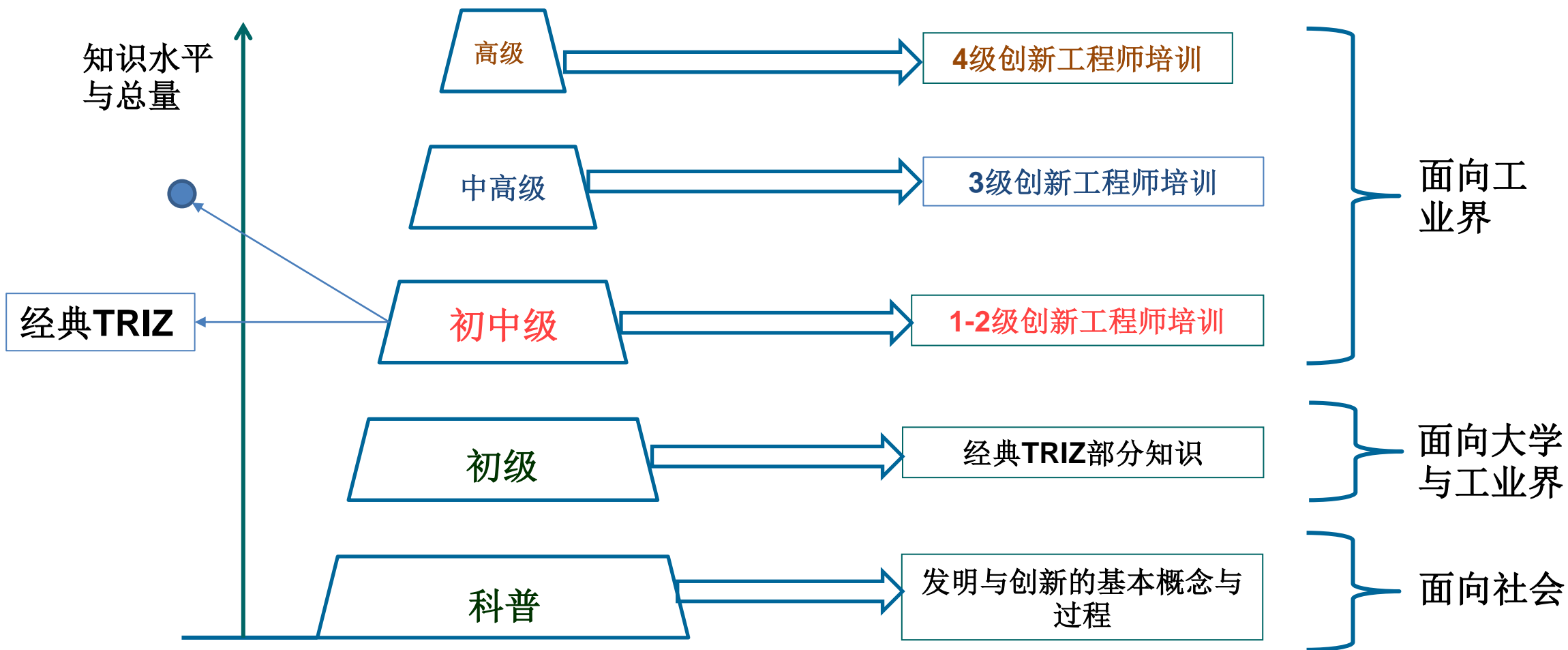
推广TRIZ三螺旋方法



乐清 (浙江温州) 基地建立的过程 (2018.1-4)



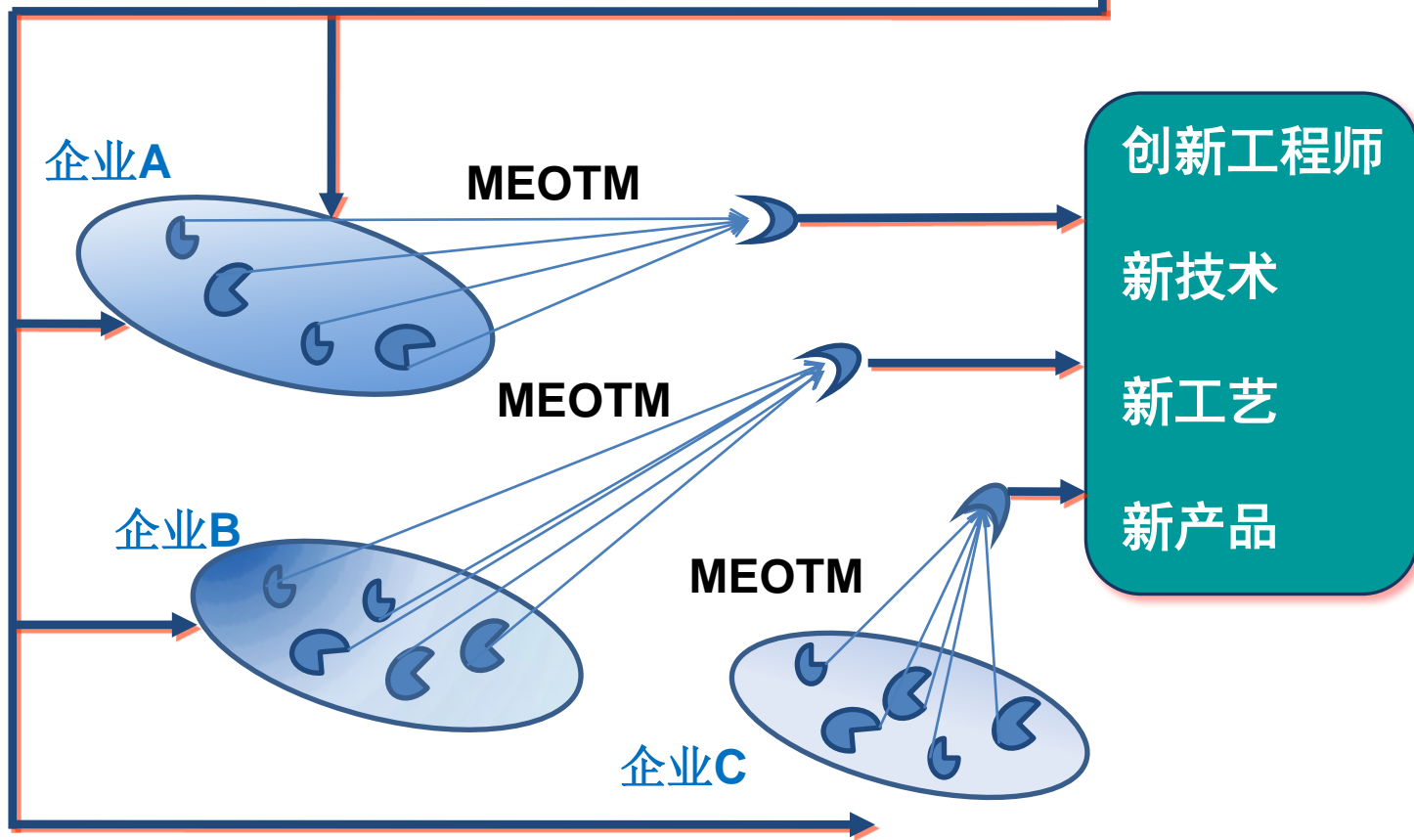
本中心的五级培训过程



技术创新方法转移可行路径

技术创新方法与实施工具 = 技术创新使能技术

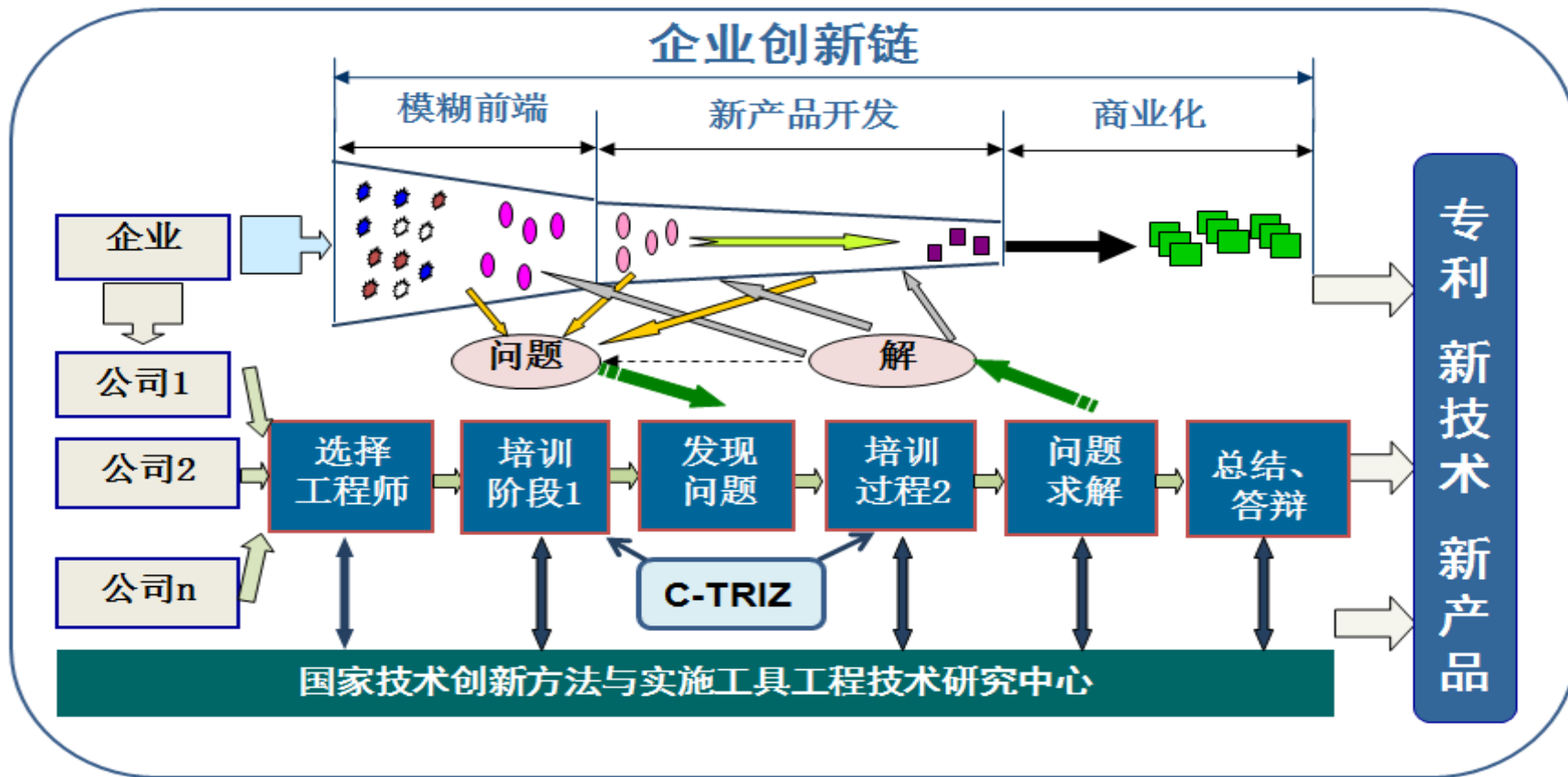
技术转移路径：政府、生产力促进中心、信息院、企业



企业研发、生产中的结构不良问题或发明问题

面向企业的技术创新方法技术转移模式 (MEOTM)

技术创新方法交互式转移模式为在中国企业大范围有效推广应用提供了保障



初中级班培训过程: 时间6-15个月

技术创新方法成果一次转移: 面向一个企业或区域的一批企业, 按照上述模式所完成的一个全过程。其输出是一批创新工程师 (一个创新团队)、一批专利、一批新技术、若干新产品。时间为半年至一年。

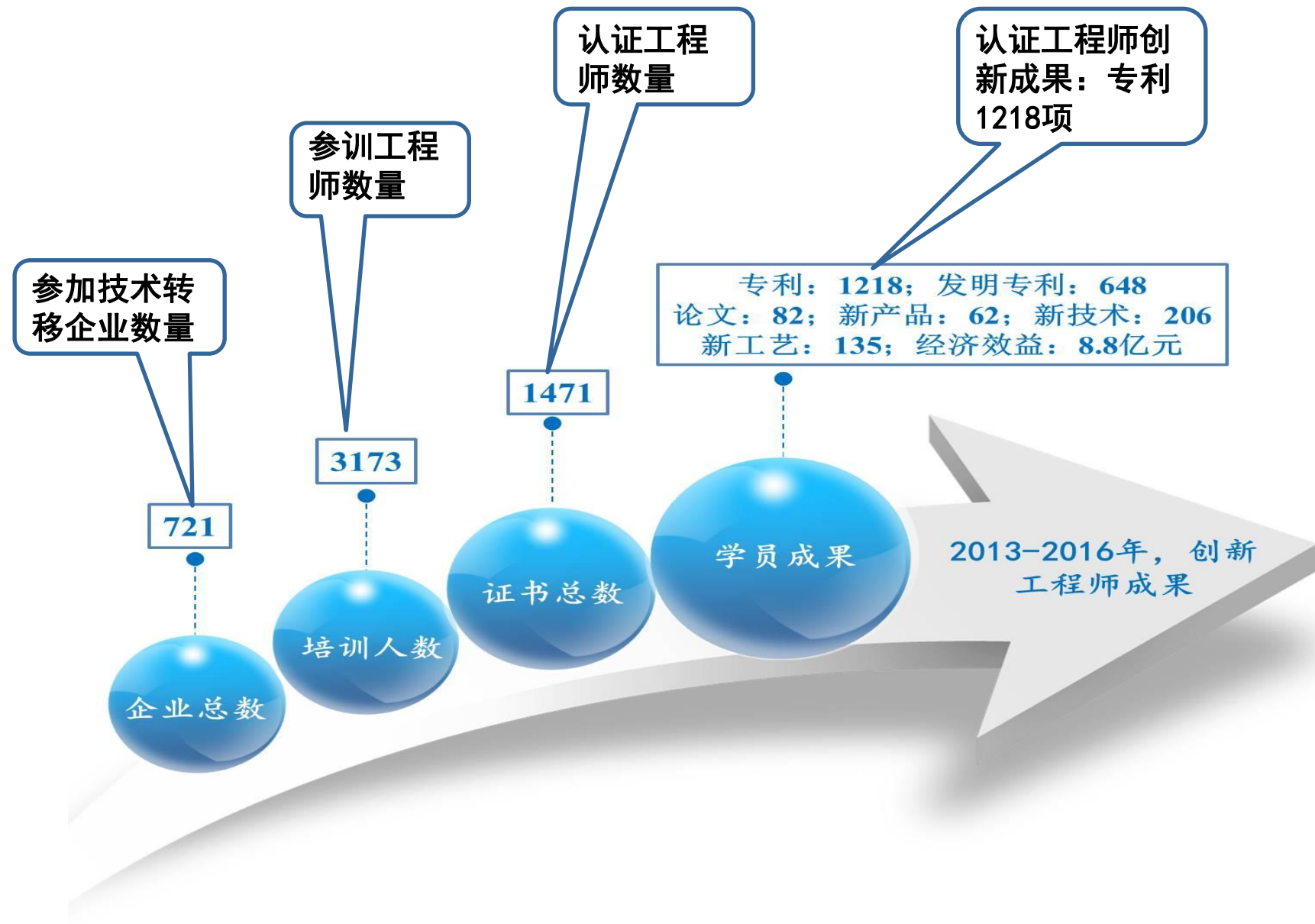


面向企业培养创新工程师案例



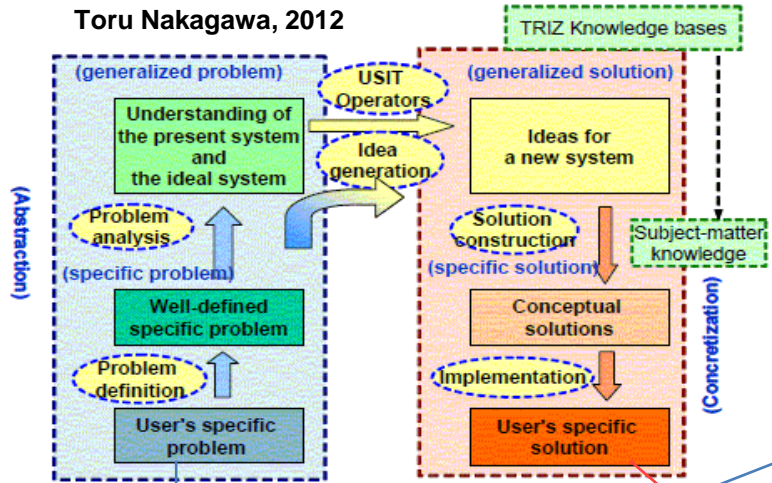
2013-2016 中心推广应用成果总汇

- 2013-2016技术创新方法企业转移成果总汇：
- 为13个省市721家企业培养工程师3173人，其中通过认证工程师1471人。
 - 技术转移过程中企业申请专利1218项，其中发明专利648项。
 - 企业效益8.8亿元。
 - 帮助12家企业建立起创新团队。



工程师学习过程中的困难

Toru Nakagawa, 2012

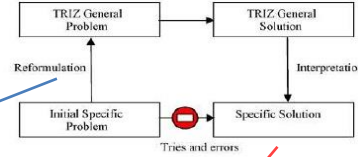


Universidade do Porto
FEUP Faculdade de Engenharia
 Product Engineering

What is TRIZ?

3. The inventive process can be structured. [4]

As knowledge grows in any particular field the development of the knowledge base can be viewed as going through three stages.



[4] Robles, G. C., Negny, S., & Le Lann, J. (2008). Design acceleration in chemical engineering. *Chemical Engineering and Processing*, 2019–2028.

November 2011

TRIZ

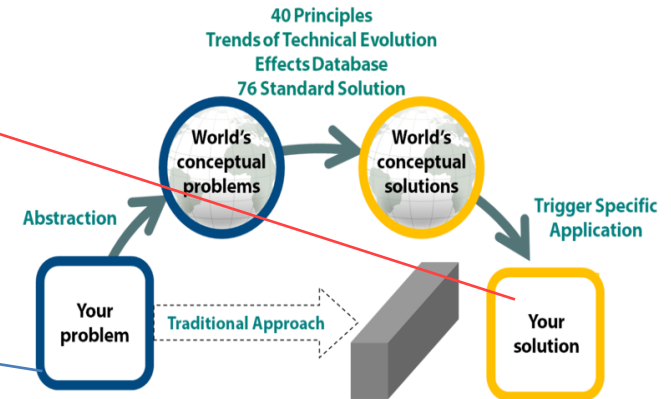
TRIZ METHOD FOR PROBLEM SOLVING



Designorate
 designorate.com

1. **“Your problem”** 很难确定。原因是第一次应用TRIZ基本概念发现发明问题。

2. **“Your solution”** 还不是直接提升企业竞争力的创新。但距离该类创新很近，是企业创新的机遇。



如何通过TRIZ的引进提升企业或区域的竞争能力 ？

innovation = invention + exploitation

- **TRIZ引入的过程（培训过程）要产生高价值专利。**
- Invention is a commercially promising product or service idea based on science or technology of cross domains, which is not applied in this domain before.
- **参训公司应关注培训过程及参训工程师所产生的发明，目标是确认“公司机遇”。**
- Innovation means the successful entry of a new product from the invention into the current or a new market.

3. C-TRIZ基本原理

发明问题解决理论：TRIZ

TRIZ之父 Altshuller



目前世界上50多个国家在应用TRIZ

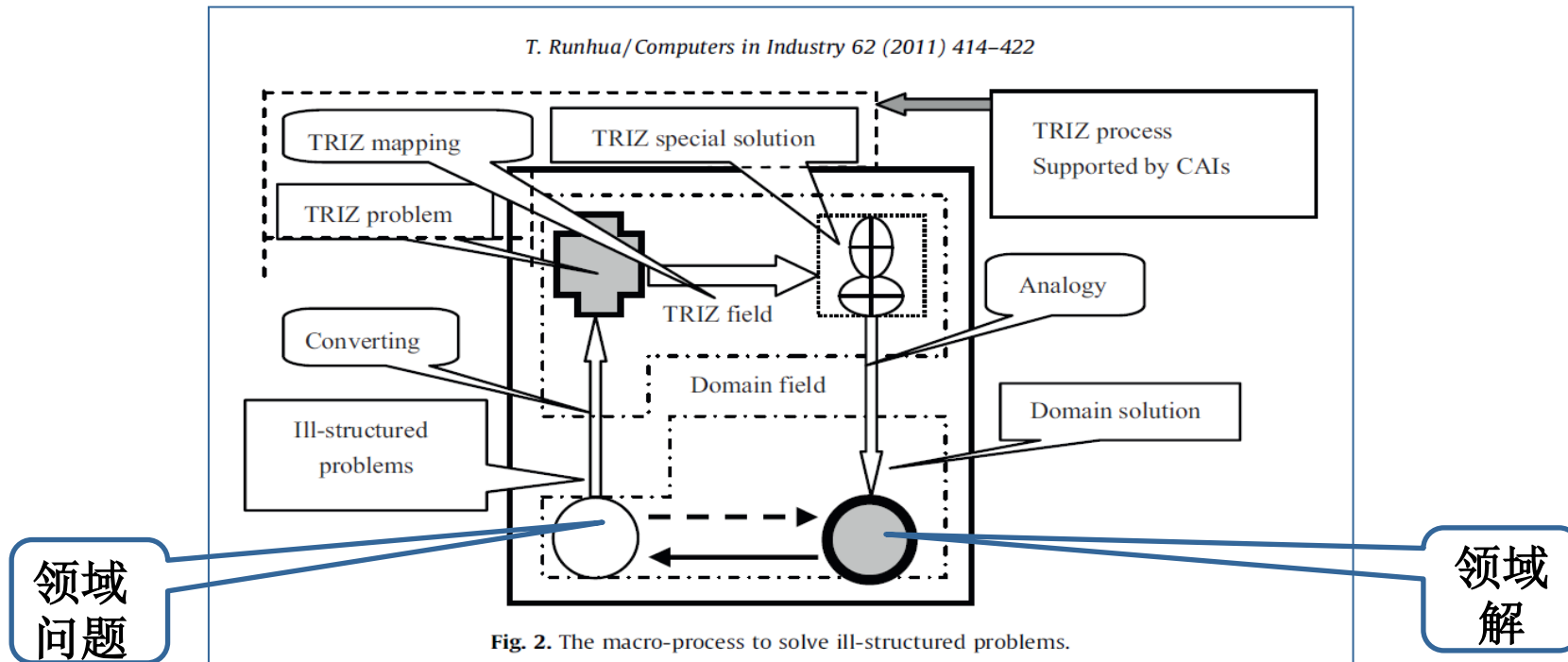


Triz is Now Practiced in 50 Countries

Bradford Goldense | Mar 21, 2016

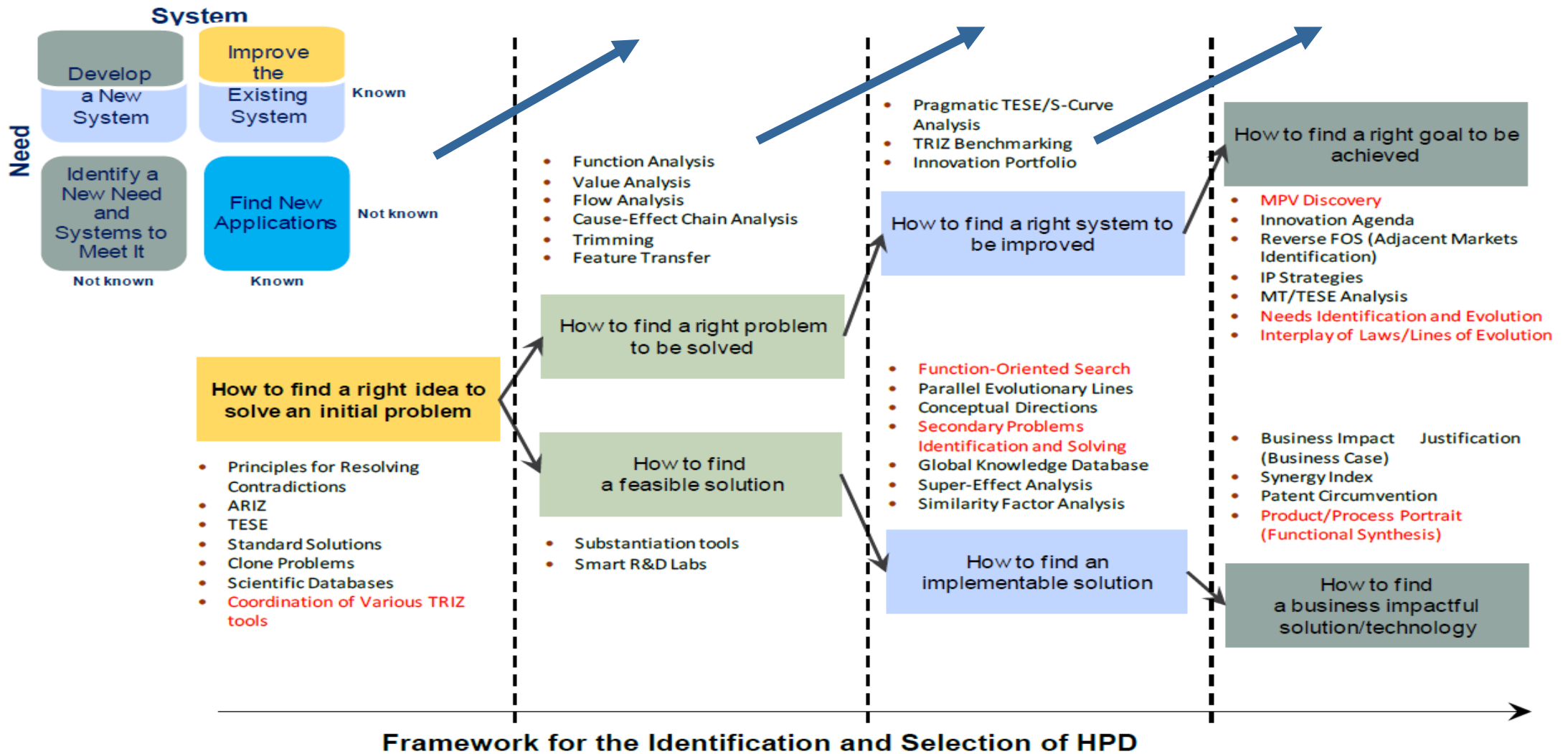
The year of 2016 was celebrated as first, the 60th anniversary of foundation of TRIZ since the first paper on TRIZ "About Psychology of Inventive Thinking" was published by Genrich Altshuller [Altshuller 1956].

应用TRIZ解决问题的流程



TRIZ主要特点： 系统化、结构化、多种工具支持的技术创新方法；技术进化的科学。

High-Priority Directions (HPD) for TRIZ Development



国际研究现状：以经典TRIZ为基础的新理论不断涌现

Genrich Altshuller (1998) 去世后TRIZ发展状况



*TRIZ



xTRIZ



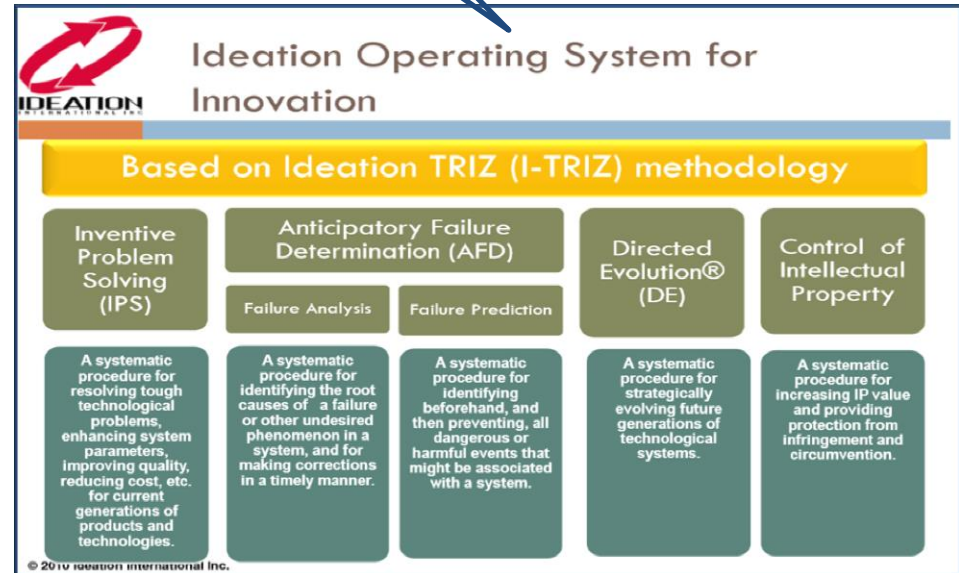
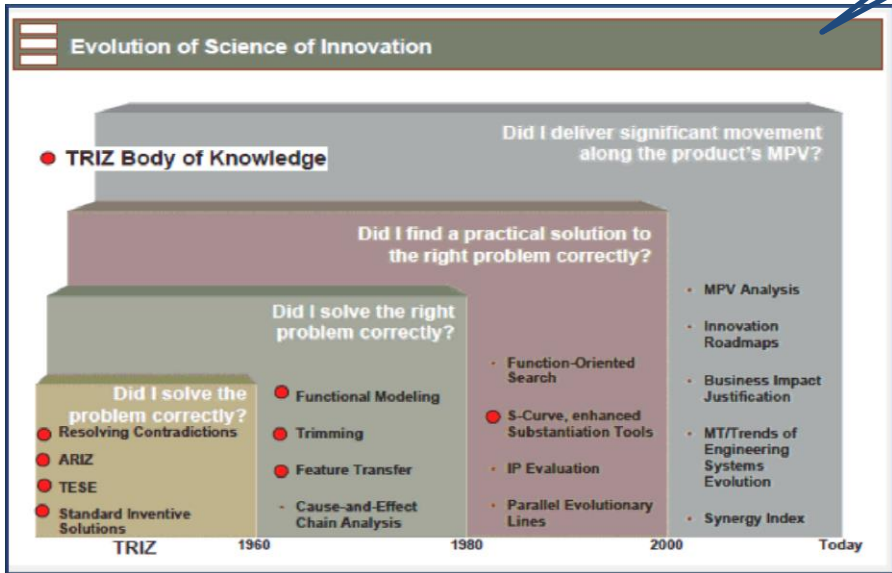
现代-TRIZ



I-TRIZ



P-TRIZ



TRIZ FUTURE CONFERENCE 2015

THE 15TH INTERNATIONAL CONFERENCE OF THE EUROPEAN TRIZ ASSOCIATION ETRIA

Berlin / October 26-29 / nhow Berlin

SUBSCRIBE FOR UPDATES

Global
structured
innovation

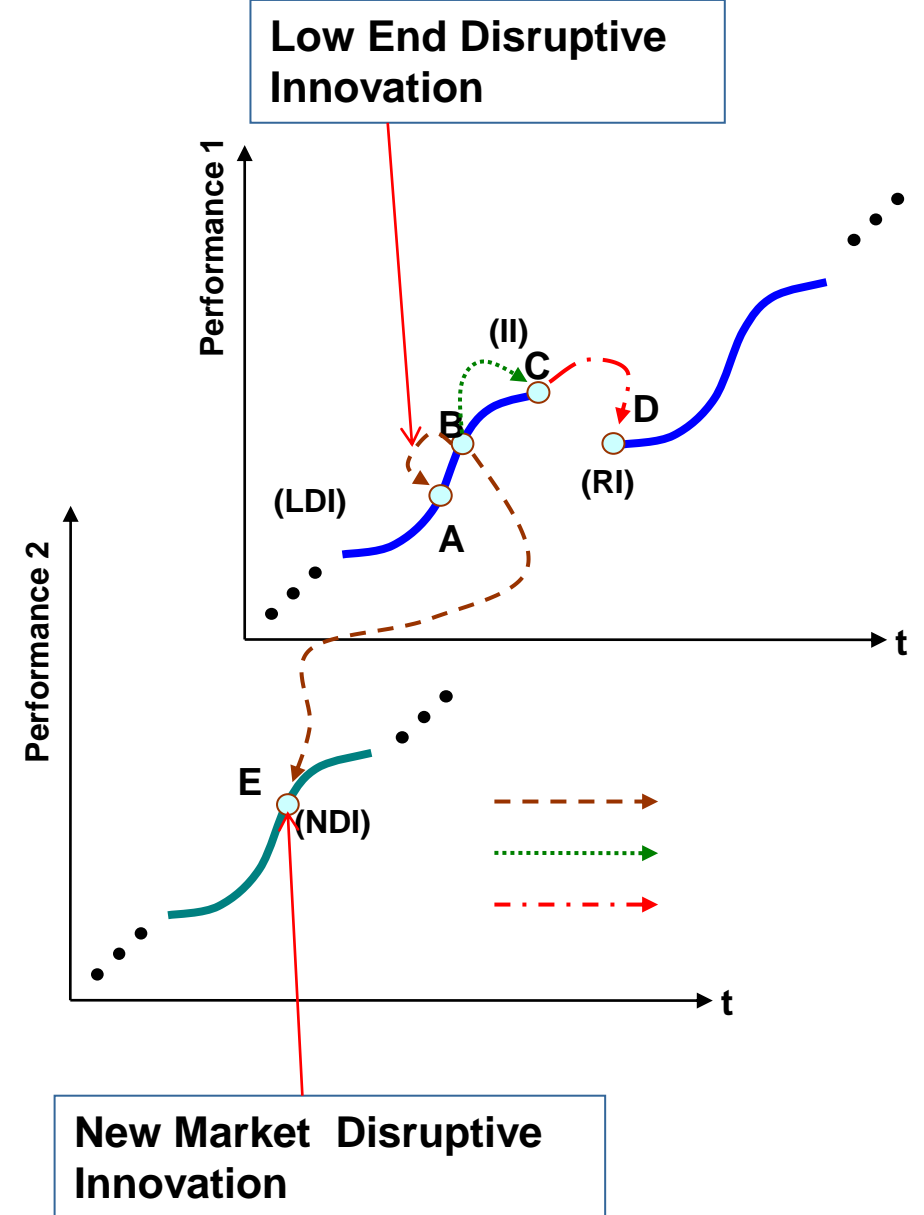
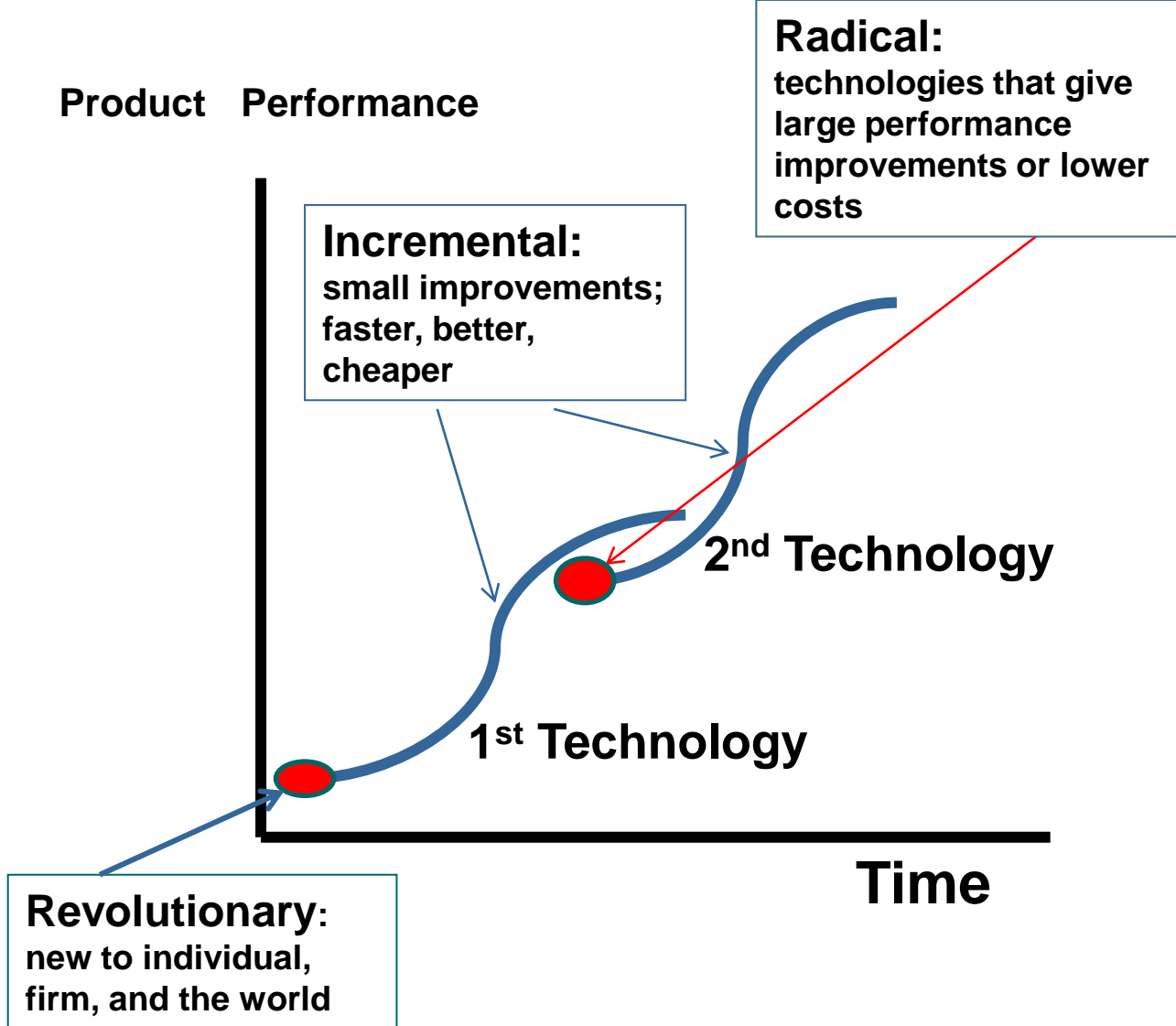
TRIZ
FUTURE
2015

Day 3 - 28.10.2015

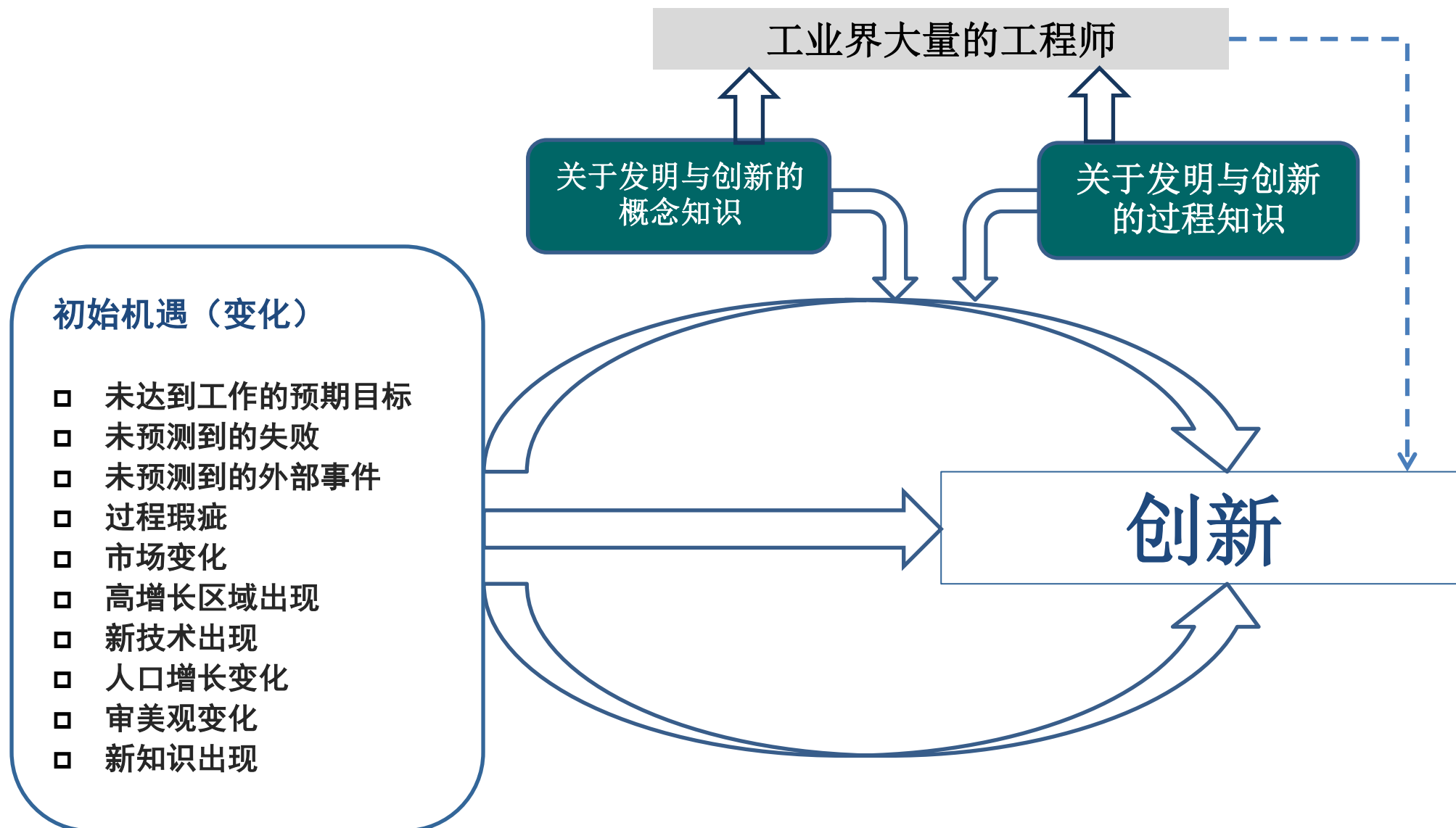
TRIZ Future Conference 2015 - Agenda 15092015.xlsx

16.15		Problem solving methods of Standard Solutions under the analogy thinking. WANG, Qiuyue; YANG, Bojun; DUAN, Xiuling	User in engineering innovative design and contradiction identification*. HOUSSIN, Remy; SUN, Xiaoguang; RENAUD, Jean; GARDONI, Mickael	
16.40	Coffee Break			
17.00	Workshops	The Workshop topics will be selected by the participants and announced at the conference		
	Workshop topics	<ol style="list-style-type: none">1. Corporate TRIZ: How to implement TRIZ into the innovation process ←2. TRIZ for Services: How TRIZ supports service design3. TRIZ education: Cooperation of industry and universities4. Extending TRIZ: Combination with other systematic methodologies for product development5. TRIZ future: Middle and long term perspectives6. TRIZ markets: Building business models and discovering "Blue Oceans"		
18.00	End of the conference day			

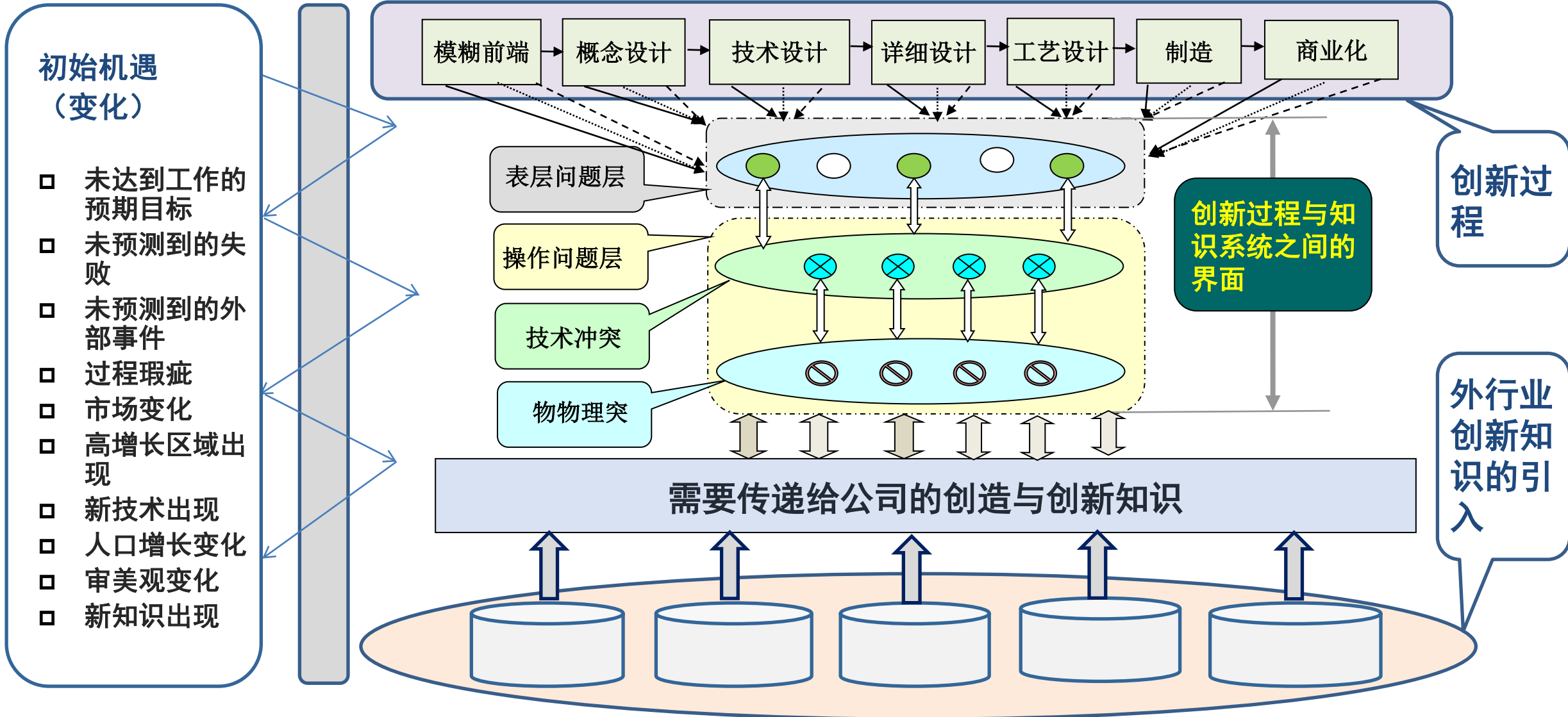
创新的类型：渐进性、突破性、破坏性



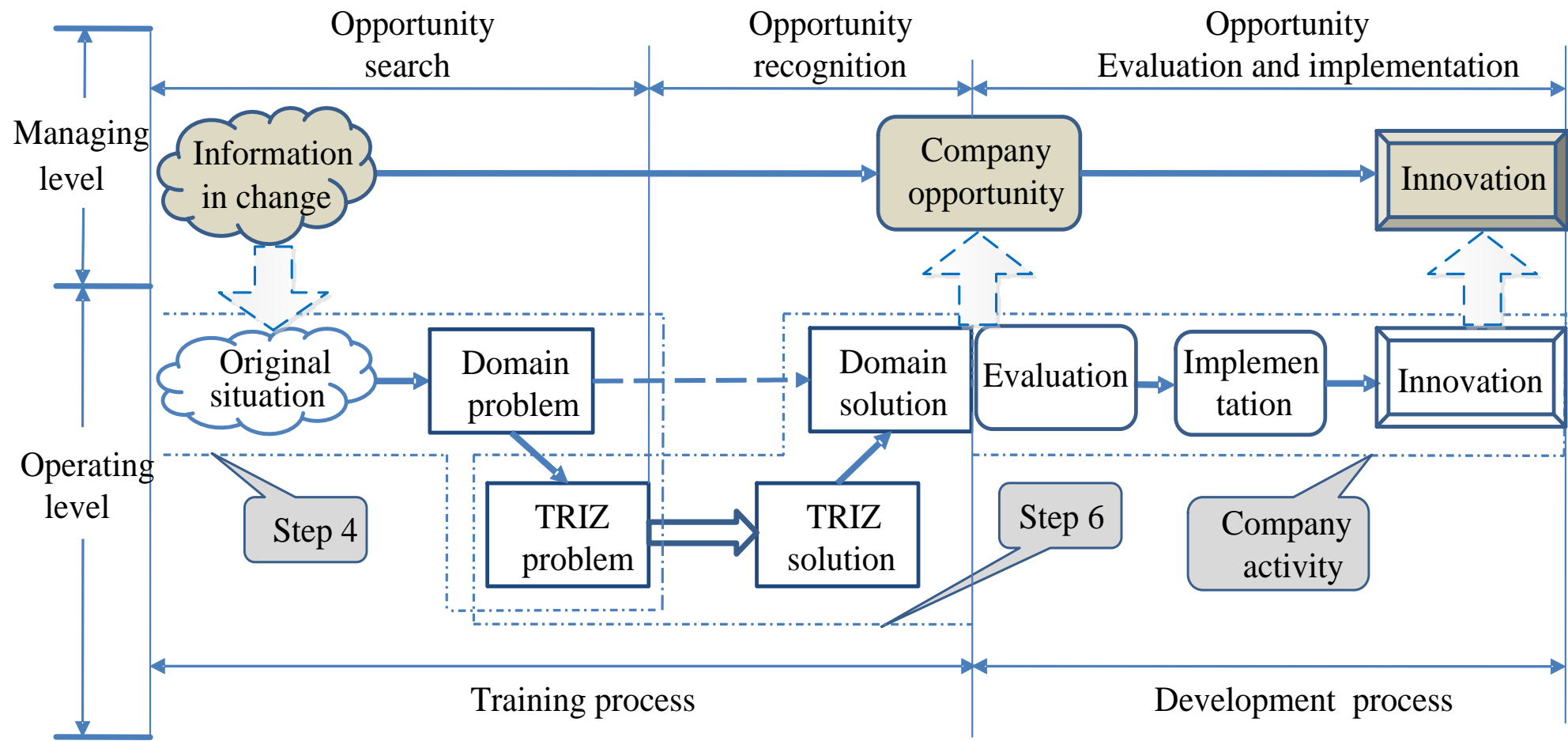
TRIZ培训过程中的机遇转换



可能的机遇是创新过程的激励因素

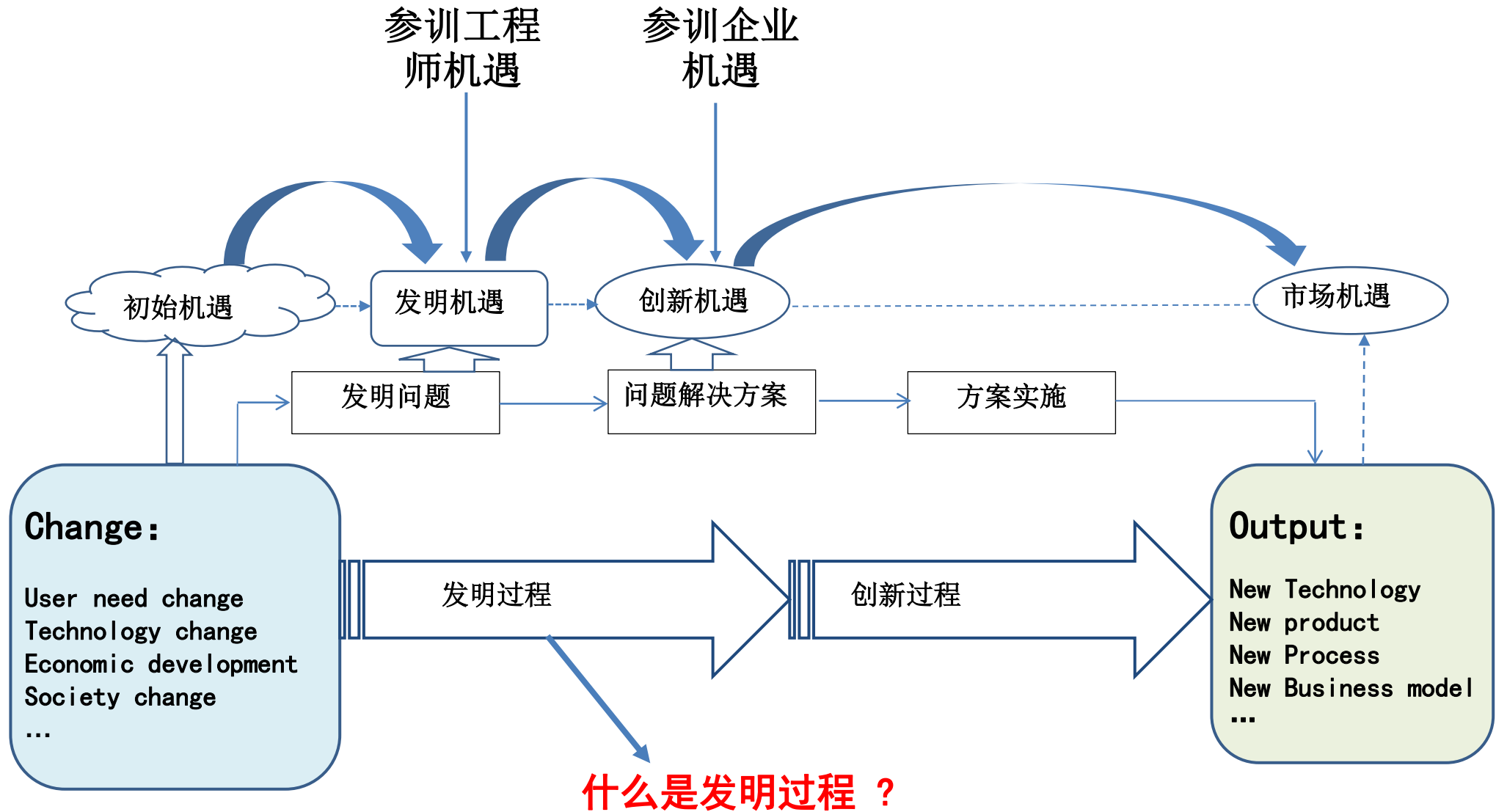


机遇驱动的培训过程



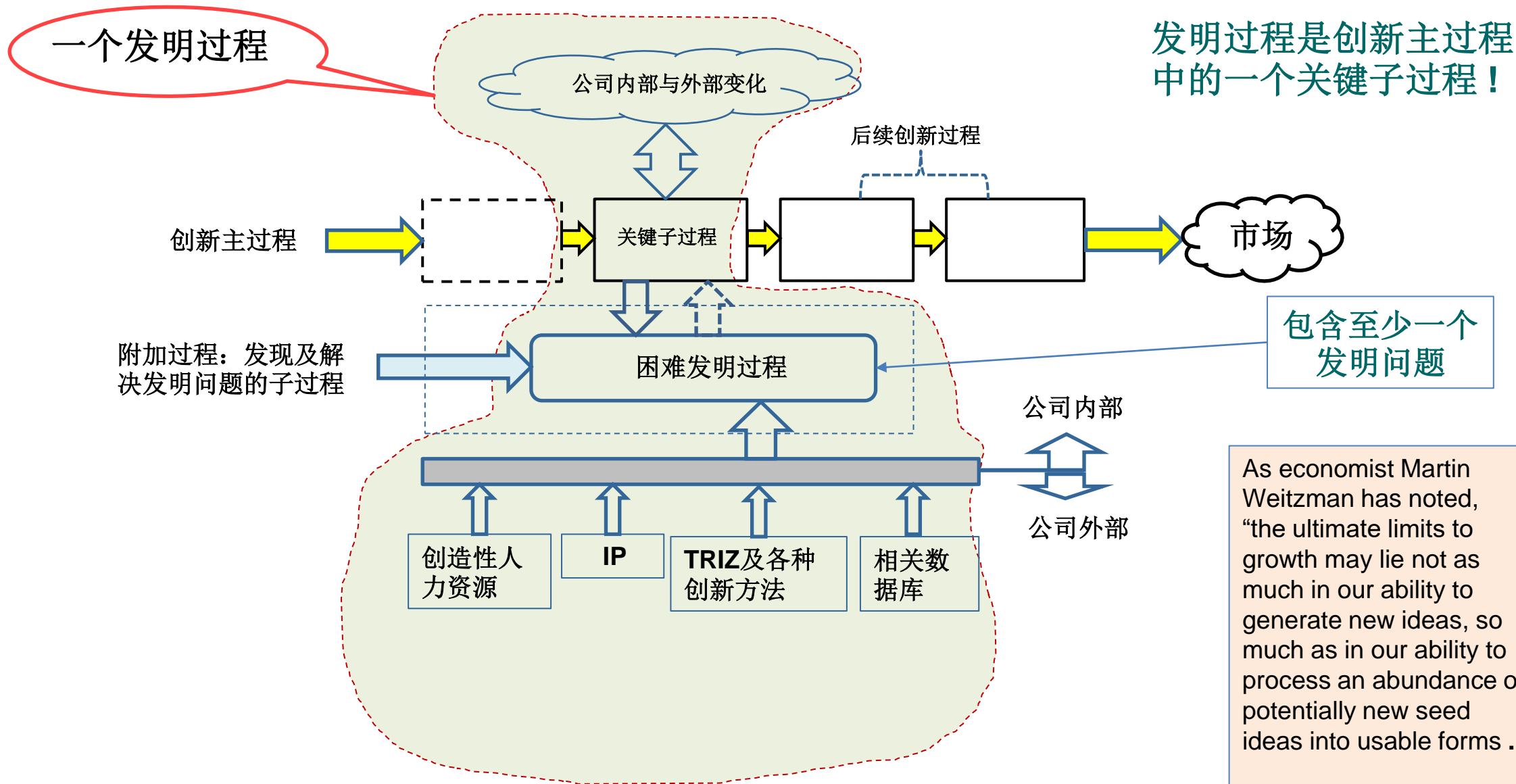
Source: Tan 2017

机遇转换过程

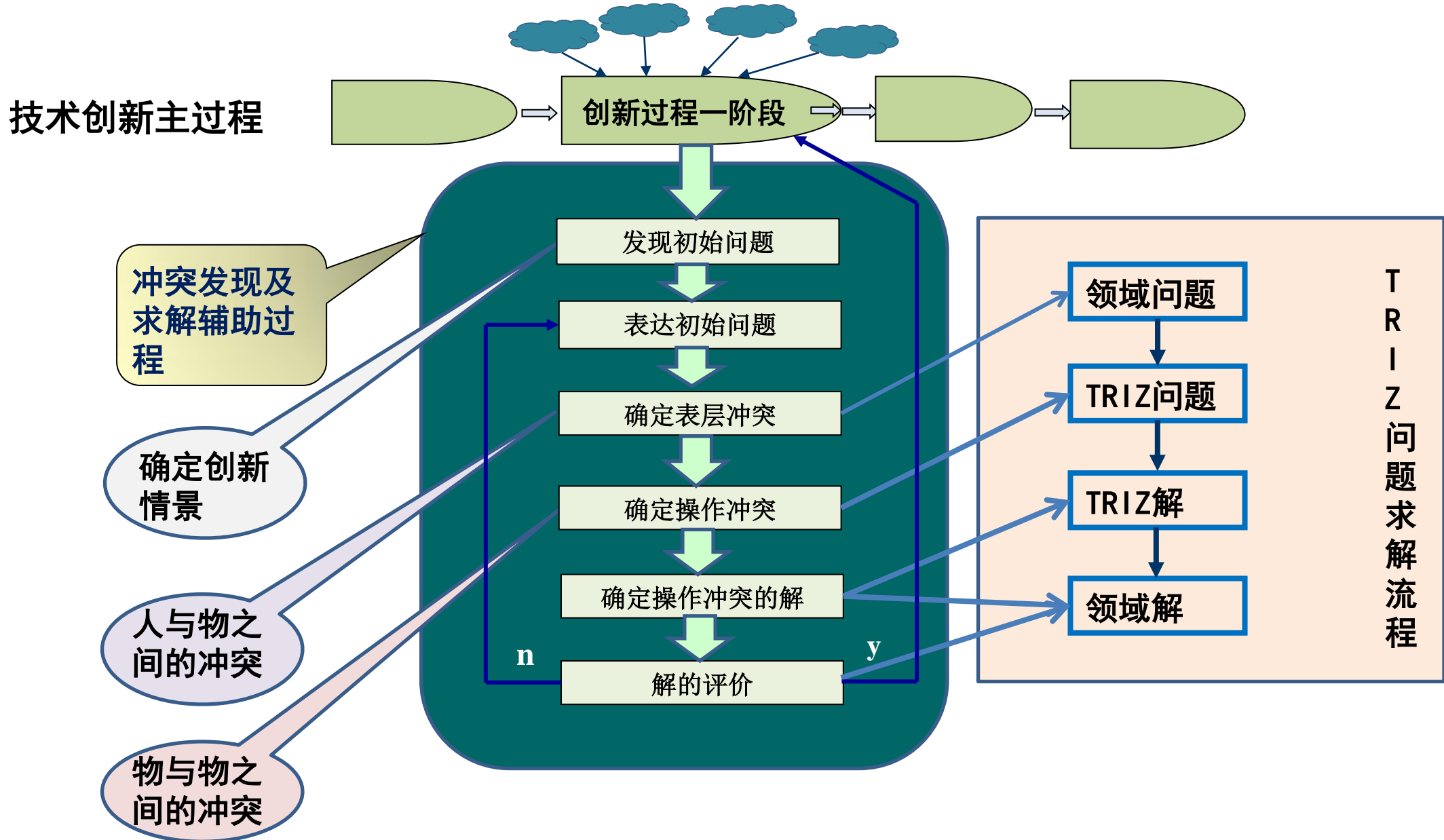


Source: Tan

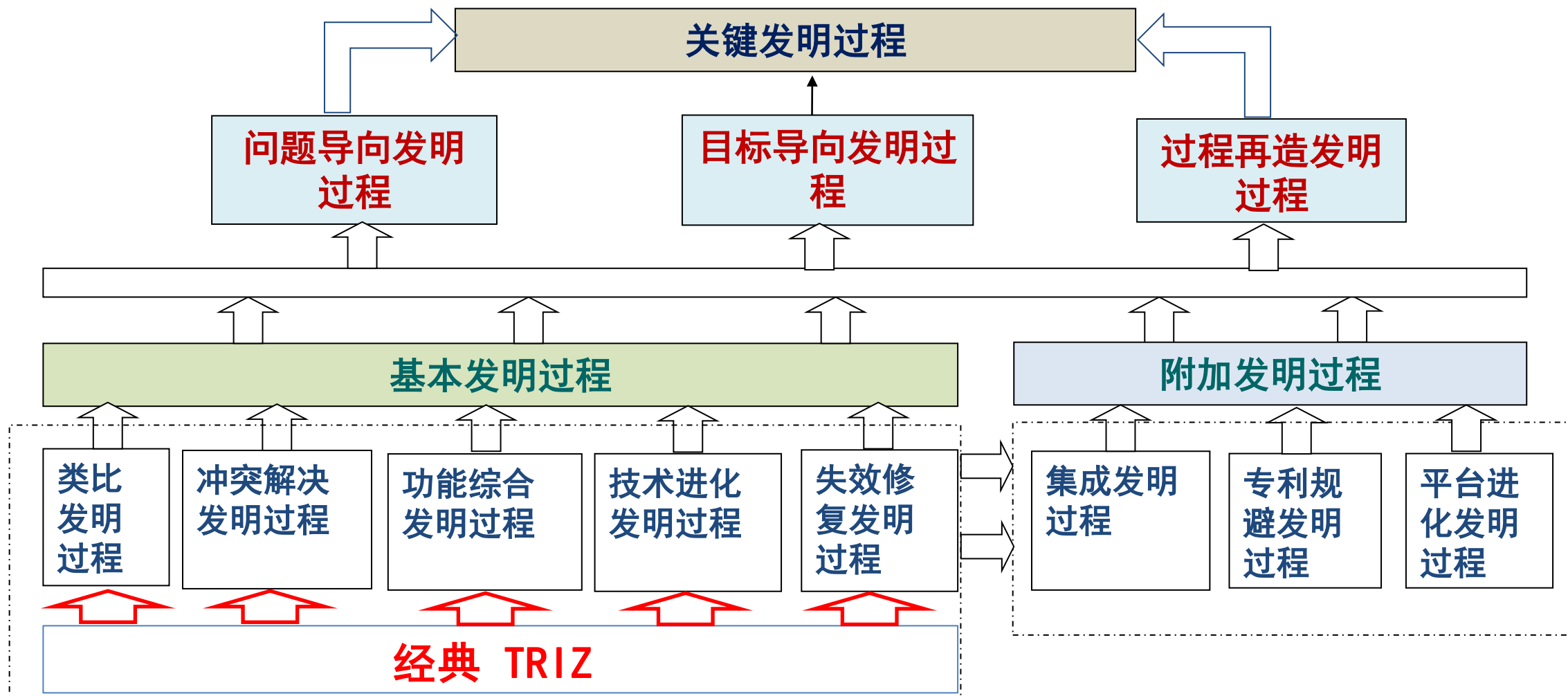
一个发明过程



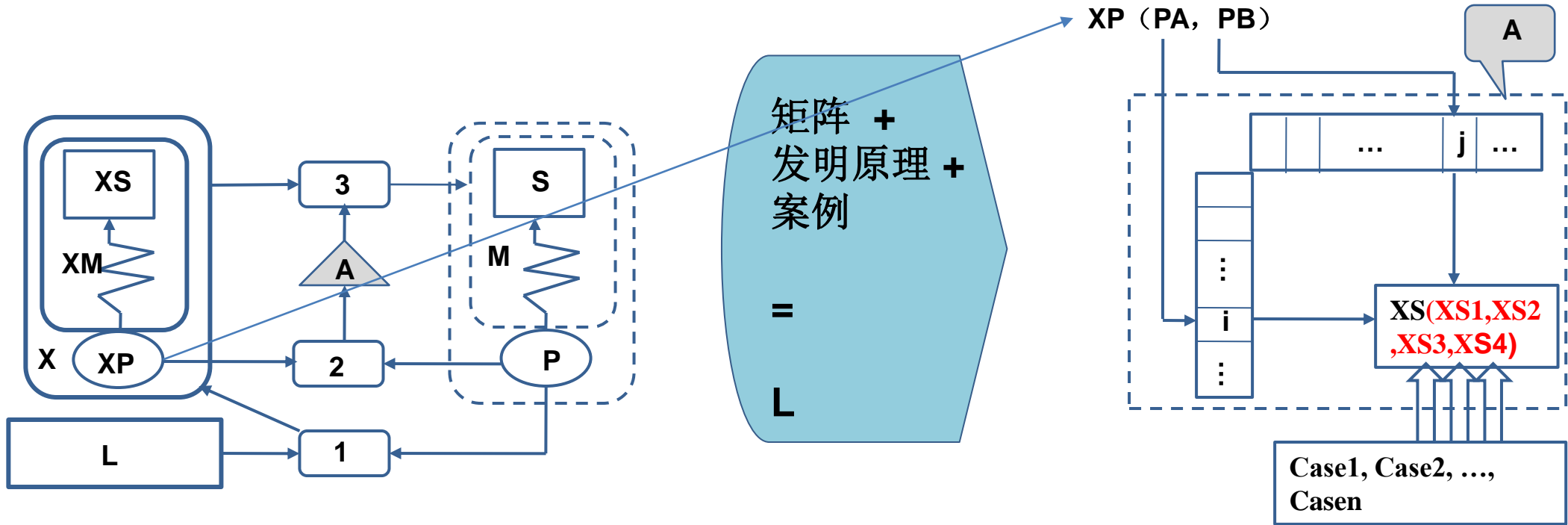
案例研究：冲突驱动的发明过程



发明过程分类



案例研究： 类比发明过程

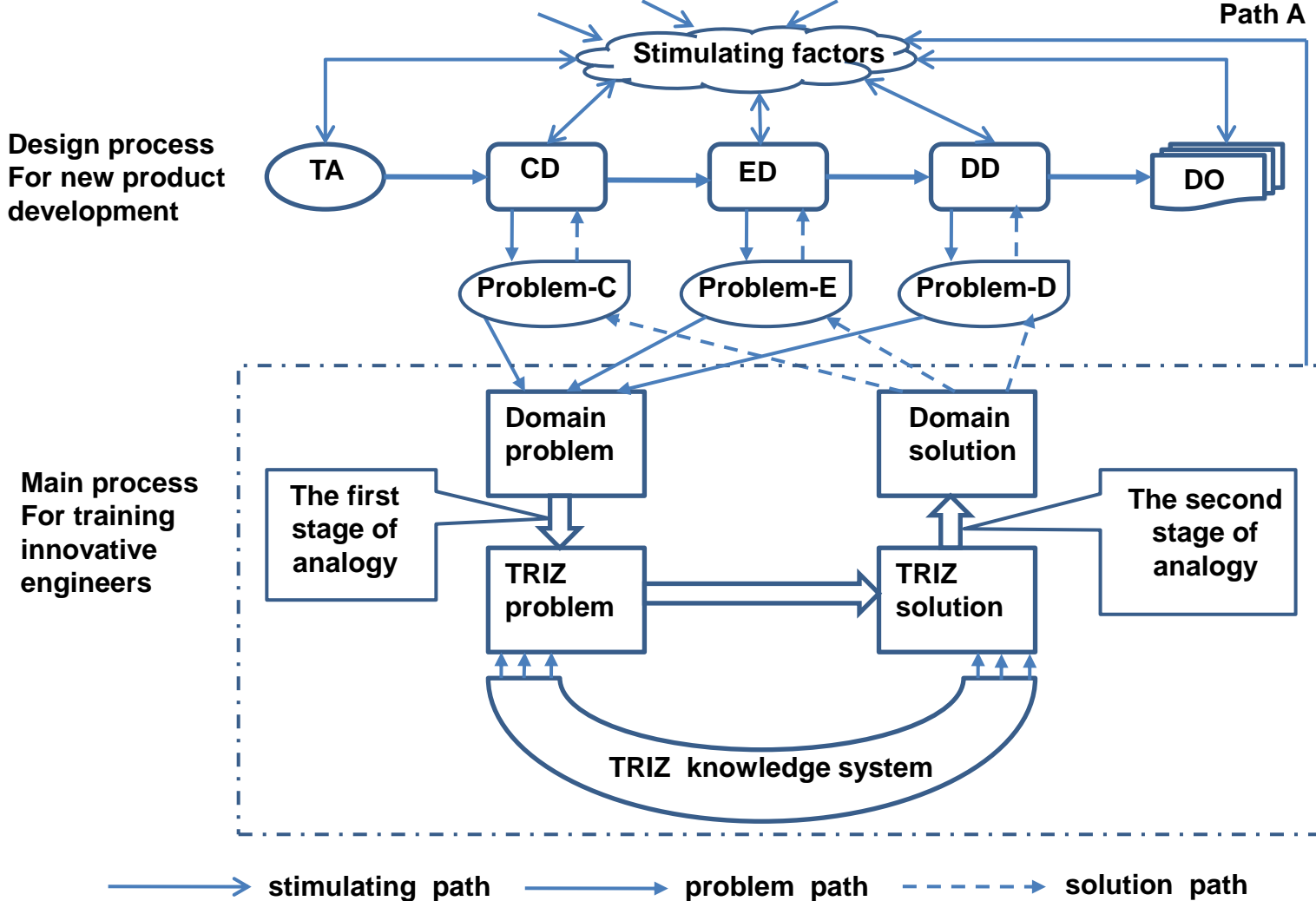


类比问题解决通用模型

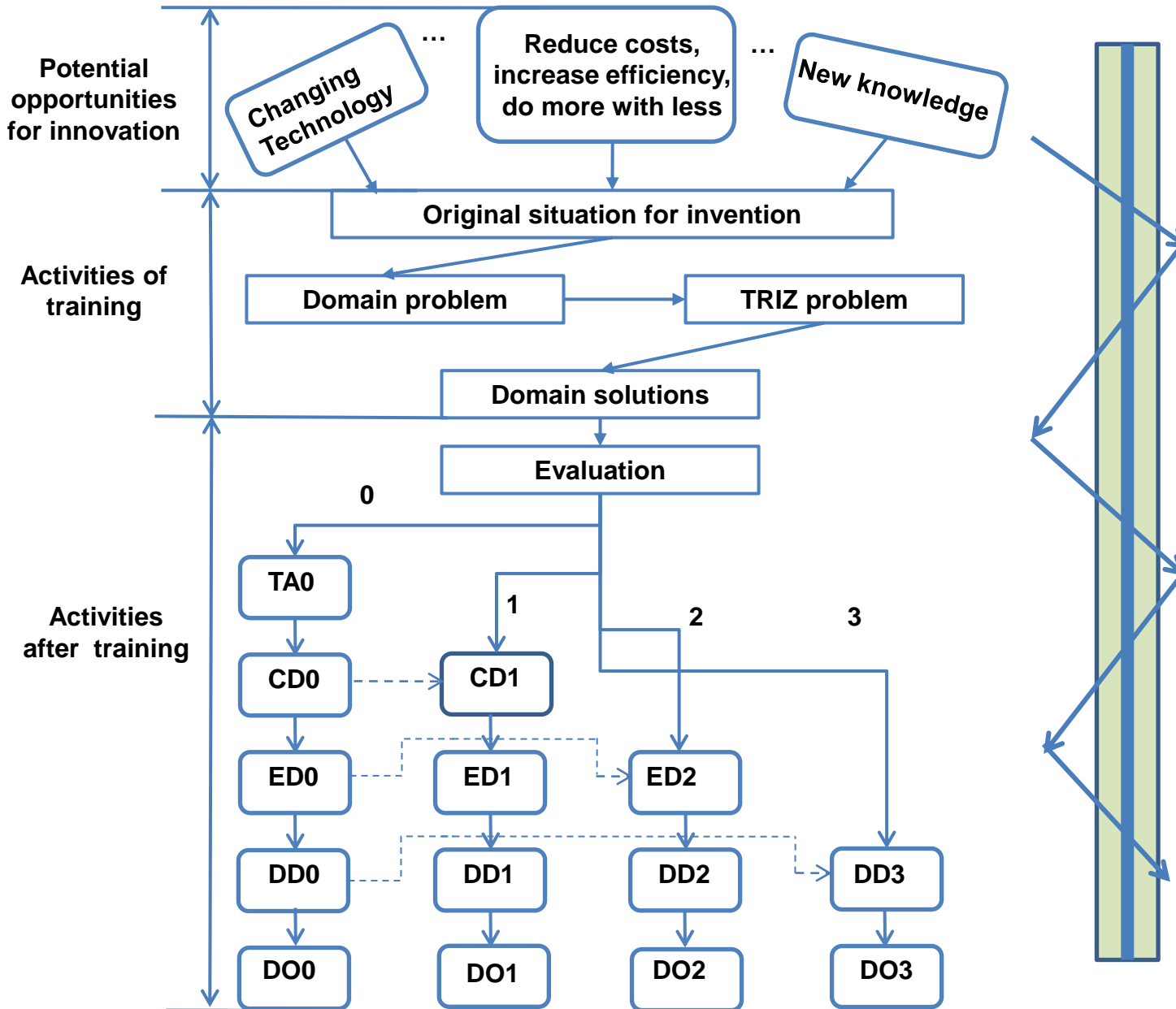
冲突解决模型

Source: Murphy J, 2014,

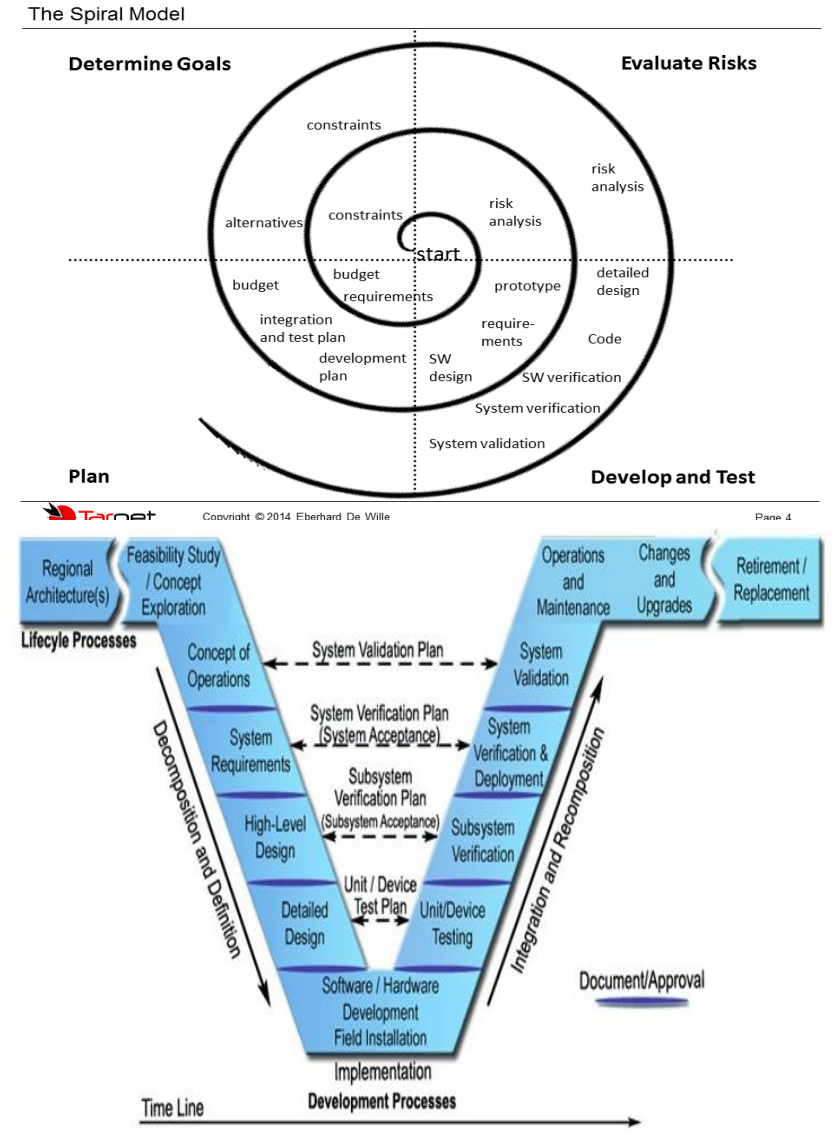
案例研究：设计过程的改进



TRIZ培训与设计过程的融合

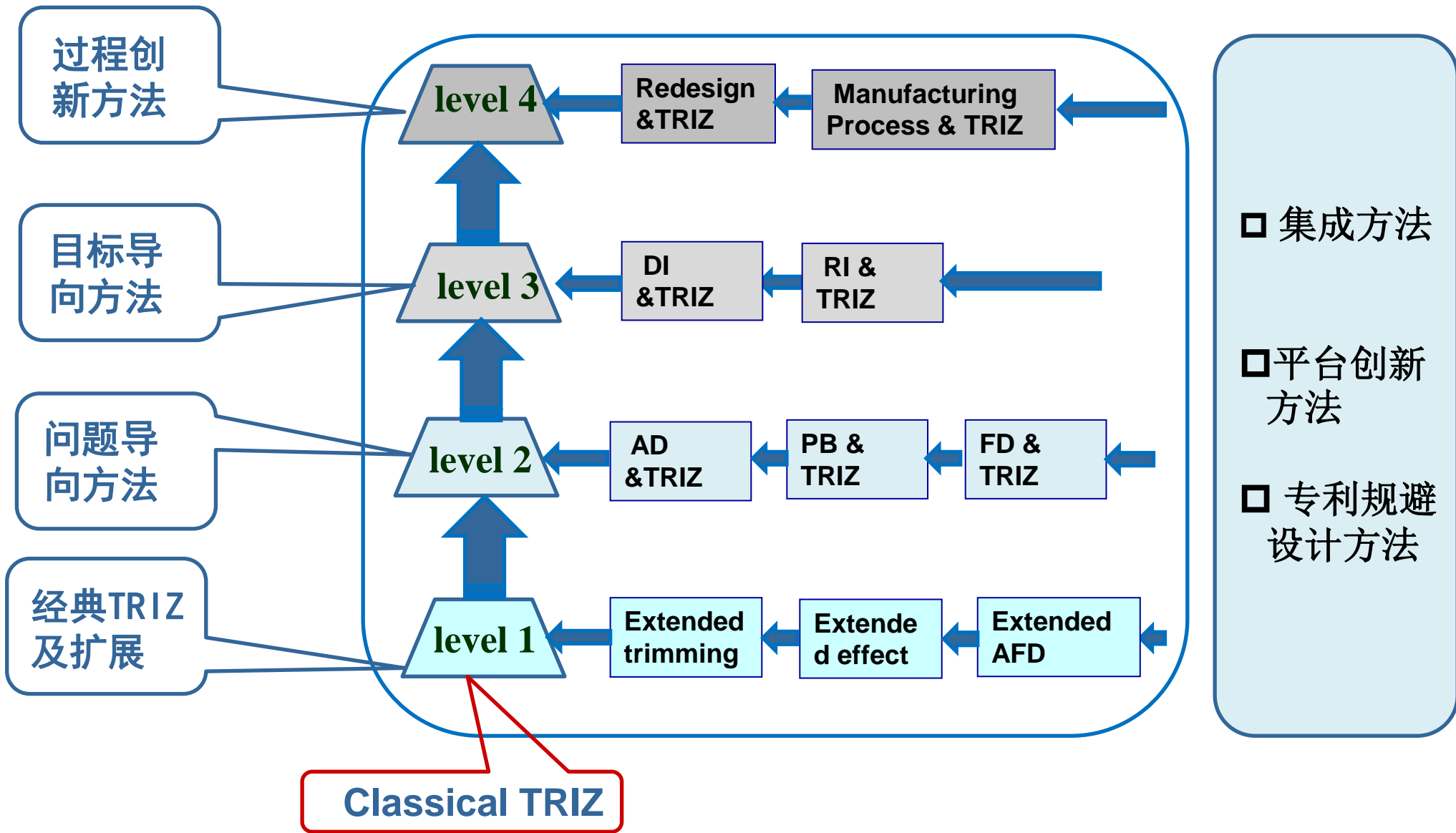


The model of Pahl & Beitz

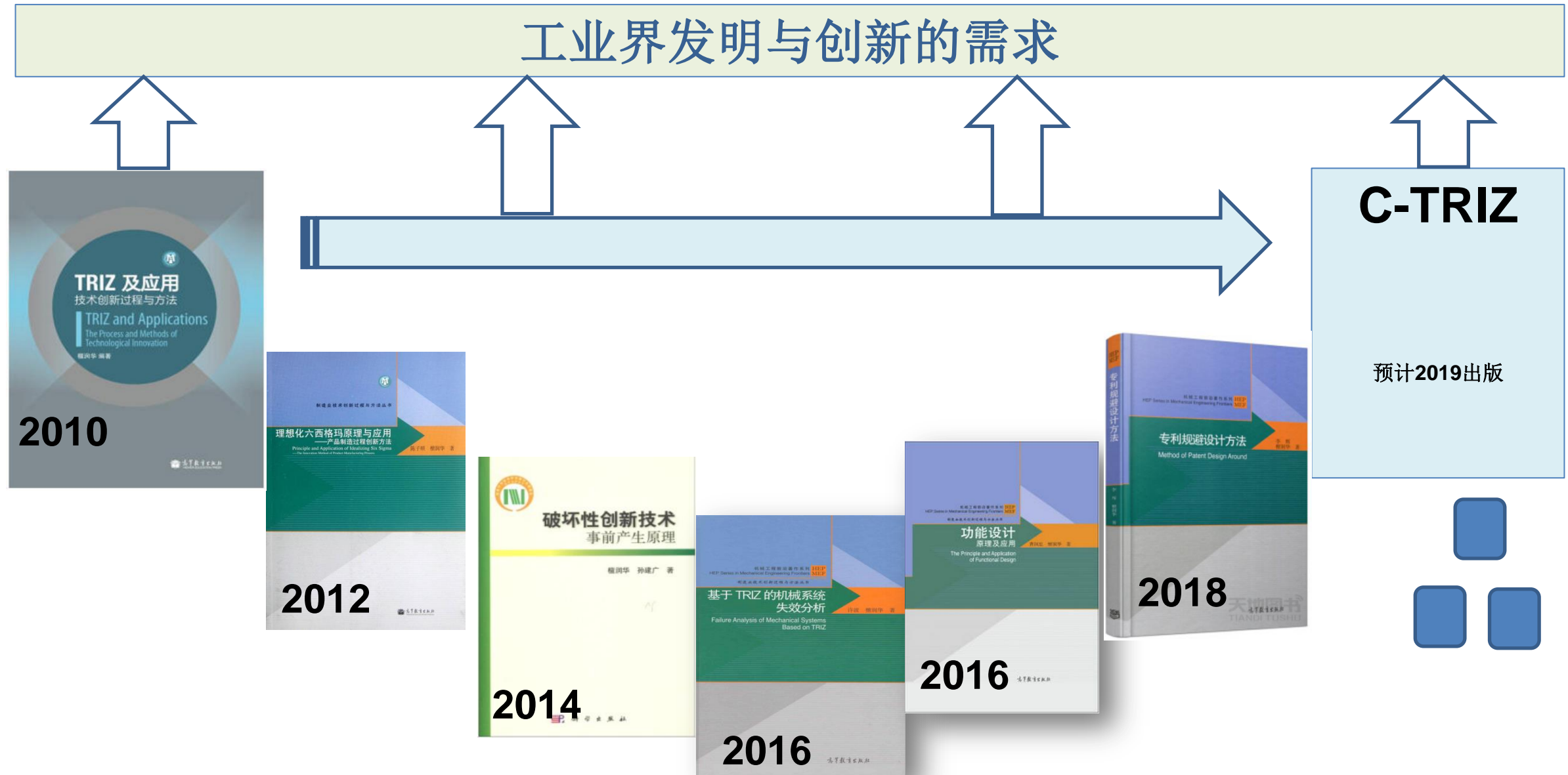


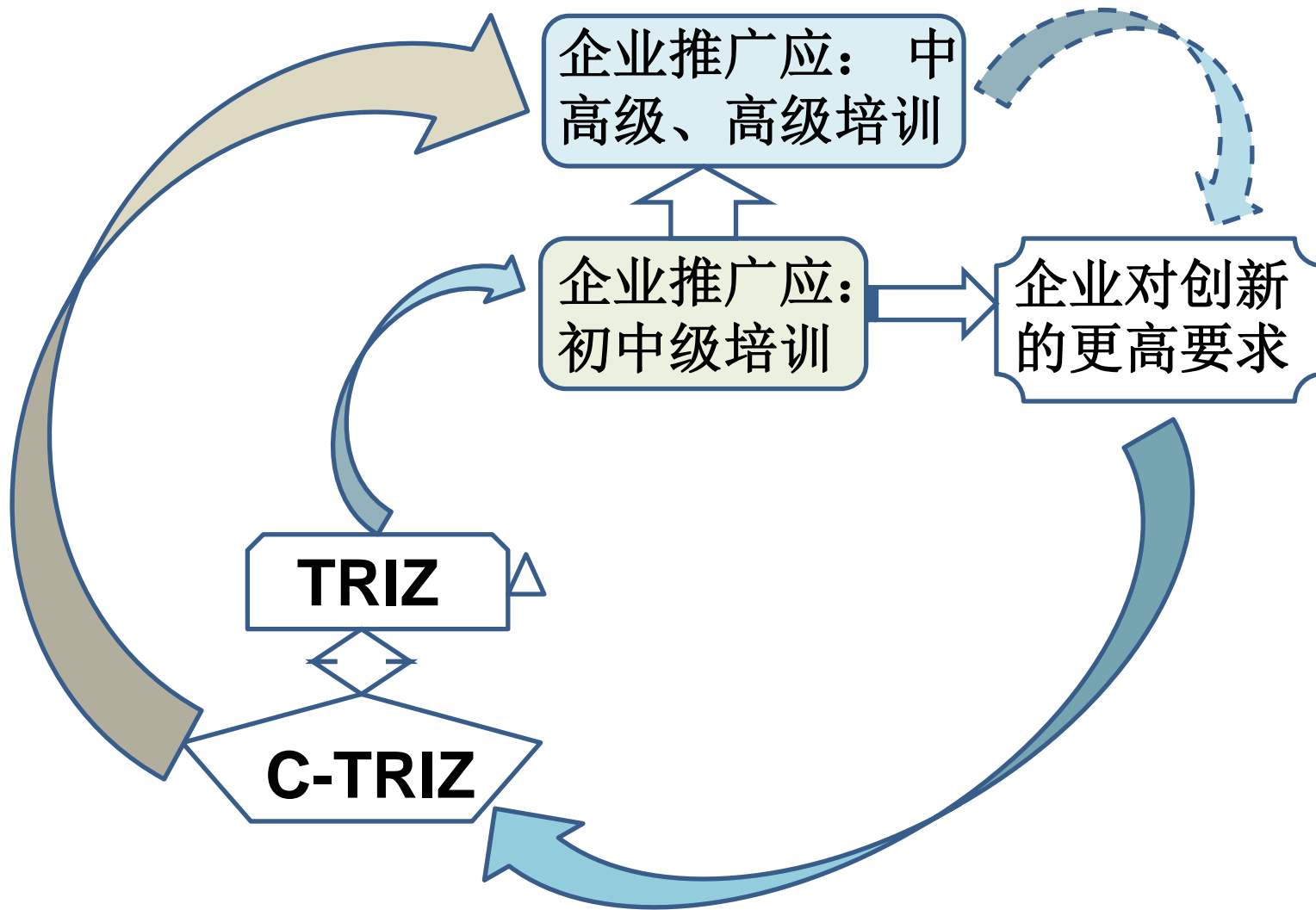
4. C-TRIZ 组成

C-TRIZ: 4层方法



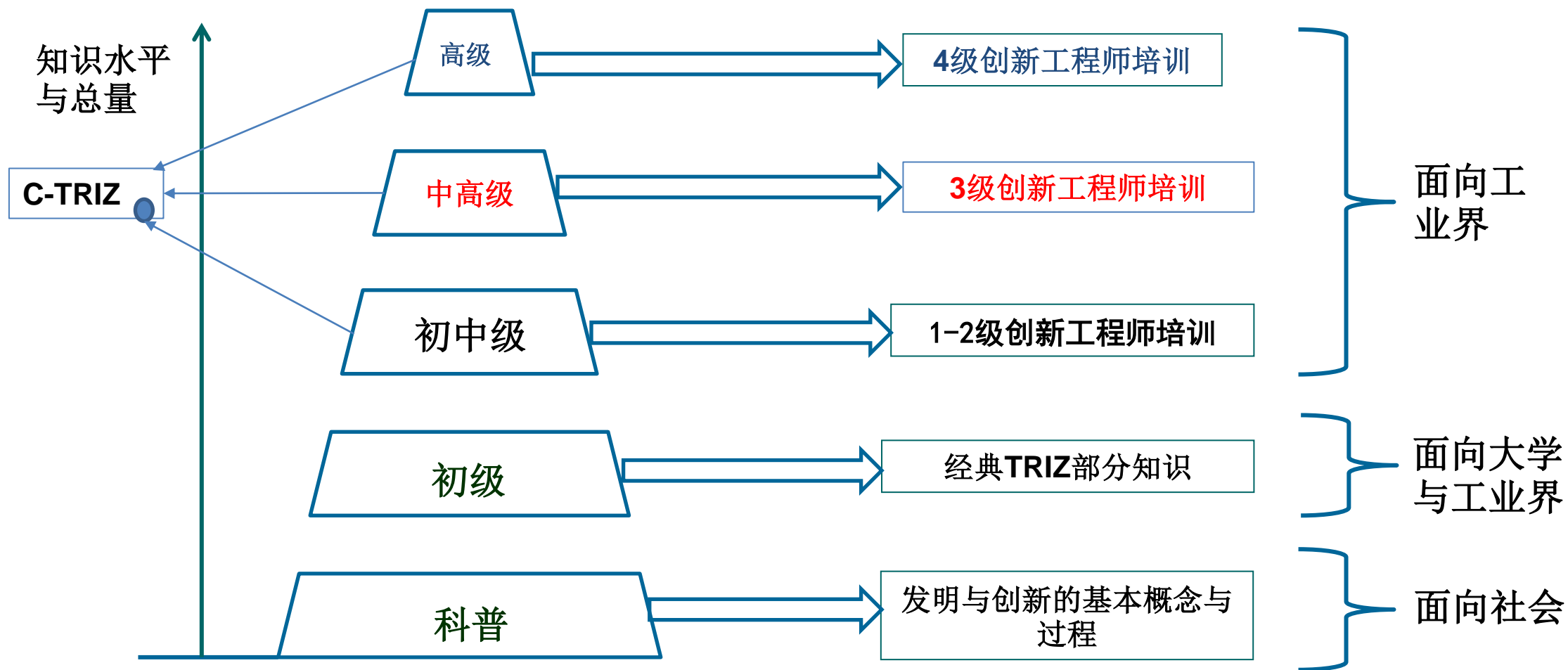
组成C-TRIZ的研究成果 (Theory of Inventive Process Solving)





5. C-TRIZ 推广应用

本中心的五级培训过程



自2015年，本中心已举办9期中高级创新工程师培训班

450名创新工程师参加了该级别的培训： 模式正总结之中



2015-9-17 河北石家庄



2015-10-11 浙江杭州



2015-11-24 吉林长春



2016-1-29 青海西宁



2016-6-13 天津河工大



2016-7-13 广东广州



2017-4-25 湖北武汉

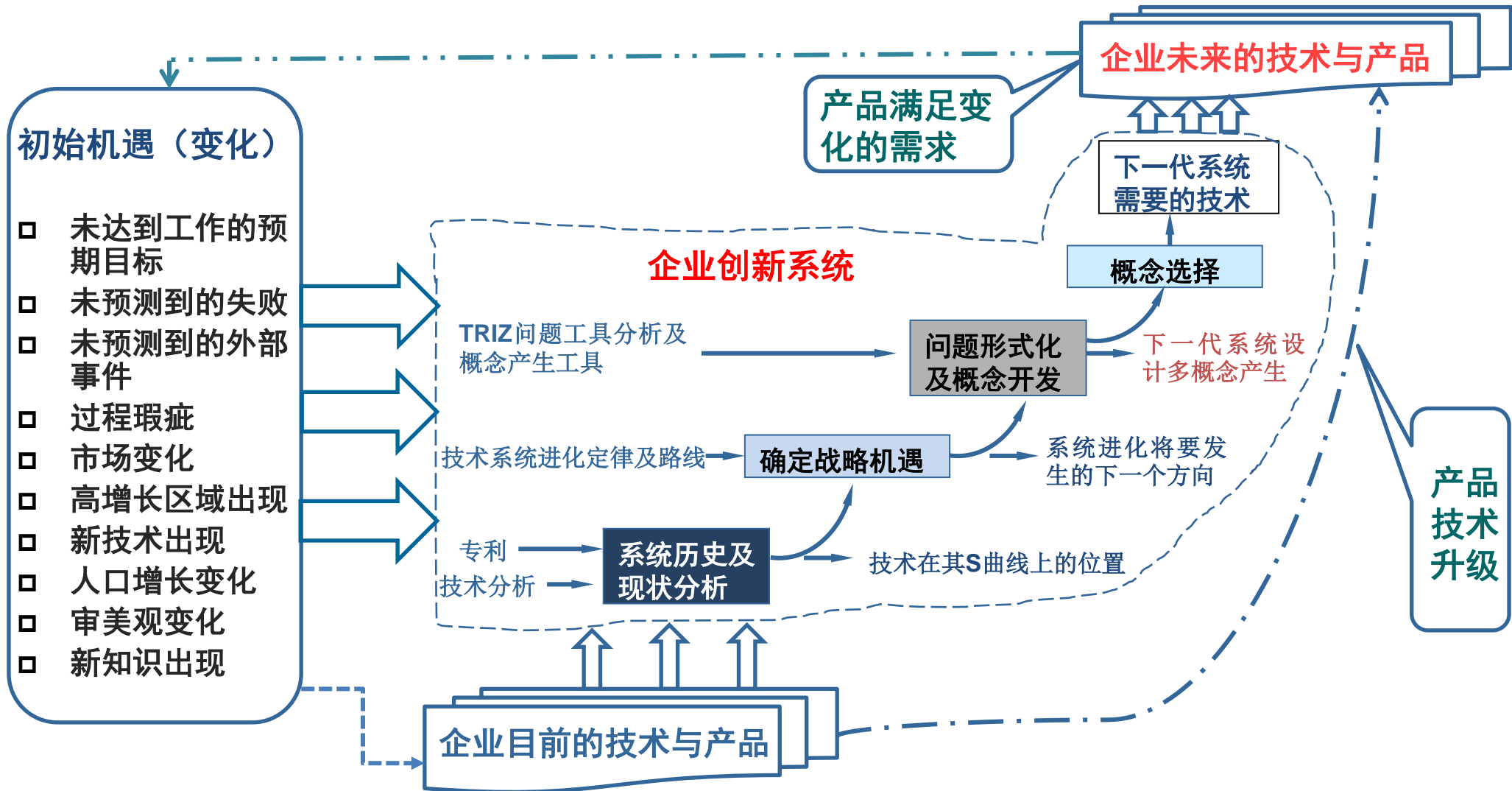


2017-7-31 华北油田



2017-11-6 浙江杭州

TRIZ/C-TRIZ 引领工业界的创新！



6. 结论

培训 Level 3 (弯道超车)

挑战 1:

能否作为一种外部资源引入企业？如何引入？

- 回答是肯定的！
- 国际多年的实践证明是可行的。
- 本中心的实践证明也是可行的。

挑战2:

谁是工业界应用TRIZ的**大众用户**？如何训练他/她们？

- 工作在企业的工程师是TRIZ的直接大众用户。
- MEOTM：是一种面向企业的大规模训练模型。实践证明训练结果很有效。

培训 Level 4-5 (直道加速)

挑战 3:

TRIZ可用于突破性**及破坏性创新**吗？整体或部分？如何进行？**提升企业的竞争力**？

- 可以！**目标导向的创新**！
- 该类创新方法是 C-TRIZ 的开发目标！
- C-TRIZ部分已完成，2019年预计专著出版。

借助于 **TRIZ/C-TRIZ** 的引入，区域或企业的
创新能力、市场竞争力
可以提升！

Welcome To Tianjin !!



The banner features a dark blue background with a landscape image of a park and a lake. At the top left is the AITRIZCON 2018-II logo. A navigation menu at the top right includes links for ABOUT, ORGANIZERS, SPEAKERS, DEADLINE, SCHEDULE, FAQ, and CONTACT. The central text reads: 11-12 AUG, 2018 / TIANJIN CHINA, AI TRIZ CONFERENCE 2018 - II, LARGEST TRIZ BASED CONFERENCE. A 'REGISTER NOW' button is positioned below the text. Three speaker portraits are shown: two on the left and one on the right.



谢谢各位专家多年来对本中心的支持！

rhtan@hebut.edu.cn

<http://www.triz.com.cn>