

# Analysis of Follow-up Evaluation Results of Research and Development (R&D) Projects Applying Logic Model to Elucidate the Process of Innovation

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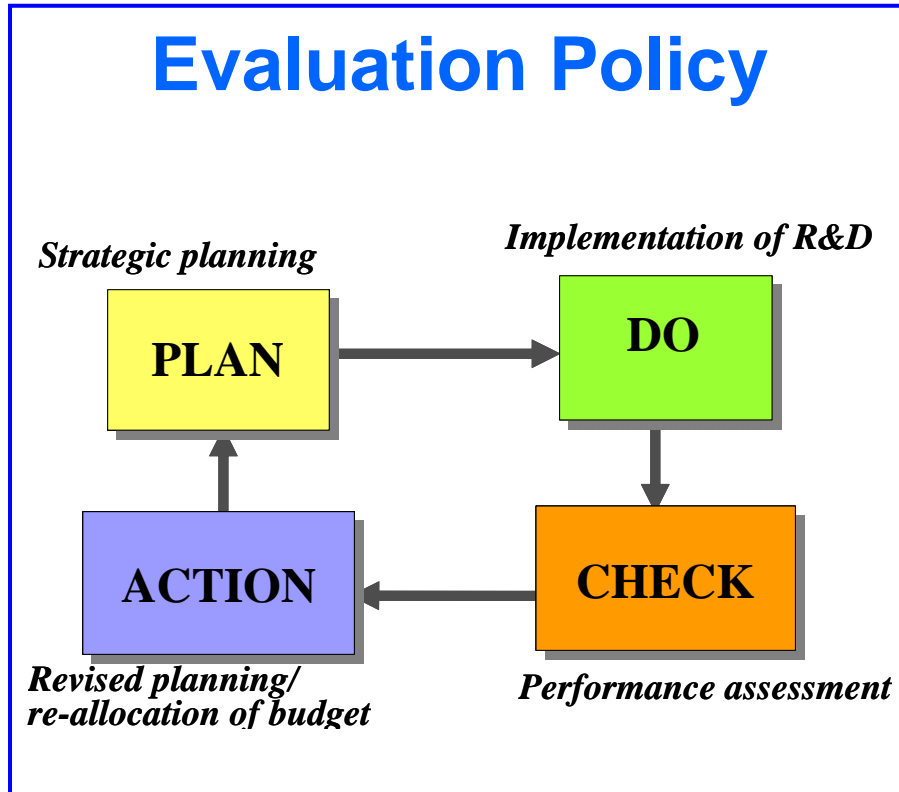
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**Opinions expressed here are solely those of the authors.**

- 1 . Background and Objectives
- 2 . Current METI R&D Follow-up Evaluation
- 3 . Challenge of New Follow-up Survey to Elucidate Innovation Process
- 4 . Conclusion

# Background of this study



**Ex-ante Evaluation**

**Ex-post Evaluation**

**Interim Evaluation**

**Follow-up Evaluation**

**Less effective** for using to formulate  
subsequent policies and measures

**Why ?**

# Objectives of this study

- Look for the reasons why follow-up evaluation is less effective to apply for formulating subsequent policies and measures
- Discuss new Follow-up Survey Method

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# METI Follow-up Evaluation System

# R&D Project Evaluations at METI

Projects related to R&D		duration (year)													
		-1	1	2	3	4	5	6	7	8	9	10			
Type of Evaluation	Monitoring Internal		○	○	○	○	○								
	Ex-ante Internal	●													
	Interim External				●										
	Ex-post External							●							
	Follow-up External												●		
Managing Division	Technology Evaluation and Research Division														

1 or 2 projects / a year

- Projects completion is five years before
- Big projects ( > around 1 billion J\)
- One project / Technical field

**1. Interview** with responsible persons of projects



**2. Survey documents** by collecting projects related materials and **interviews**



**3. Panel reviews** by **external evaluators**

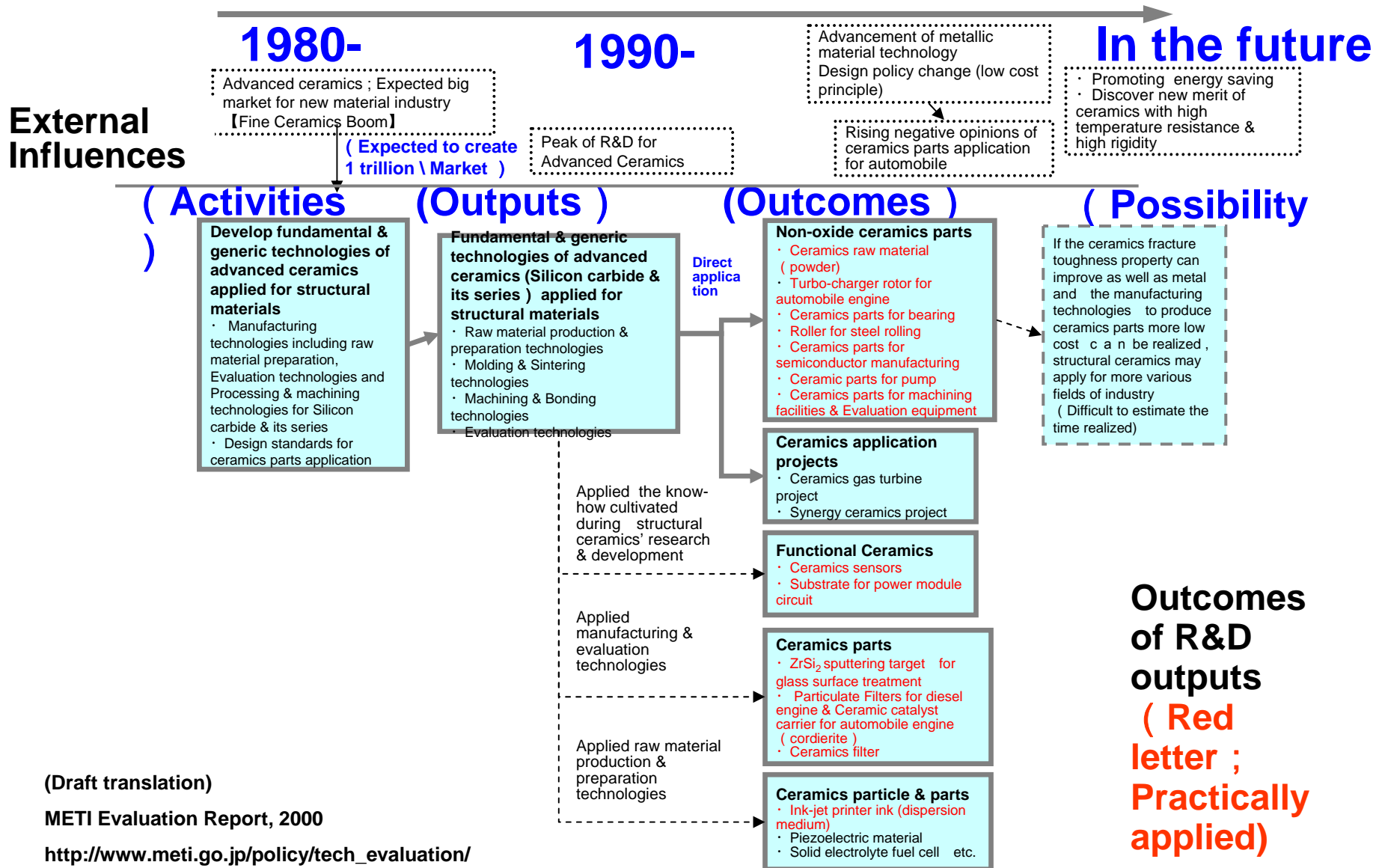


**4. Evaluation report** for each evaluation item with comments of evaluators

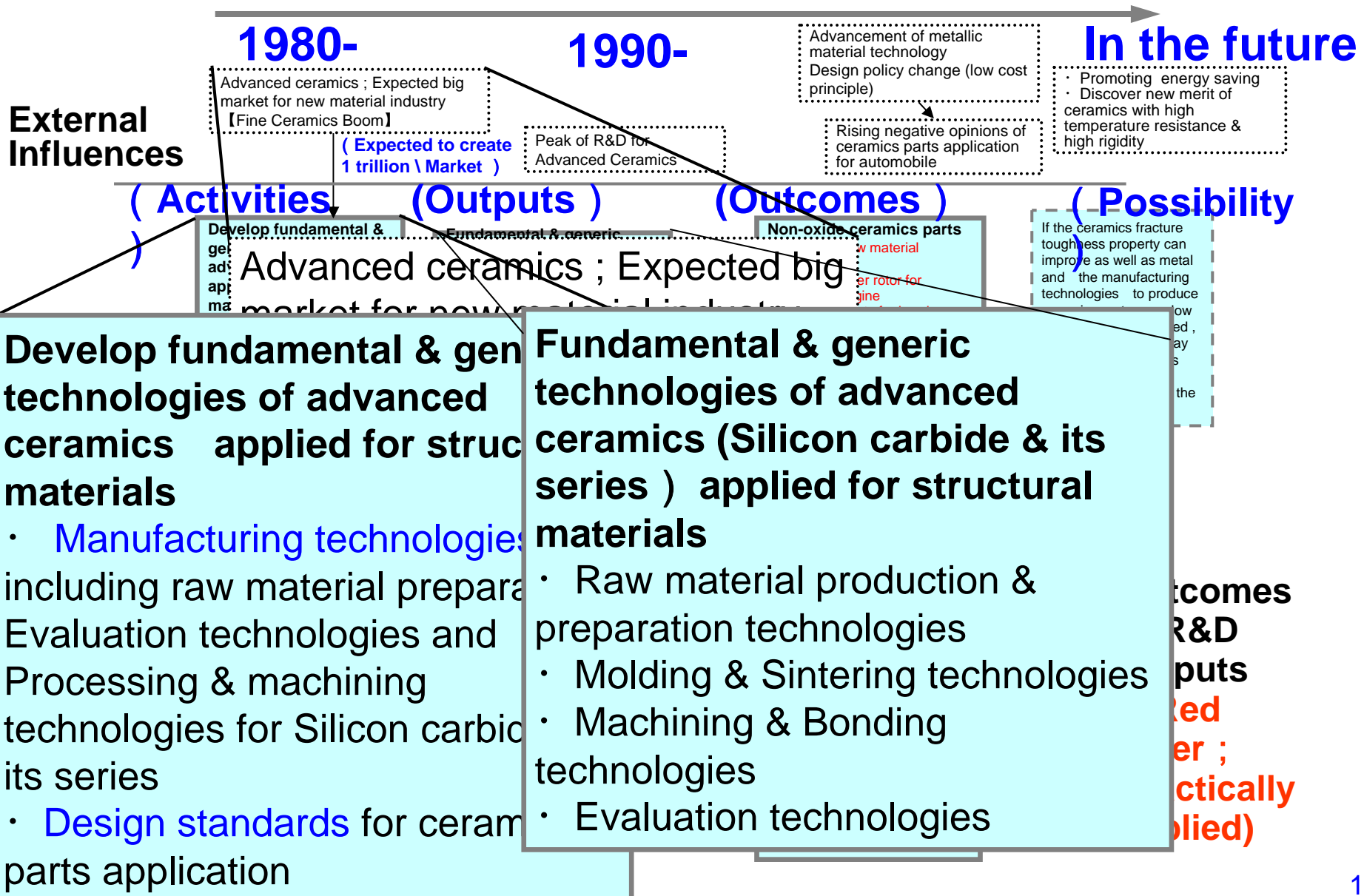


# One Example : Follow-up Survey

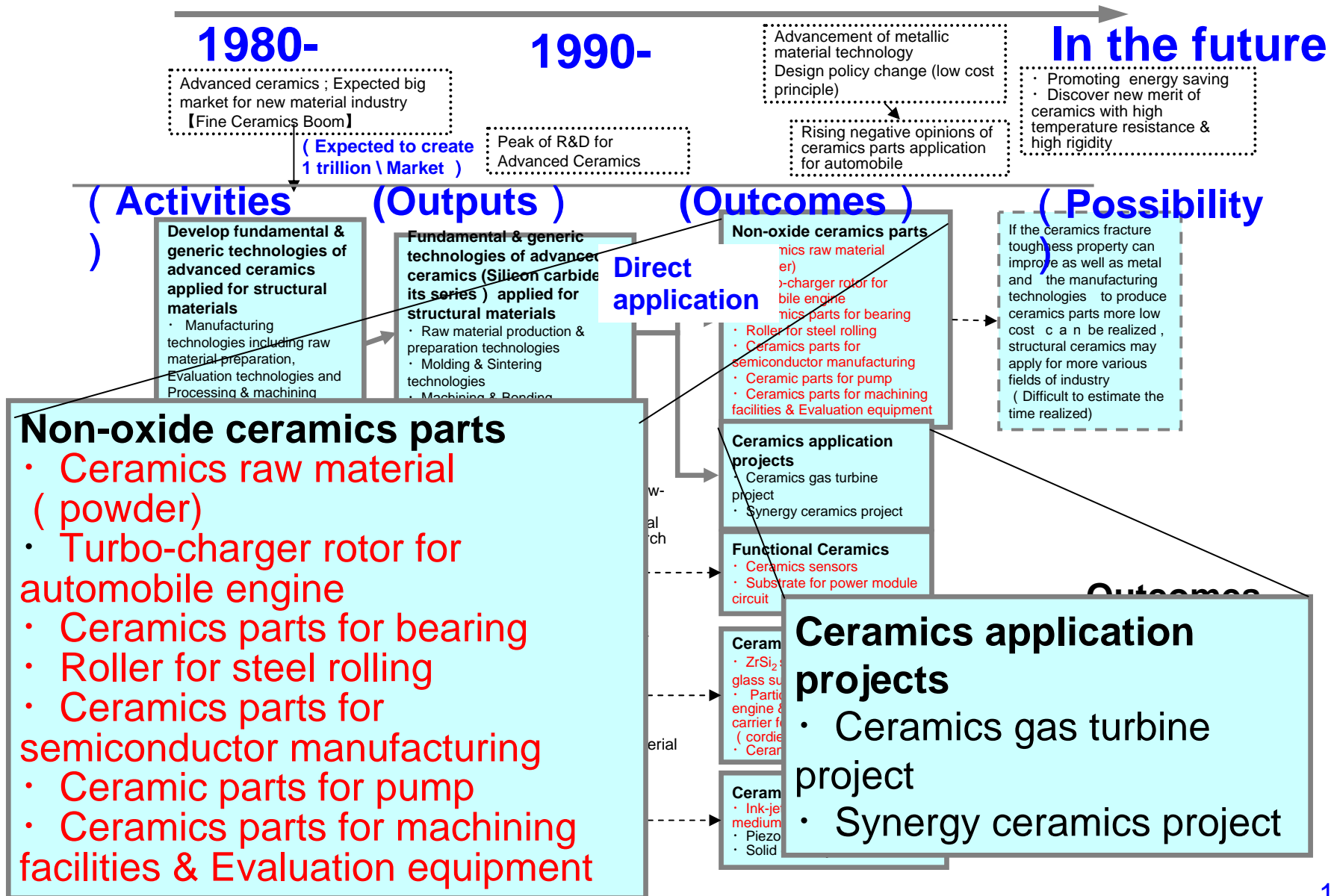
# Outcomes & Impacts Linkages Investigated at Follow-up Evaluation Study of Advanced Ceramics Project



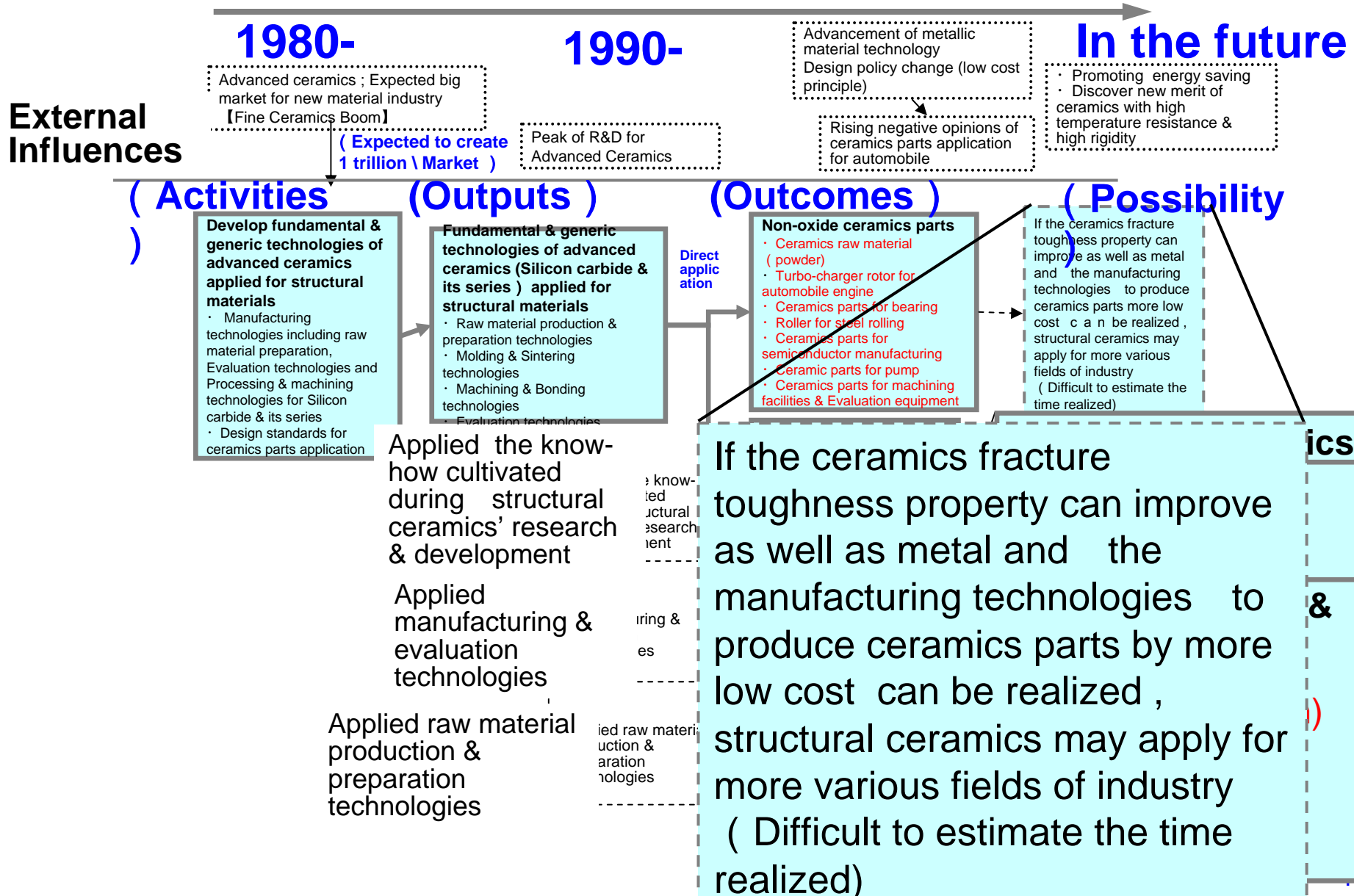
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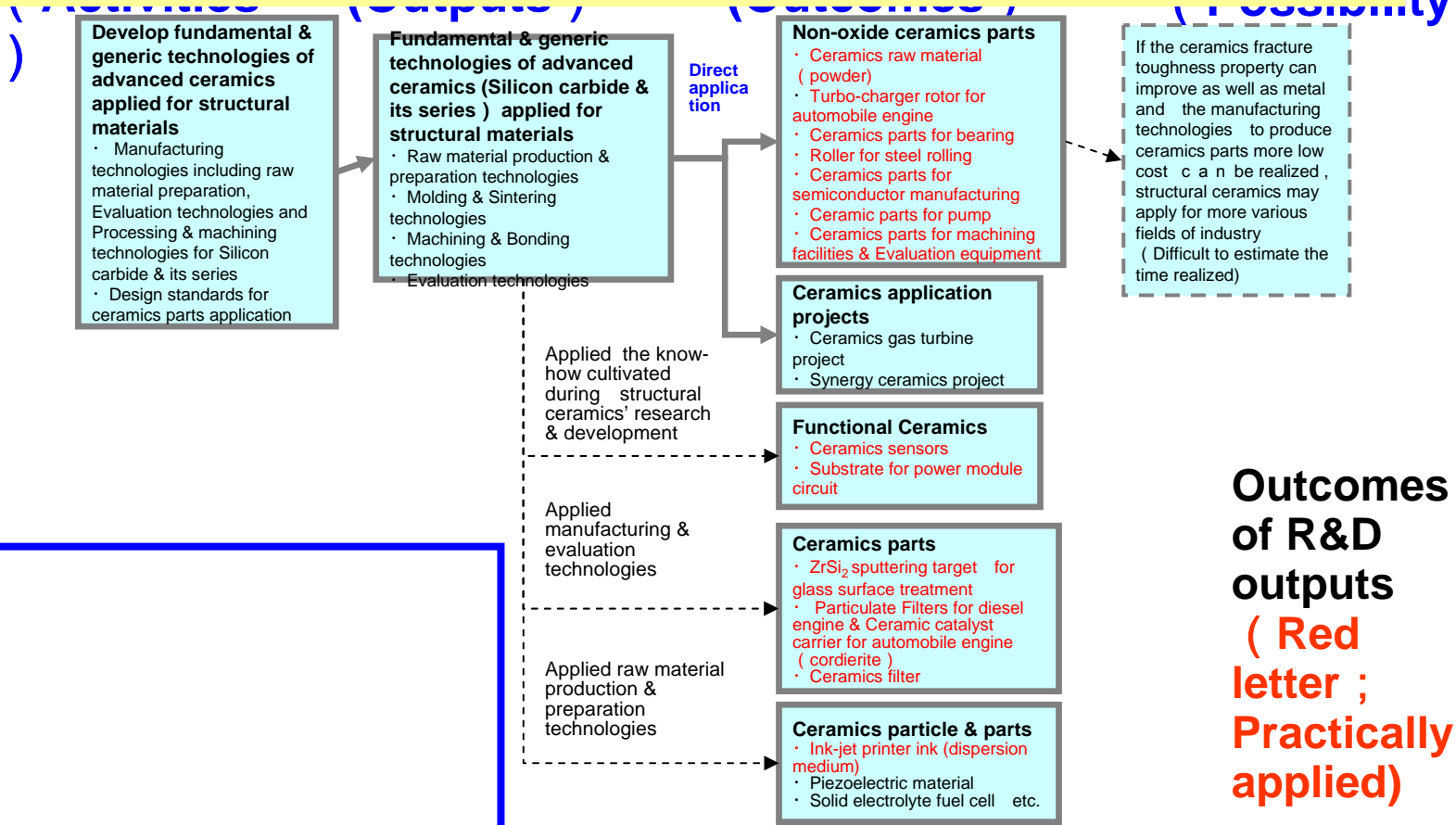


# Outcomes & Impacts Linkages Investigated at Follow-up Evaluation Study of Advanced Ceramics Project



# Features of logic model for follow-up

No respective linkages among outputs and outcomes. Technical elements which connect linkages are not explicit



**Outcomes of R&D outputs (Red letter ; Practically applied)**

# Features of logic model for follow-up evaluation in METI

## 【Evaluators' comments for the unrealized impacts of 1 trillion \ Market】

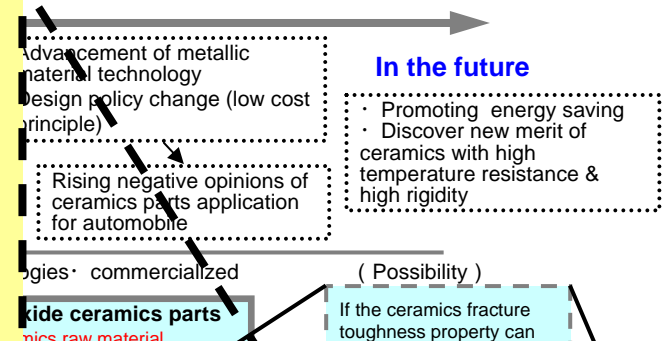
1 . Opinion change: Worth the cost, not performance

## No description of the expected outcomes which are necessary to make up impact

2 . Realized the material which satisfy the customers' request of 1 trillion \ market

3 . Technologies of cost reduction have not reached aimed target to realized 1 trillion \ market

4 . Contending technology advancing such as metal and ceramic material of oxide system



ceramics fracture toughness property can improve all as metal and the manufacturing technologies to reduce ceramics parts more low cost can be realized, natural ceramics may apply for various field of industry (difficult to estimate the time needed)

**Effective information for confirming  
project effects and impacts ;  
Accountability to the public**

But

- Missing relevant linkage
- Missing middle
- Missing outcomes expected

→ **How to solve?**



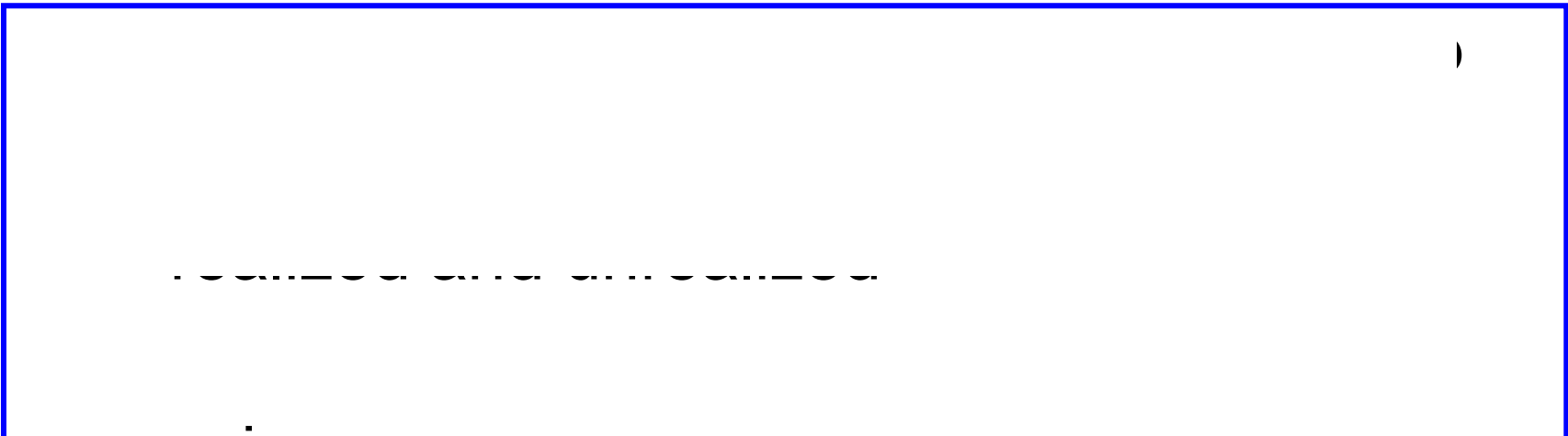
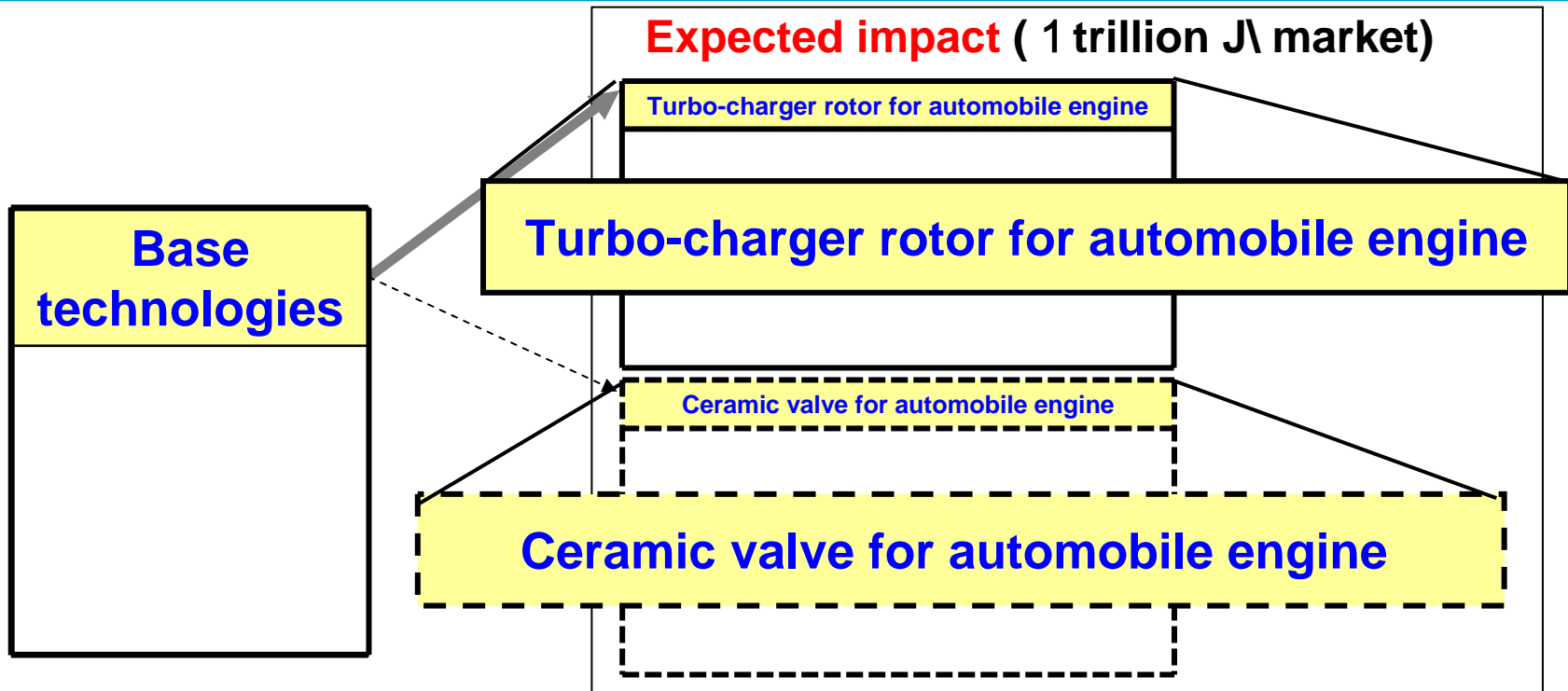
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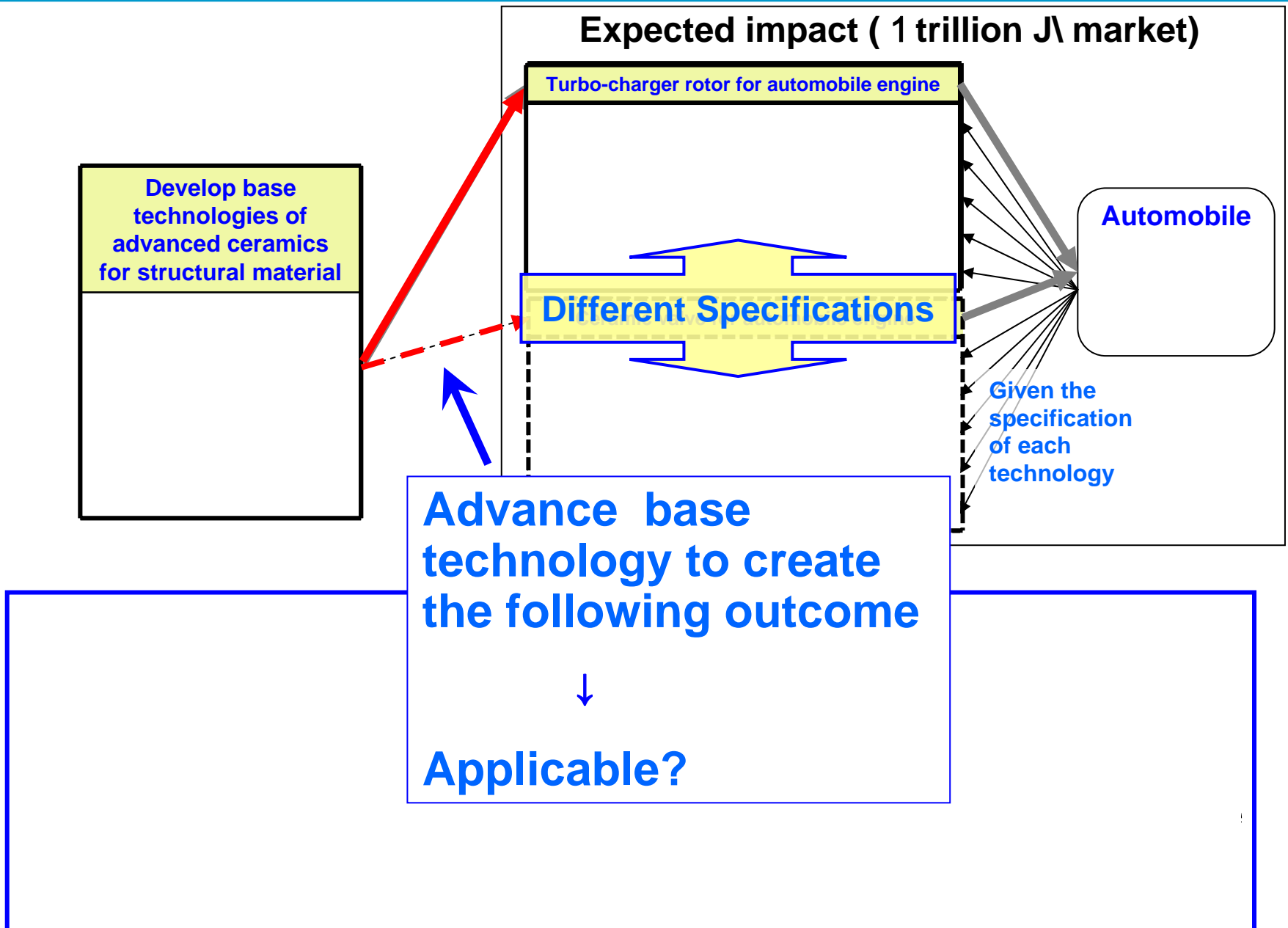
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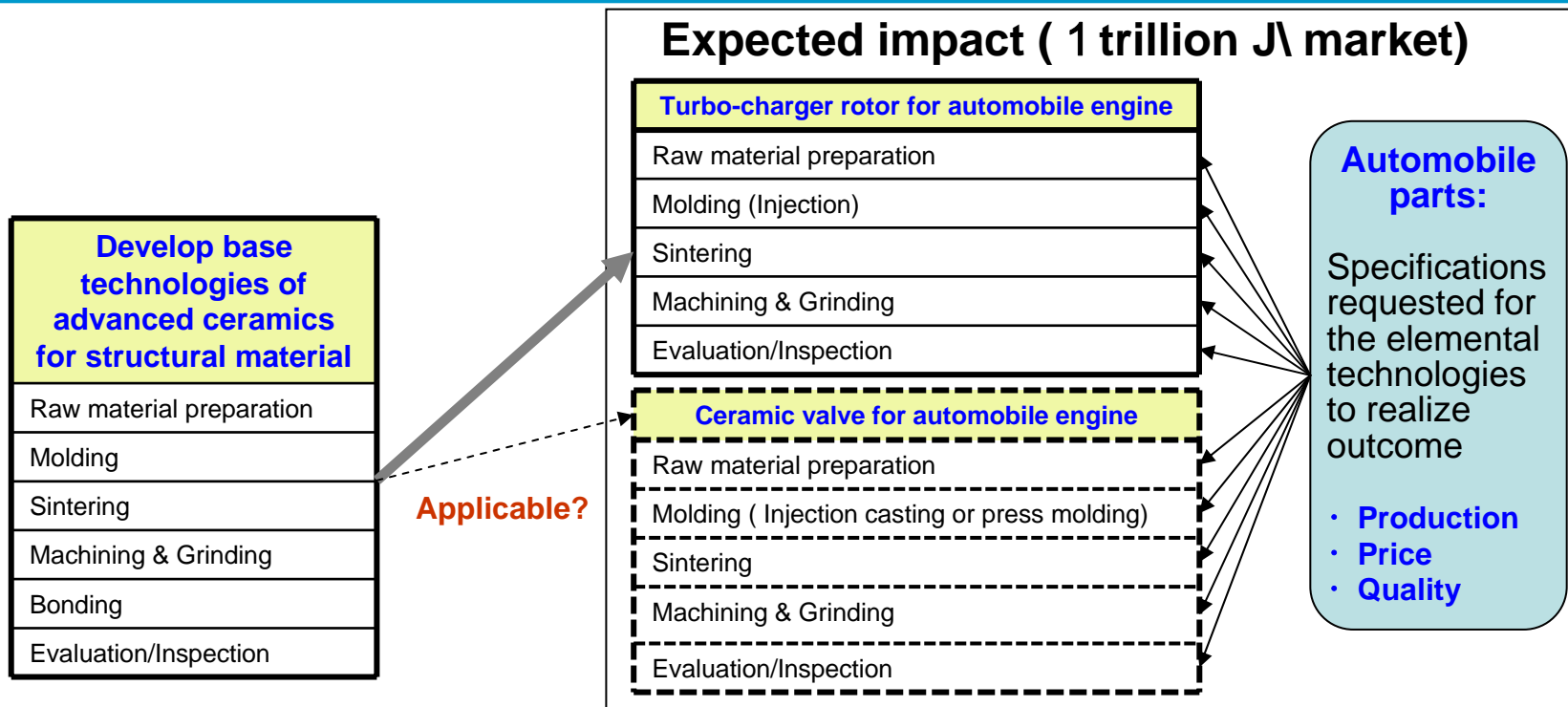
## How to solve?

**I will challenge how to solve in the view point of one engineer who tried to developed engine valves for automobile but failed.**

# Case Study Trial for Advanced Ceramics Project





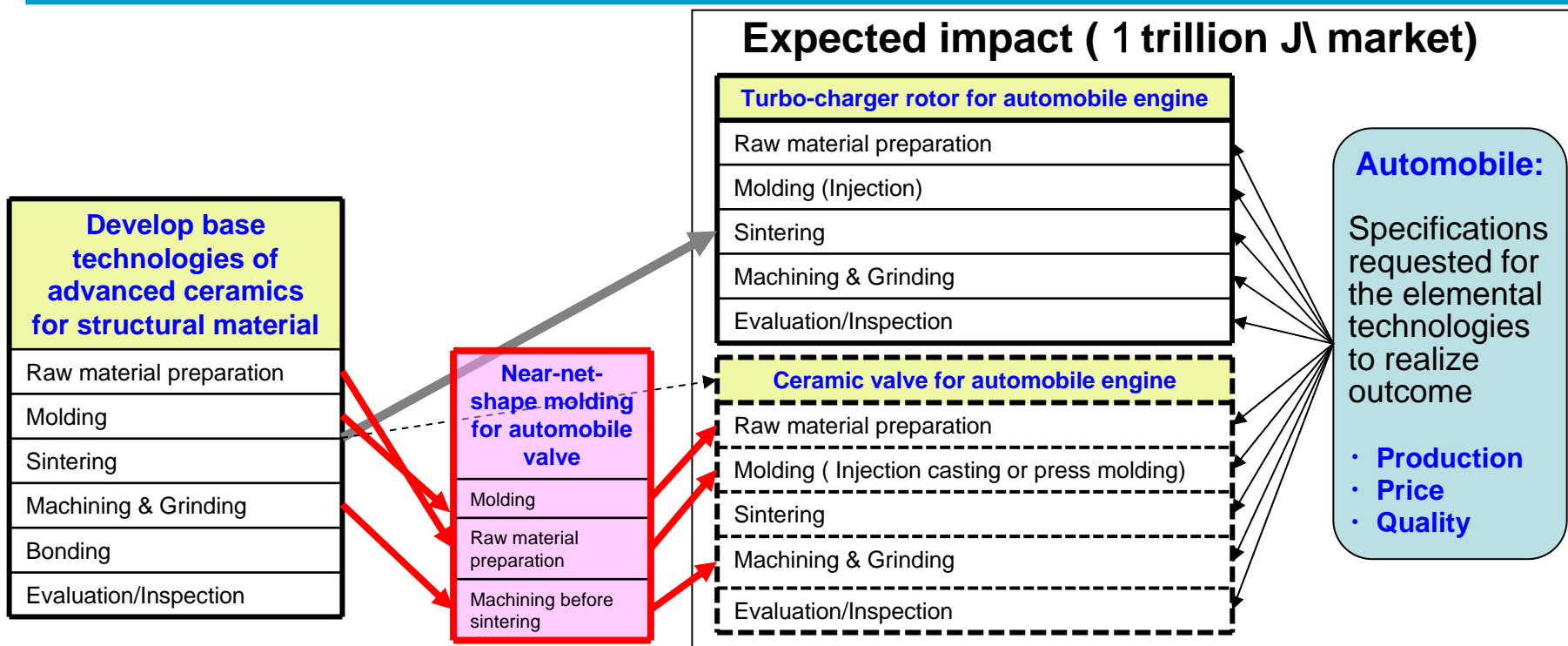


( Comparison ; authors' opinion )

Basic Technologies developed	Applicability of basic technology developed			
	Turbo-charger rotor	Ceramic valve ( my opinion comparing with rotor)		
Raw material preparation	○	×	<ul style="list-style-type: none"> <li>• Higher fracture toughness property</li> <li>• Cost-reduction : Near-net-shape molding,</li> <li>• Machining before sintering,</li> <li>• Automatic machining &amp; grinding system,</li> <li>• Automatic inspection system</li> </ul>	
Molding	○	×		
Sintering	○	△		
Machining & Grinding	○	△		Need mass production system
Evaluation	○	△		Higher reliability

# Case Study Trial for Advanced Ceramics Project

## ; Simple model



( Case study example ; authors' opinion )

Basic Technologies	Applicability of basic technology developed		
			ic valve ( my opinion comparing with rotor)
Raw			<ul style="list-style-type: none"> <li>• Higher fracture toughness property</li> <li>• Cost-reduction : Near-net-shape molding,</li> <li>• Machining before sintering,</li> <li>• Automatic machining &amp; grinding system,</li> <li>• Automatic inspection system</li> </ul>
Moldi			
Sinte			
Machining & Grinding	○	△	Need mass production system
Evaluation	○	△	Higher reliability

**This R&D activity is needed for advancing technologies**

**More survey of this 'Missing Middle'**

- 1 . Develop logic model with relevant linkages to the outcomes which will make up expected impacts
- 2 . Select outcome linkages for ‘Case study’: outcome realized vs. outcome expected
- 3 . ‘Case study’ based on element technologies

# Case study protocols

Item	Conventional	Additional
1.Reasons for involving this project	<ul style="list-style-type: none"> <li>What the purpose of Bonding this project?</li> </ul>	<ul style="list-style-type: none"> <li>What's your business target and what's the (element) technologies did you create ?</li> <li>What's outcomes do you plan to make up</li> </ul>
2. Project activities	<ul style="list-style-type: none"> <li>What's kind of influences of this project on R&amp;D results of your company?</li> </ul>	<ul style="list-style-type: none"> <li>What's kind of influences of this project on R&amp;D results of your company in the vie point of element technology?</li> </ul>
3. R&D results	<ul style="list-style-type: none"> <li>What's kind of influences of this project influence on the following items of your company ? ;</li> <li>- R&amp;D portfolio</li> <li>- R&amp;D strategy</li> </ul>	<ul style="list-style-type: none"> <li>What's kind of influences of this project on the following items for your company in the view point of element technology ? ;</li> <li>-R&amp;D portfolio</li> </ul>
4. R&D impacts	<ul style="list-style-type: none"> <li>What's kind of influences of this project on your R&amp;D? Let me see the successful ( or unsuccessful ) results (technologies developed, products or productive process) , and their history to them?</li> </ul>	<ul style="list-style-type: none"> <li>What's your comments on this logic model?</li> <li>- another outcomes of missing middle</li> <li>- another outcomes to make up impact</li> <li>What's the unsuccessful reasons in the viewpoint of element technologies of outcome ?</li> <li>Case study questionnaires</li> </ul>
5.Business impacts	<ul style="list-style-type: none"> <li>What's kind of influences of this project on the success of your business?</li> </ul>	<ul style="list-style-type: none"> <li>What's kind of influences of this project on the success of your business in the view point of element technologies of outcome?</li> </ul>
6.Lessons of this project	<ul style="list-style-type: none"> <li>What's is your lesson (i.e. on management) of this projects</li> </ul>	



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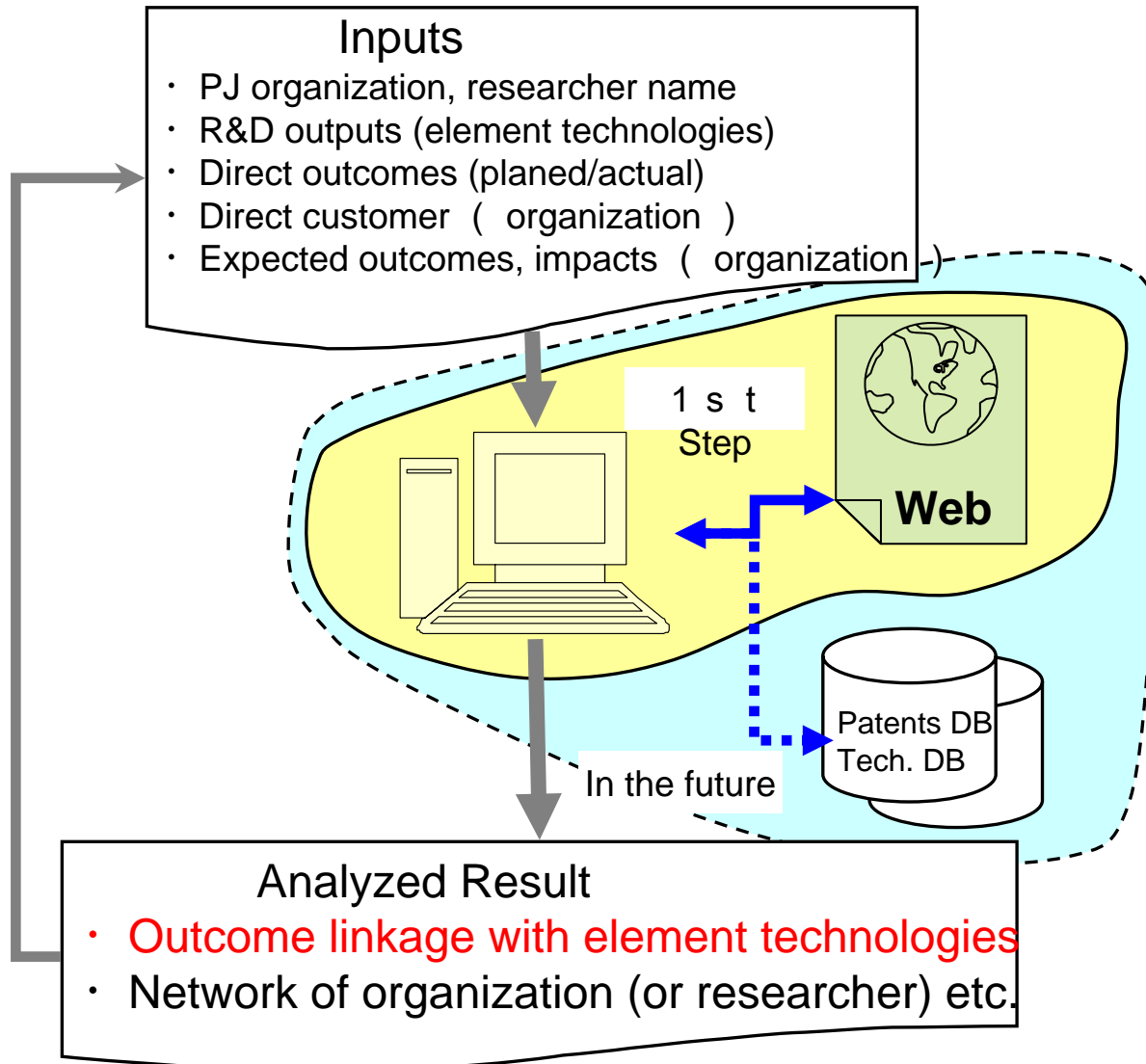
- Follow-up survey is essential for PDCA cycle
- Effective follow-up survey method require;
  - Comprehensive logic model with relevant linkage
  - Case study :
    - Outcome realized vs. outcome expected
    - Based on element technologies which make up outcome

# Next step

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- We'll try to apply this method for the follow-up evaluation survey
- Launched the development of the supporting system which analyzes the information of Web to investigate outcomes relationship and element technologies which make up the outcome as follows;

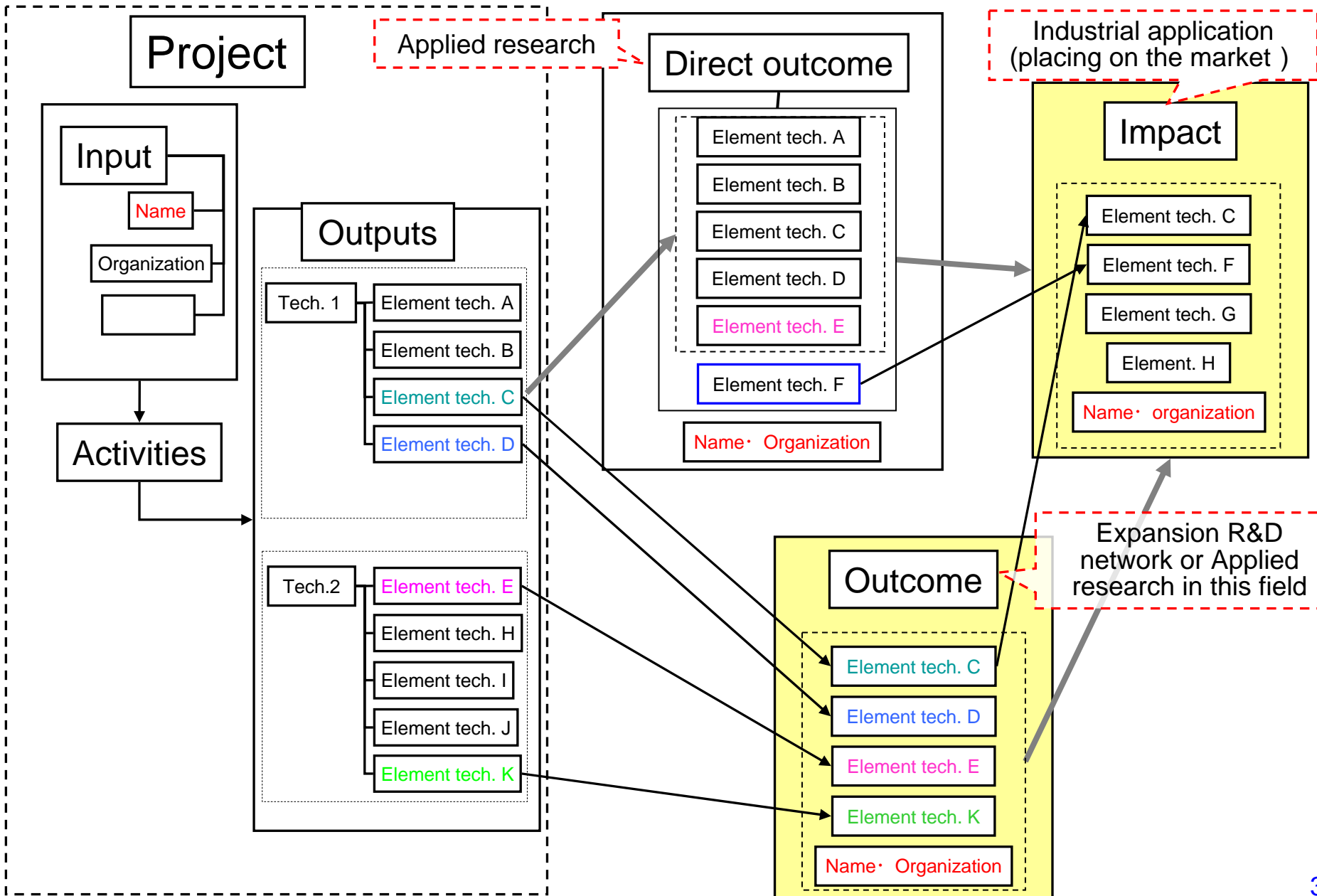
## Measurement of the impact of technology by structuring knowledge from the Web.



Private communication with  
Dr. Yutaka Matsuo, Institute  
of Engineering Innovation,  
The University of Tokyo  
Center for Knowledge  
Structuring, The University  
of Tokyo

- There is vast amount of information on the Web.
- We can identify relations among entities; e.g.,
  - social relations among researchers; co-authorship, co-attendance, co-affiliation
  - social relations among corporations; alliance, lawsuit
  - relation between concepts; is-a, part-whole
  - and many other relations; causal relation, functional relation...
- We are developing Web mining methods to extract relations among entities, as well as precisely identifying entities.
  - Combined with IR, natural language processing, and machine learning.
  - Mainly in WWW and Semantic Web field.

# Logic model (structuring the technologies linkages )



# Simplified logical technologies(outcomes) linkages to realize hydrogen fuel cell vehicle

