WIPO REGIONAL FORUM

University-Industry Collaboration to Promote Technology Transfer

organized by
The World Intellectual Property Organization (WIPO)
in cooperation with
The National Office of Intellectual Property of Vietnam (NOIP)
and with the assistance of
The Japan Patent Office (JPO)

Theme IV "Cross-Border Collaboration between Universities, Public Research Institutes and Industry"

Topic 8: Opportunities and Challenges for Open Innovation

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<u>Cross-Border Collaboration</u> between Universities, Public Research Institutes and Industry ???

Wao!

So Difficult!

That's Impossible!

Are you Serious?

Survey on Cross-Border Collaboration between University, Public Institutions and Industry

From Research by Tokyo Institute of Technology, Yoshitoshi Tanaka 2007

Difficulty for cross border collaboration

Legal Issues

Law & Regulations on Agreement Technology Transfer
Guarantee to reach to the technical achievement
Obligation to settle patent dispute
Prohibit exporting the transferred technology
Registration of Licensing Agreement
Technology Licensing after termination of licensing agreement

Law & Regulations on enterprise business
Enterprise Law, Investment Law, Tax Law, Trading Law, Customs Law, Building Construction Law, Unti-monopoly Law, PL Law, Intellectual Property Laws, etc.

Political Issues

Political structure/system/power
Democracy or Communism
Administrations by Government
Center Government & Local Government
Government & Enterprises
Public Enterprises & Private Enterprises
Political Stability
Networking
International Relations

Technological and/or Economical Gap

High-Tech & Commodity Tech
Market demands-Product Quality and Function
Product Dissemination Level
Parts Suppliers and Assemblers
Environmental Awareness
Labor and its Salary
Exchange rate of currency, Stock Price
Industry's structure

Social Issues

Population, Birth rate
Life Style
Product Price and Cost Issues
People's idea on the sense of value
Fashion & Trend
Education

Communication Issues

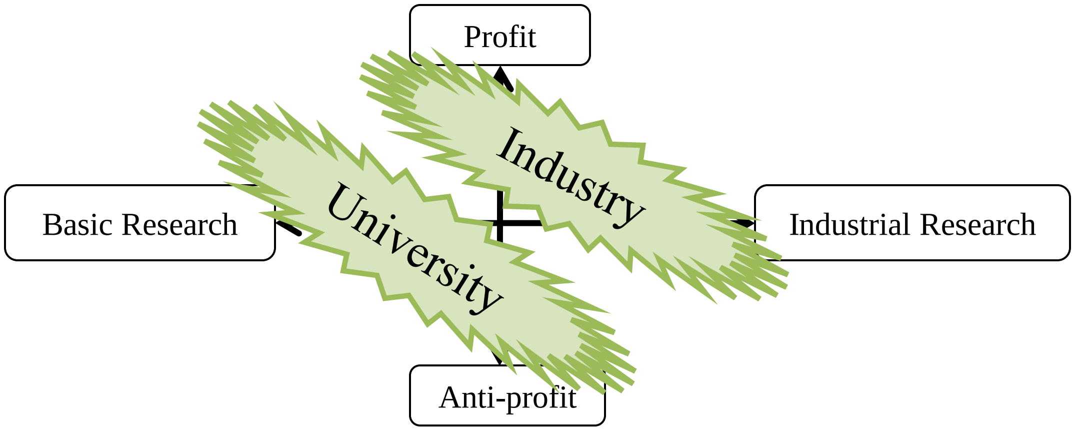
Cultural Difference
Language barrier
Sense of Value
Different history, idea, industry, life style

Sharing Objectives

Purpose & Aim of Cross border Collaboration
Purpose & Type of Technology Transfer
Establish good Partnership

Difficult to make Collaboration between university and industry even if in One country, because of Existence of different culture, mission, etc

	University	Industry
Mission	Education & Research	Commercialization
Culture	Bottom Up	Top Down
Sense of Value	Systematization of Knowledge	Creating Profit & Growth
Time span	No limitation	Depend on Market
Subject for research	Basic Research	Industrial Research



Not necessary to integrate different cultures

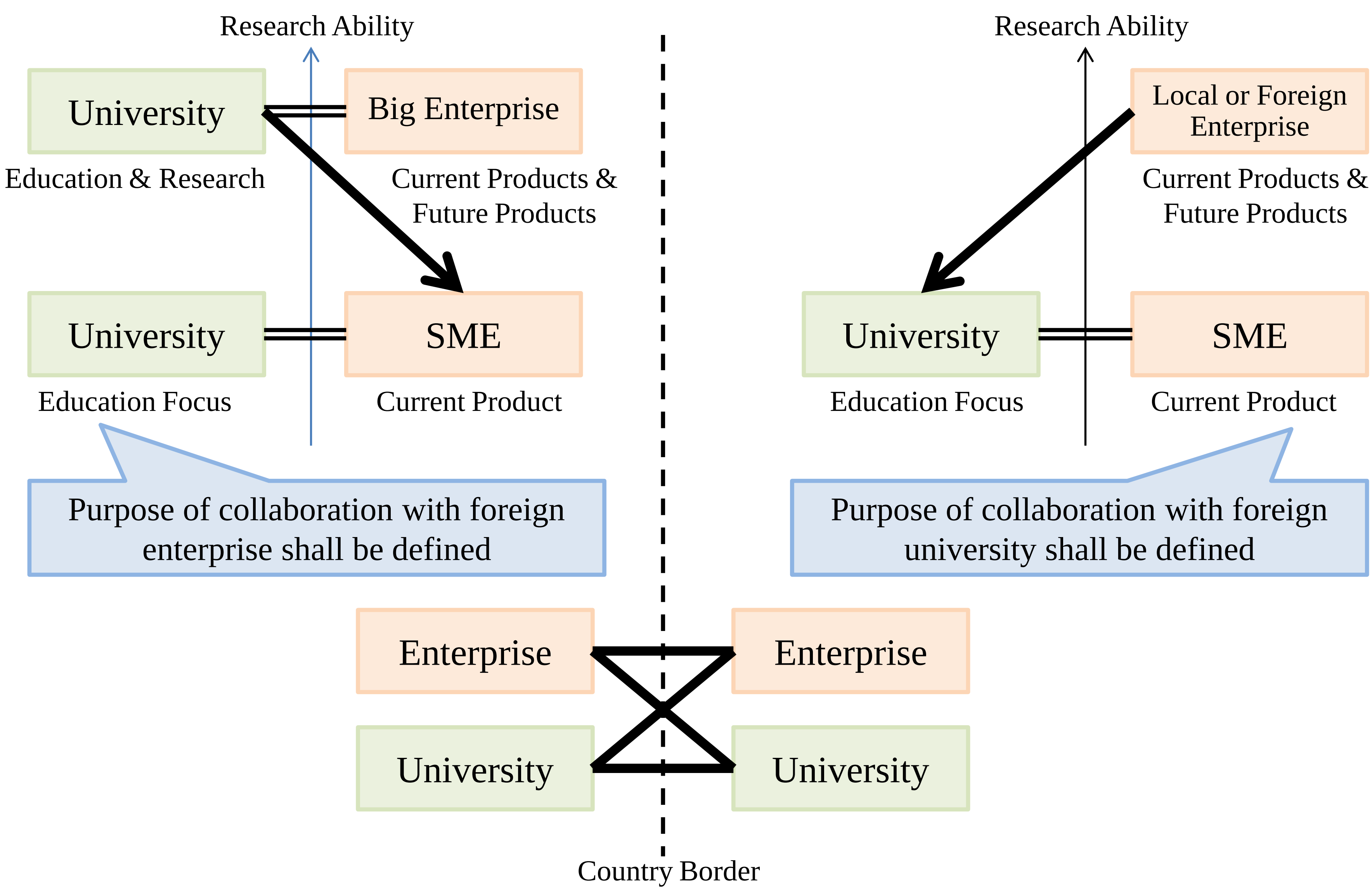
↓

Understand & Sharing different cultures

Difficulty of Cross-Border Collaboration

- Competence Balance between University and Industry
- Promotion of International Communication
- Business Launching Decision based on Collaborative Research between university-industry
- Secrecy Management
- Patent Protection in both countries
- International Management Capability
- Cross-Border Collaboration between universities

Competence Balance between University and Industry

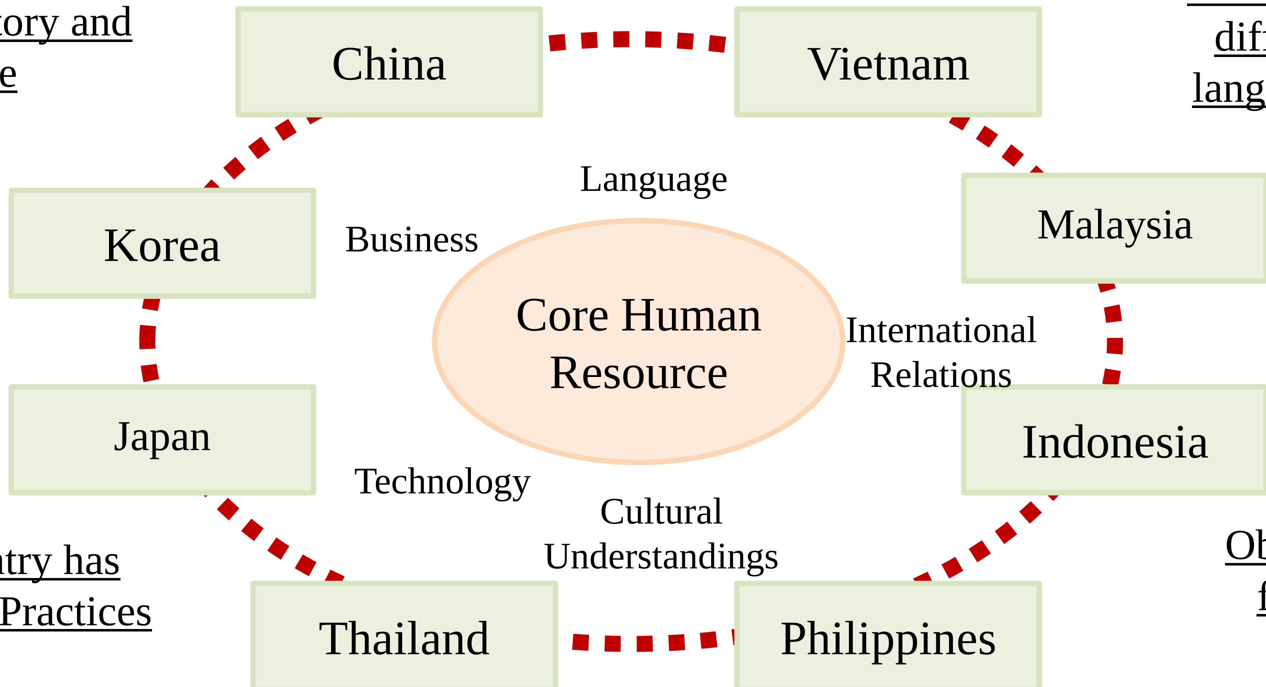


Promotion of International Communication

We have to use the common Language: English

Each country has different history and culture

Each country has different local language in Asia



Each country has different IP Practices

Objective Sharing for university-industry collaboration

Comparative Study on Global Human Resource will be effective

Cultural Study in Asia for mutual understandings is very important

Partnership shall be established based on cultural factors in each country

Power Distance:
The member to whom power is weak anticipates and accepts the state that power is unequally distributed.
Cooperation might go well for the university-industry cooperation even with a strong one side power.

Individualism:
In the individualism society, the relation of the individual is not so strong.
In the collectivism society, the relation of the individual is strong, and the individual is protected as long as it swears faithfulness to the group. In the university-industry cooperation, it is likely to be able to make an effort by aiming at the development of the country toward the same objectives.

Masculinity:
In the masculine society, the man and woman's distinction is clear, the man is self-assertive, and it aims at a material success. The woman is gentler than the man and pays attention to the quality of living.
In the feminism society, male and female roles come in succession on the social life. The man and the woman pay attention to the quality of living in modesty. A modest, sincere university-industry cooperation might be able to be promoted.

	Power Distance	Individualism	Masculinity	Uncertainty Avoidance	Long term orientation
Malaysia	104	26	50	36	-
Philippines	94	32	64	44	19
China	80	20	66	30	118
Indonesia	78	14	46	48	-
India	77	48	56	40	61
Singapore	74	20	48	8	48
Vietnam	70	20	40	30	80
Thailand	64	20	34	64	56
S. Korea	60	18	39	85	75
Japan	54	46	95	92	80
US	40	91	62	46	29
Australia	36	90	61	51	31
Sweden	31	71	5	29	33
Denmark	18	74	16	23	46
France	68	71	43	86	39
Germany	35	67	66	65	31
Italy	50	76	70	75	34

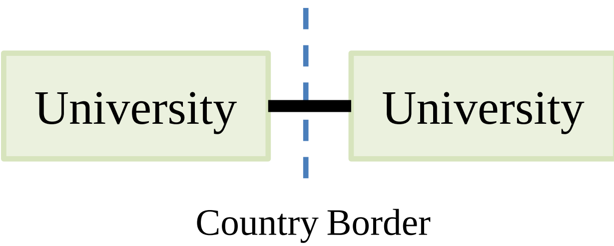
Uncertainty Avoidance:
The uncertainty avoidance is that the member feels the threat with an uncertain situation. This feelings appear to the desire assumed to want to provide a codified rule and a custom rule, in order to improve the predictability. In the university-industry cooperation, the advance preparation to improve the predictability might be necessary.

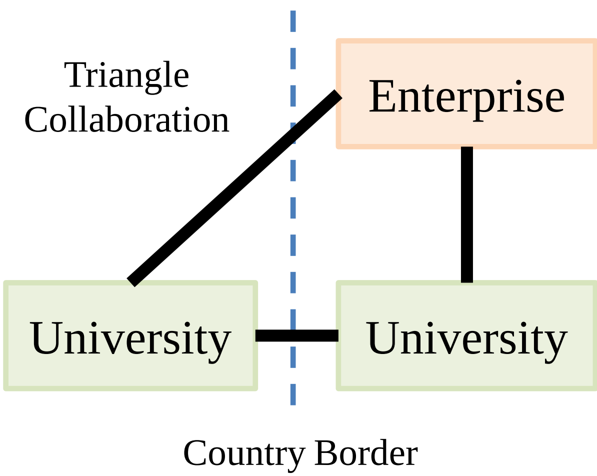
Long Term Orientation:
In the country characterized in a long-term intention, people tend to keep durability, endurance, the sense of observance related to the rank, saving, sense of shame, future reward, etc. It is likely to be able to establish a long-term university-industry cooperation.

There is no rules and regulations, university-industry collaboration shall be planned and structured by you in each country, targeting growth as important tools.

Business Launching Decision based on Collaborative Research between universities

Let's start from collaborative research between universities!





Academic Cooperation Agreements of Tokyo Institute of Technology

Country	Name of University (example)	No of university
China	Tsinghua University, Beijing Institute of Technology, etc	12
India	Indian Institute of Technology, VIT University	2
Indonesia	University of Indonesia, Bandung Institute of Technology, etc	3
Korea	KAIST, KIST, Seoul National University, etc	10
Mongolia	National University of Mongolia, Mongolian University of S&T	2
Philippines	University of the Phlippines, De La Salle University	2
Singapore	National University of Singapore, Nanyang Technological University	2
Taiwan	National Tsinghua University, National Taiwan University	5
Thailand	Chulalongkorn University, KMUTT, KMITL, etc	8
Vietnam	Hanoi University of Science and Technology, etc	2

<u>Involvement of Enterprise/Management's Decision</u>

- Technical Evaluation
- Commercial Evaluation
- Staffing Qualified people
- Marketing
- Human Networking
- Business Incubater
- Management

Secrecy Management

University-Industry Collaboration

Technology Transfer

- No rule for Secrecy Management
- Lack of Awareness
- No existence of business customers

Enterprise ⟷ Enterprise

<u>Strict Secrecy Management</u>

- Rule for Secrecy Management differs country by country
- Awareness on Secrecy differs country by country
- Industrial Situation differs country by country
- Sense of Value differs country by country

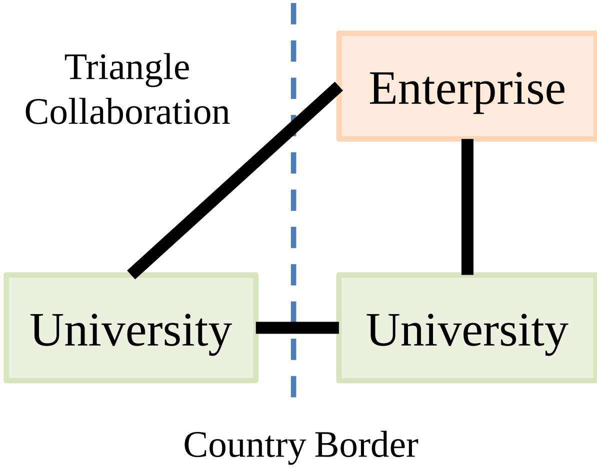
Comparative Study on the Rule of Secrecy Agreement will be effective

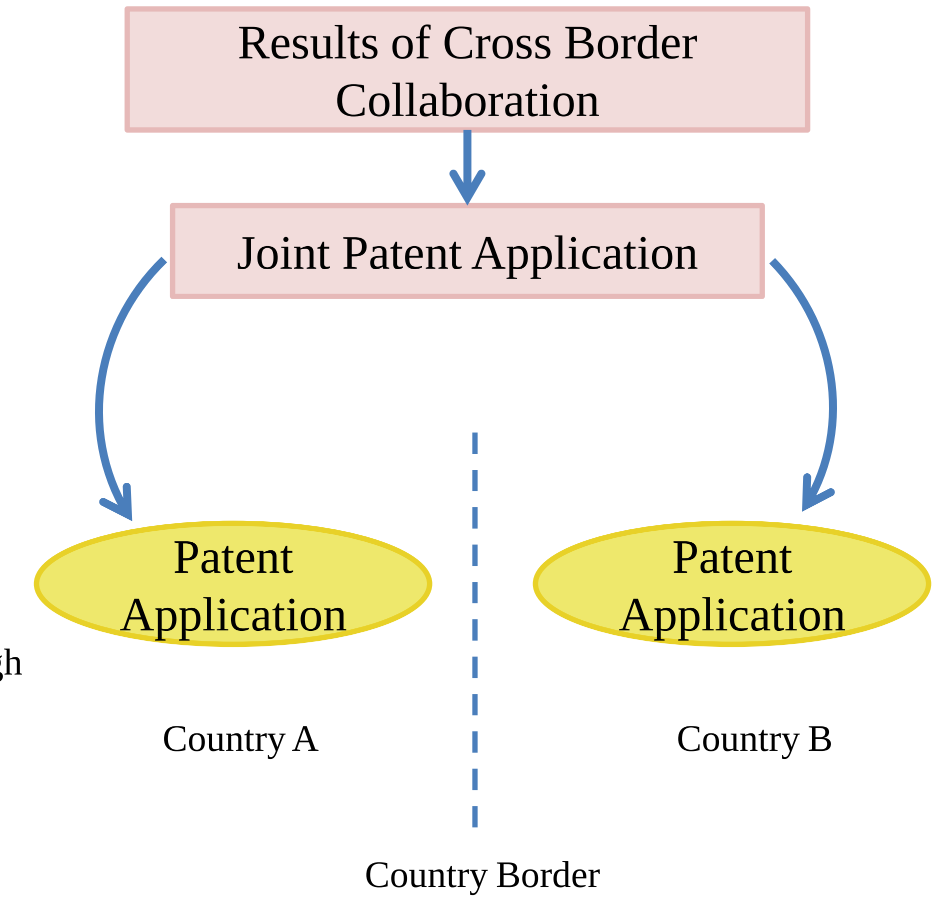
Comparative Study on people's awareness/recognition about Secrecy will be effective

Comparative Study on Secrecy at university will be effective

Comparative Study on Secrecy Management in enterprises at both countries will be effective

Patent Protection beyond countries





- Intellectual Property System (Law) is harmonized
- However, its Practices are not yet harmonized enough
- IP Awareness differs country by country

Comparative Study & Mutual Supports

- Exchange information of IP Practices
- Cooperation to improve IP Practices
- Training for IP Specialists, especially in university and enterprises
- Utilization of PPH system
- Promotion of IP Awareness

International Management Capability

Research

- Create Basic Technical Seeds
- New Findings and Systematization
- Technical Elements

Development

- Expand from Research to Development
- Product Specification by Marketing
- Manufacturing Technology

Start Up

- Start up Company
- Organization Set Up
- Value Chain Establishment
- Launching New Product
- From Marketing to Sales

Commercialization

- Expand Business Operation
- Sales Promotion
- Increase Manufacturing Capacity

Devil River

Death Valley

Darwin’s Ocean

Actions	➢ Introduce Marketing into Research and Development ➢ Clarify Target for Development ➢ Project Management based on Technical Seeds	➢ Expand from Marketing to Sales ➢ Use Venture Capitalist bridging Product Concept to Investors	➢ Leadership by Professional Management ➢ Make a Strategy for Growth competing with Competitors

International Management Team from all collaborative countries has to work together to realize Cross Border Collaboration

Different Legal/Political Situation

Different Industry/Economy

Competence Unbalance

Difficult Business Decision

Lack of International Management Skills

There are many Issues to be solved, but let’s work together!

Different Technical Level

Difficult International Communication

Cultural Difference

Lack of Secrecy Management

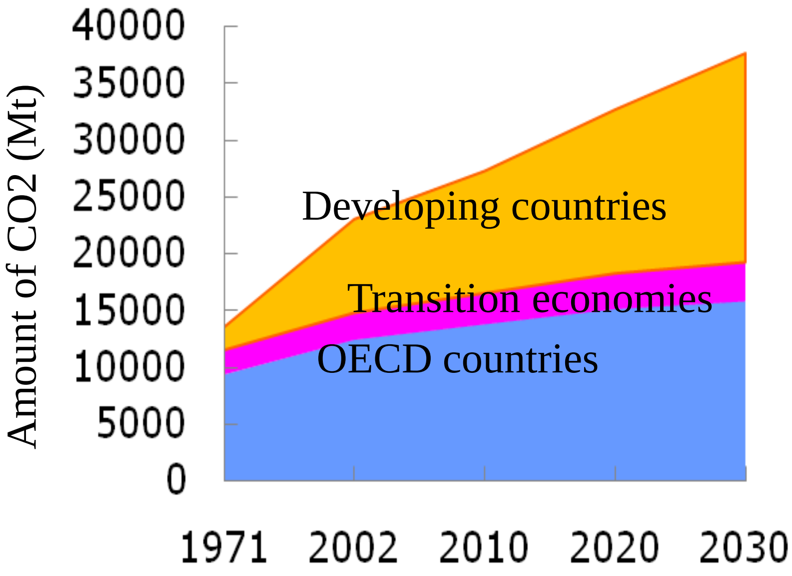
Research Example of Technology Transfer of Clean Technology

Can the conscious of technical characteristics overcome with harvesting local capability?

-International technology transfer of clean technologies focusing on technical characteristics-

Background (1)
Climate change and North-South technology transfer

- Climate change has been a global issue.
- Especially, the big increase in energy consumption in developing countries will be a big concern.



(IEA World Energy Outlook 2004)

"In order to enhance the development and transfer of technology, we decide to establish a technology mechanism to accelerate technology development and transfer.

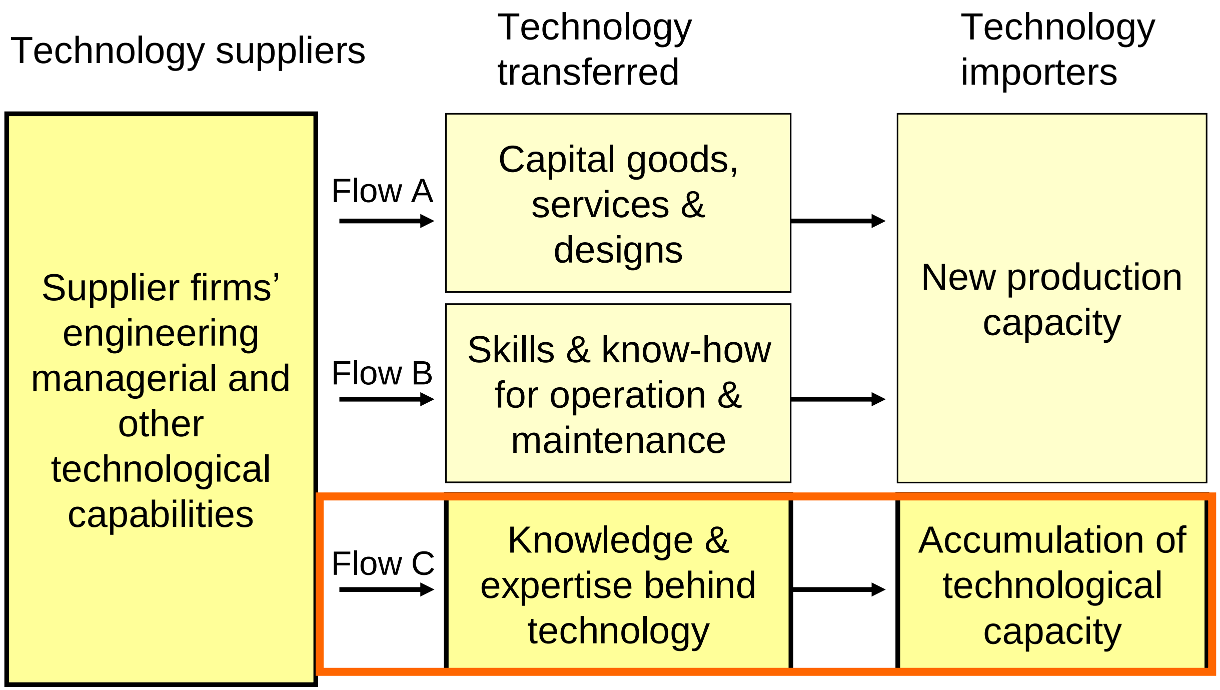
2009.12 Copenhagen Accord (COP15)

Background (2)
What is technology transfer?

"Technology" that transferred are consists of both hard(physical) and soft(knowledge and process) components.

3 flows identified within the process of transferring technology

Bell(1990)



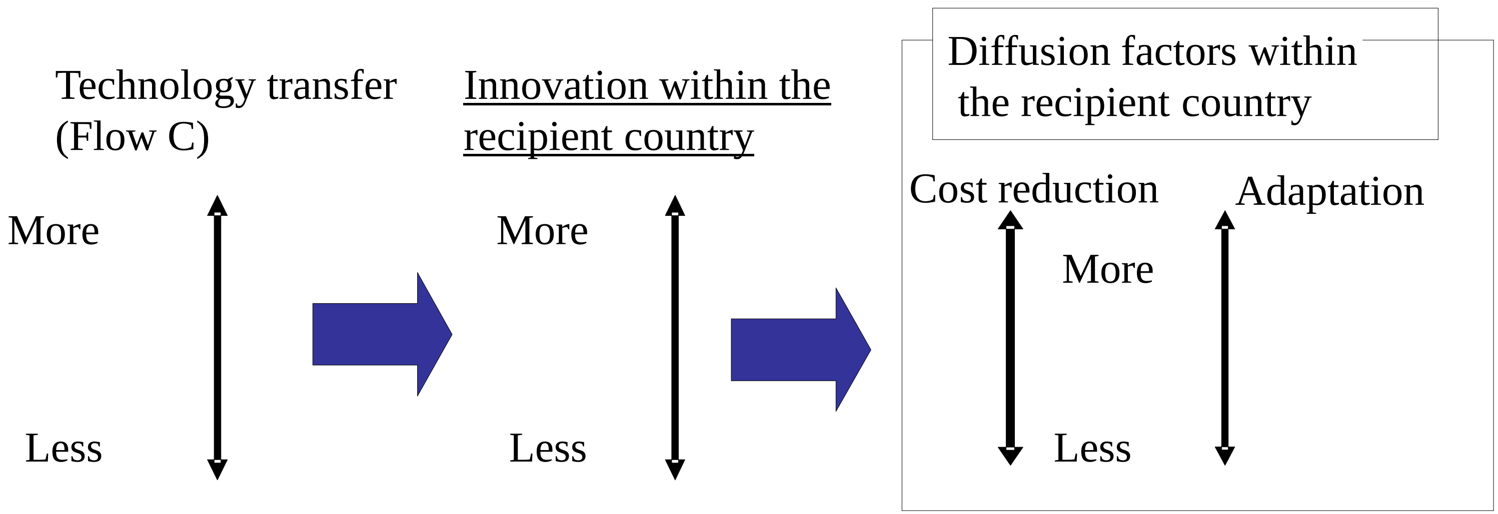
Flow C contributes to the receiver's improvement of technological capacity, which leads to their own innovation.

Background (3)
Technology transfer from the importers' perspective

- The aim of the transfer can be either production for exporting to the other countries and/or diffusion of the technology within the local market
- Diffusion of technology in the local market is critical for the reduction of green house gases. Hence technology transfer must aim to diffuse the technology within the local market.

Flow of environmental technology transfer on the receivers' end（Findings from the existing literature）

Ueno(2009), SPU and TERI (2009), Oakwell (2010)

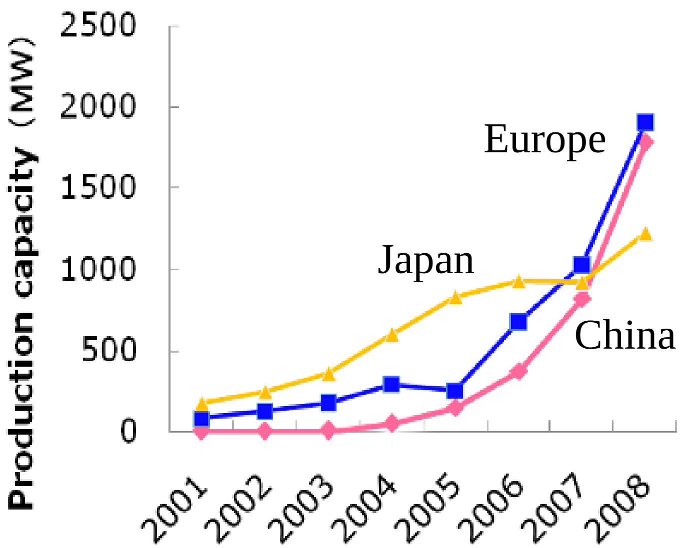


Flow C is needed for environmental technology transfer

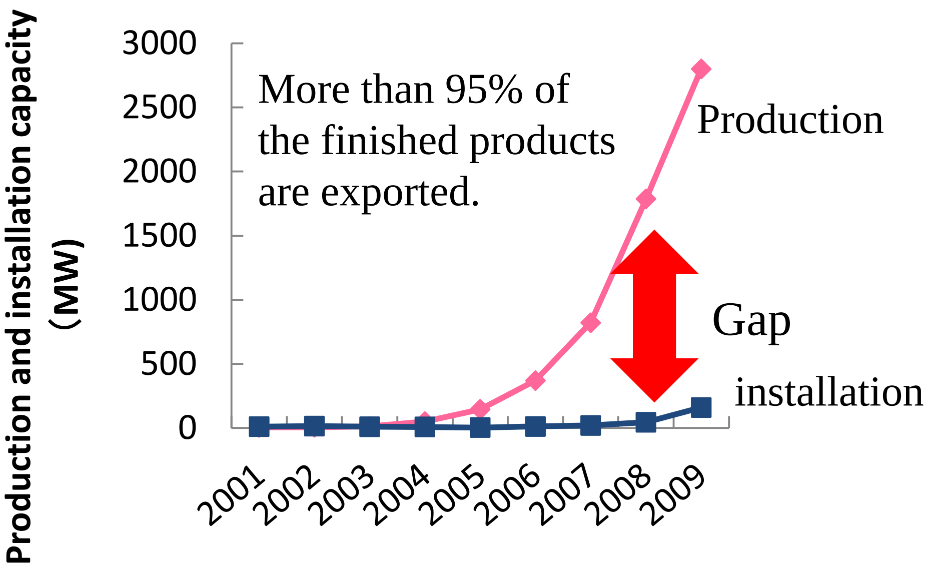
Technology transfer case I.
-Domestic production & diffusion

CASE 1. Solar Photovoltaic Technology transfer

China's domestic production capacity increased, but not the domestic installation capacity. Thus technology transfer does not contribute to China's greenhouse gas mitigation.



Domestic Solar cell production capacity by country(yearly)



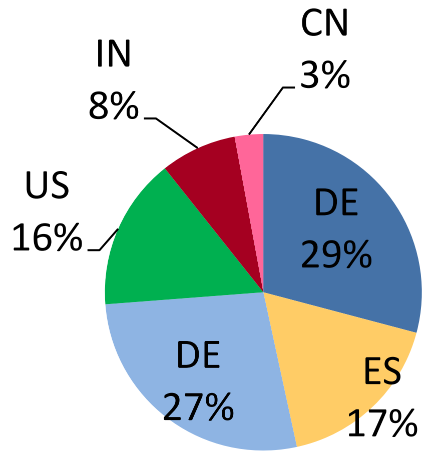
Solar cell production and in China installation capacity（yearly）

Technology transfer case II.
-Domestic production & diffusion

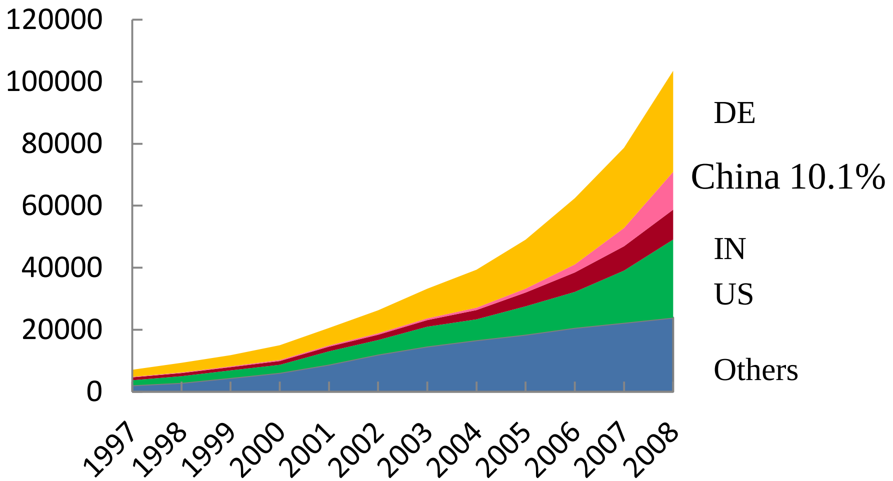
<u>CASE 2. Wind power technology transfer</u>

Not only production capacity, but domestic installation capacity also increased.

2006



Wind turbine world production share by country



Cumulative installation capacity of wind power by country (MW)

Chinese companies gained license of each component from different developed countries' companies, and this caused Chinese growth of technical capability.

Background Overview

Problem：Increasing green house gas emission in the developing countries
Solution: Transfer cutting-edge technologies to developing countries to effectively reduce green house gas emission

Enabling domestic production in developing nations is not enough: Diffusion of technology in their local market is critical

Environment conducive to developing nation's own R&D and cost reduction is needed for domestic installation.

＝Knowledge behind the technology also needs to be transferred (Technology transfer involving Flow C)

Support this kind of technology transfer

Involvement of Flow C in its transfer differs depend on the technology.

Research Purpose

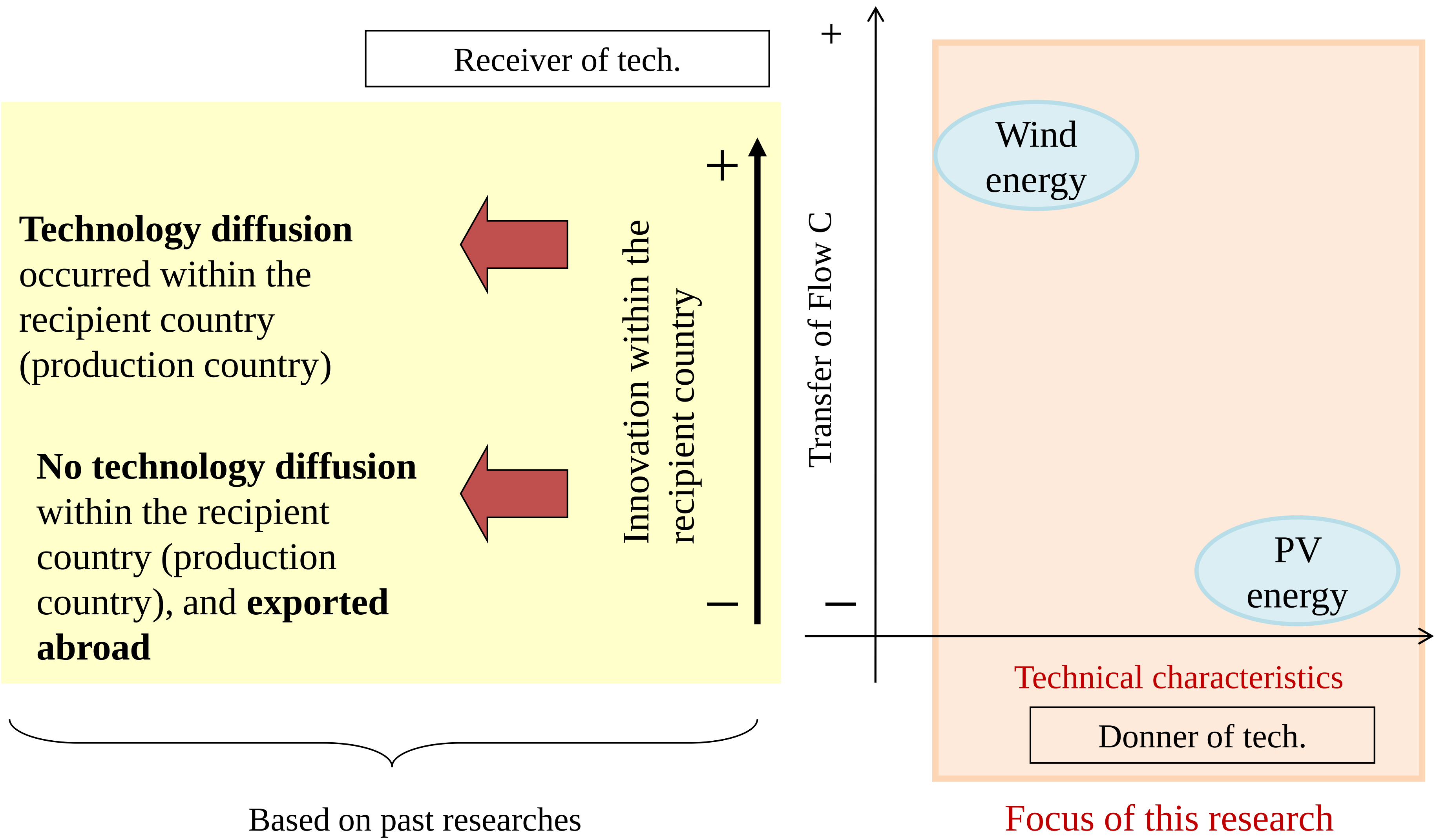
Identify what kind of technology transfer should be supported to effectively reduce green house gas emission in the developing countries, by quantitative analysis of different technologies.

①Transfer that effectively reduce green house gas emission ≒Transfer involving Flow C (Entails transfer of knowledge behind the technology)

②Comparison of Solar Energy and Wind Energy Generation technologies

③Quantitative analysis: Patent categorization and data analysis

Research design



Research scope

This research will compare the technical characteristics of Photovoltaic energy (PV energy) and wind power technologies from patent application data

Hypothesis:

1. Compared to wind power technology, PV companies involves in R&D engaged in several component technologies.
2. Compared to wind power technology, each component technology of PV technology is influenced by several technological fields.
3. Compared to wind power technology, each component technology of PV technology is researched by technological cooperation, involving multiple actors.

Assessment Steps

I. Identify Patent-based Wind power and PV technologies

WIPO "Patent-based Technology Analysis Report-Alternative Energy"

Japan patent office "Patent application trends in 8 key fields"

II. Break down PV and wind power technologies into component technologies by choosing patent classification

Selected 'crystallized Si solar panel' & 'horizontal axis propeller type wind turbine'

III. Construction of patent data

Database used for Patent search: JP-net
Research period：2005-2009,
Search criteria： I. Primary FI II. Keywords in patent application

IV. Data analysis for each hypothesis

FI classifications used for this study (Crystallized Si solar panel)

H01L31/04 adapted as conversion devices	31/04H Electrodes and substrates for single and polycrystal photoelectric power devices
	31/04L Joint construction for single and polycrystal photoelectric power devices(such as Schottky and MIS)
	31/04C Integrated single and polycrystal photoelectric power devices(module classified here)
	31/04Y Laminated single and polycrystal phtoelectric power devices (tandem types classified here)
	31/04X Manufacturing methods for single and polycrystaline films(Si, Ge)
	31/04F Antiglare films, obverse surface protection films, and reverse surface reflective films
	31/04G Lenses, reflectors, and filters
	31/04K Solar battery power circuits and testing devices

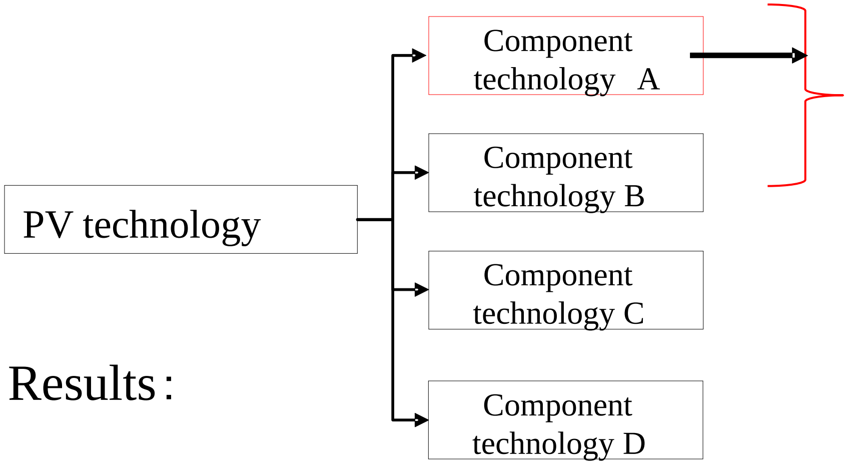
FI classifications used for this study
(Horizontal axis propeller type wind turbines)

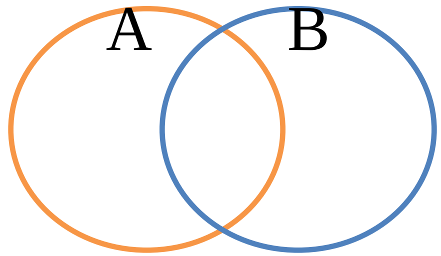
F03D Wind motors	1/02 Wind motors with rotation axis substantially in wind direction: having a plurality of rotors
	1/04B having stationary wind-guiding means: air channel member in the horizontal direction
	1/06A Rotors:Propeller type windmill
	7/04E Regulation, i.e. controlling automatically: variable pitch control
	7/04K Regulation, i.e. controlling automatically: Azimuth control
	9/00 B Adaptations of wind mortors for special use; Combination of wind motors with apparatus driven thereby: Conversion of the wind force energy into another energy without the power
	11/00A Details, component parts, or accessories not provided for in, or of interest apart from, the preceding groups: related to the vane
	11/02 Transmission of power, e.g. using hollo exhausting blades

Hypothesis 1:

Compared to wind power technology, PV companies involves in R&D engaged in several component technologies.

Hypothesis 1: Component technology relationships and Examination of applicant duplication





Integral Ratio(IR)

$$= \frac{F(A \cap B)}{F(A \cup B)}$$

A,B：Classification within one technology
F(x): number of applicants who filed applications in classification (component technology) x.

Results：

- T-test：IR for PV tech significantly higher at 99% confidence level. (t(54)=-4.201 p<0.01)

For PV technology, one company is engaged in R&D of multiple component technologies. (IR is small)

↓

Each company has the environment to adjust those components considering the mutual impact of another and achieve optimum performance

↓

Implies the integrality among component technologies, and difficult to transfer flow C.

Hypothesis 1: Component technology relationships and Examination of applicant duplication

IR for PV technology (2005-2009)

	31/04H	31/04L	31/04C	31/04Y	31/04X	31/04F	31/04G	31/04K
31/04H	–	0.135	0.156	0.055	0.096	0.168	0.088	0.143
31/04L		–	0.154	0.128	0.167	0.086	0.172	0.131
31/04C			–	0.082	0.150	0.134	0.110	0.161
31/04Y				–	0.068	0.040	0.054	0.062
31/04X					–	0.102	0.107	0.113
31/04F						–	0.081	0.131
31/04G							–	0.074
31/04K								–

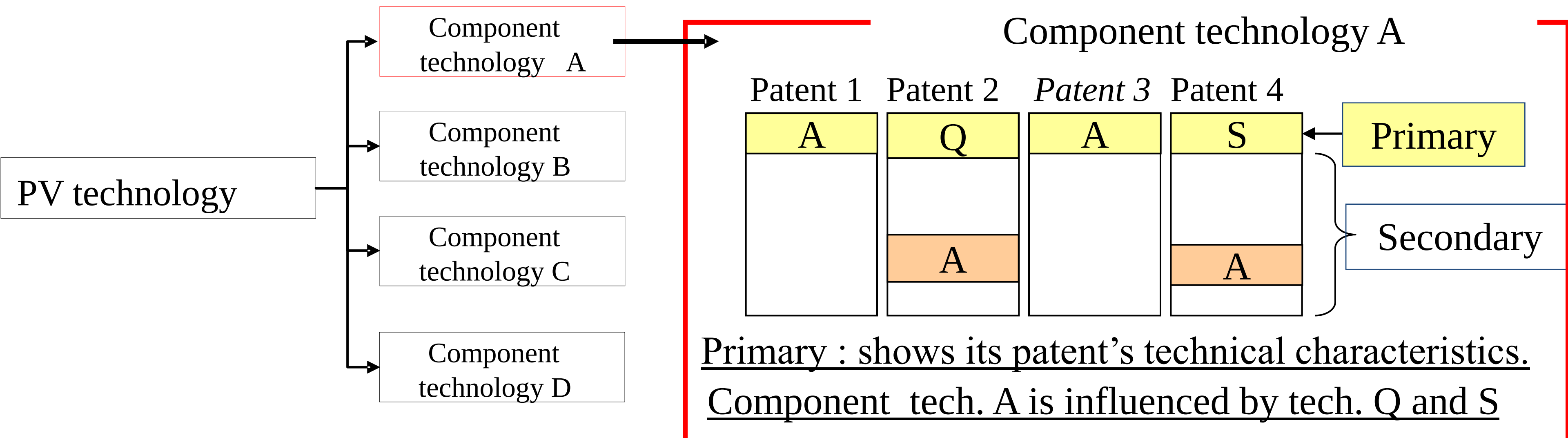
IR for Wind Power Technology (2005-2009)

	1/02	1/04B	1/06A	7/04E	7/04K	9/00 B	11/00A	11/02
1/02	–	0	0	0.038	0.045	0	0.028	0
1/04B		–	0	0.032	0.077	0	0.053	0
1/06A			–	0.182	0.053	0.087	0.044	0.028
7/04E				–	0.217	0.067	0.113	0.098
7/04K					–	0.077	0.103	0.079
9/00 B						–	0.082	0.047
11/00A							–	0.108
11/02								–

IR values match the actual relationships of component technologies.

Hypothesis 2:
Compared to wind power technology, each component technology of PV technology is influenced by several technological fields.

Hypothesis 2: Degree of influence from technological fields

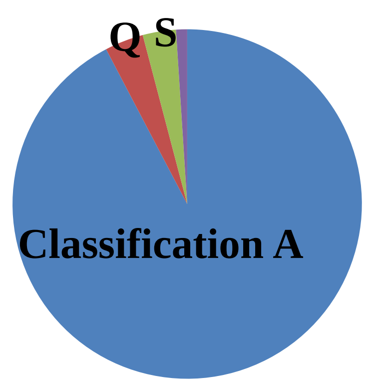


- **CHHI** : Measures the influence of primary classifications on other fields using HHI

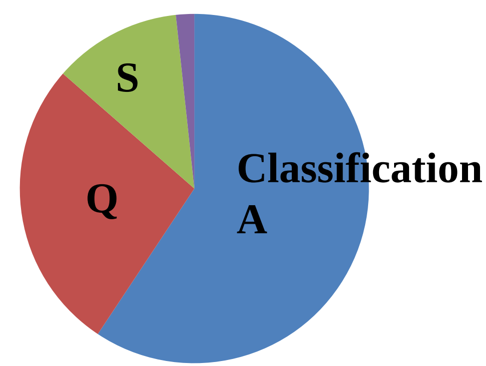
Example : CHHI of component technology A (n) where amount of primary A==x, Q=y, and S=z

=Σ(Amount of each primary classification's filed application)2

＝((x/n)^2 + (y/n)^2 + (z/n)^2 + ･･･)



High CHHI



Low CHHI

HHI:

HHI measures the oligopoly of product market. Calculated by total sum of the square value of each company's share in the market.

Hypothesis 2: Degree of influence from technological fields

T test results t(14)=-1.843 p<0.1   PV power values were significantly lower.

Wind power technology	1/02	1/04B	1/06A	7/04E	7/04K	9/00 B	11/00A	11/02
	0.885	0.876	0.776	0.789	0.938	0.475	0.871	0.714
PV technology	31/04H	31/04L	31/04C	31/04Y	31/04X	31/04F	31/04G	31/04K
	0.523	0.829	0.887	0.848	0.237	0.580	0.578	0.436

Compared to wind power, PV technology components have higher degree of influence from other technological fields.

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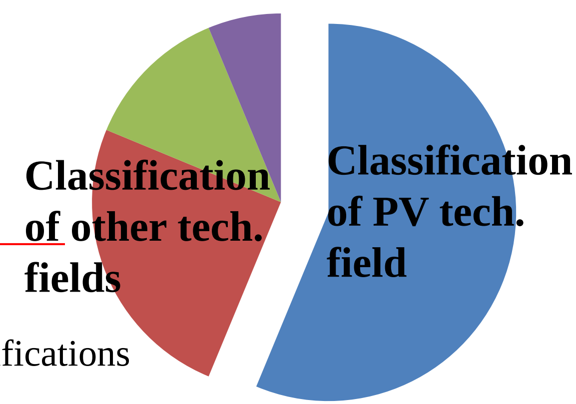
Likely that knowledge of other technological fields have accumulated in each PV technology component.

PV has wider technological fields than wind power.



Primary classifications

Hypothesis 3:

Compared to wind power technology, each component technology of PV technology is researched by technological cooperation, involving multiple actors.

Hypothesis 3: Degree of joint research

Ratio of co-applicant applications for each component technology

Wind power technology	1/02	1/04B	1/06A	7/04E	7/04K	9/00 B	11/00A	11/02
	0%	3.0%	0%	3.1%	0%	4.3%	5.1%	4.1%
PV technology	31/04H	31/04L	31/04C	31/04Y	31/04X	31/04F	31/04G	31/04K
	9.2%	4.4%	6.3%	8.8%	10.3%	4.8%	3.8%	4.4%

➢Technologies related to PV cell production has high ratio of joint research. Possibly related to the influence by hypothesis 2.

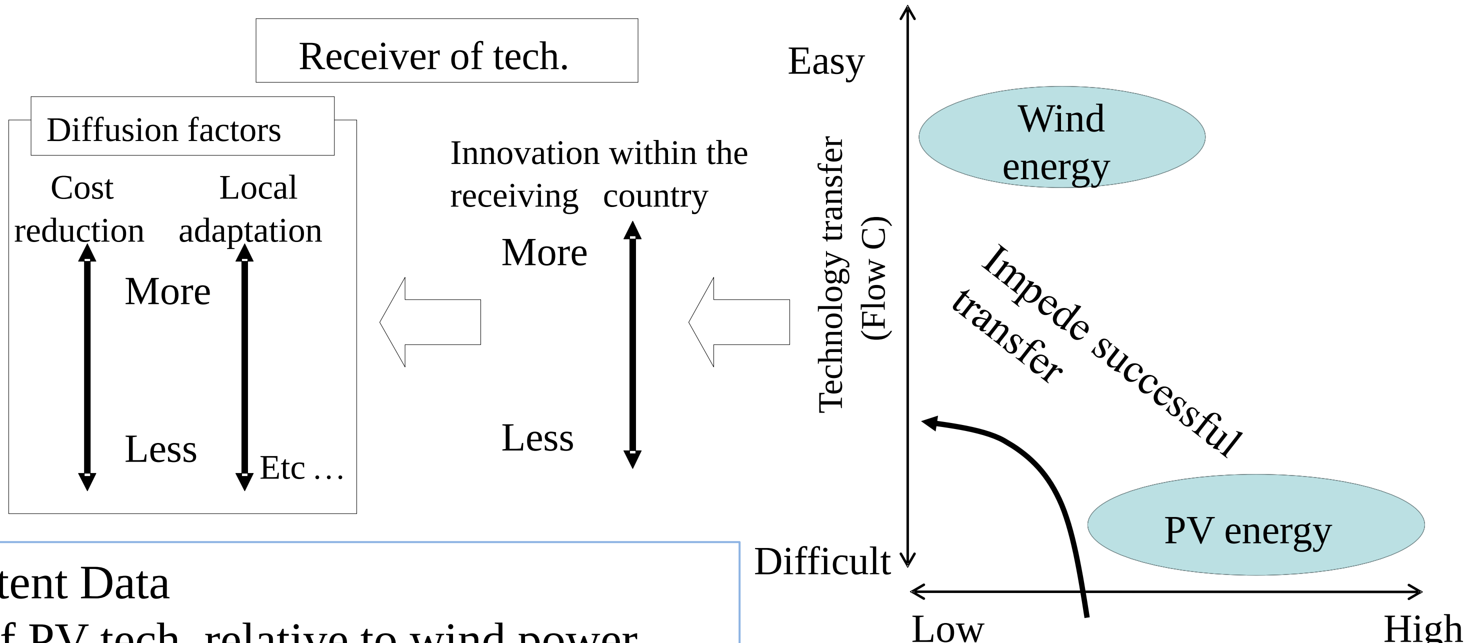
➢PV has more co-applicant applications than wind power

Research of each component technology of PV technology is done by multiple actors

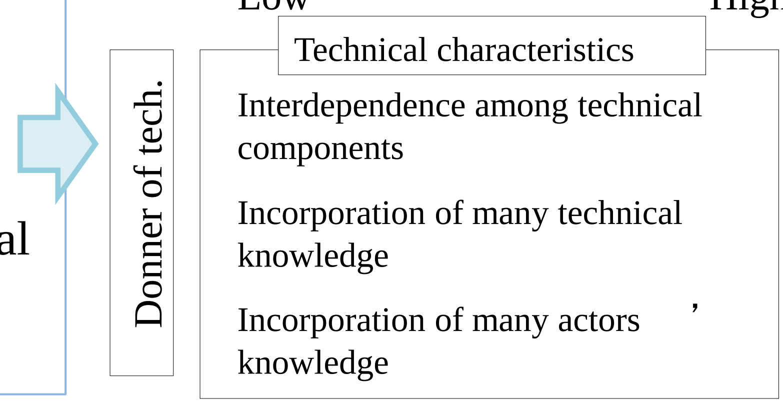
→Institutions likely to share internal resources to invent new technologies in joint research

＝These characteristics are likely to be impeding factors for successful transfer

Summary



Findings from Patent Data
[Characteristics of PV tech. relative to wind power tech]
Hypothesis1. Component technology relationships and Examination of applicant duplication
Hypothesis 2. Degree of influence from technological fields
Hypothesis 3. Degree of Joint Research



<u>Support technologies that have less degrees of the three characteristics that impede successful transfer. This encourages innovation from the receivers' end and push diffusion of technology in the local market. In all, successful transfer that combat climate change.</u>

Research Summary

【Conclusion】

- Hypothesis 1, 2, 3 were accepted. Identified three technological characteristics that impede technology transfer.
- Even within one product, technical characteristics are different in each component.
- By analyzing Patent data, showed that inter-technological /inter-component-technology comparisons were possible.

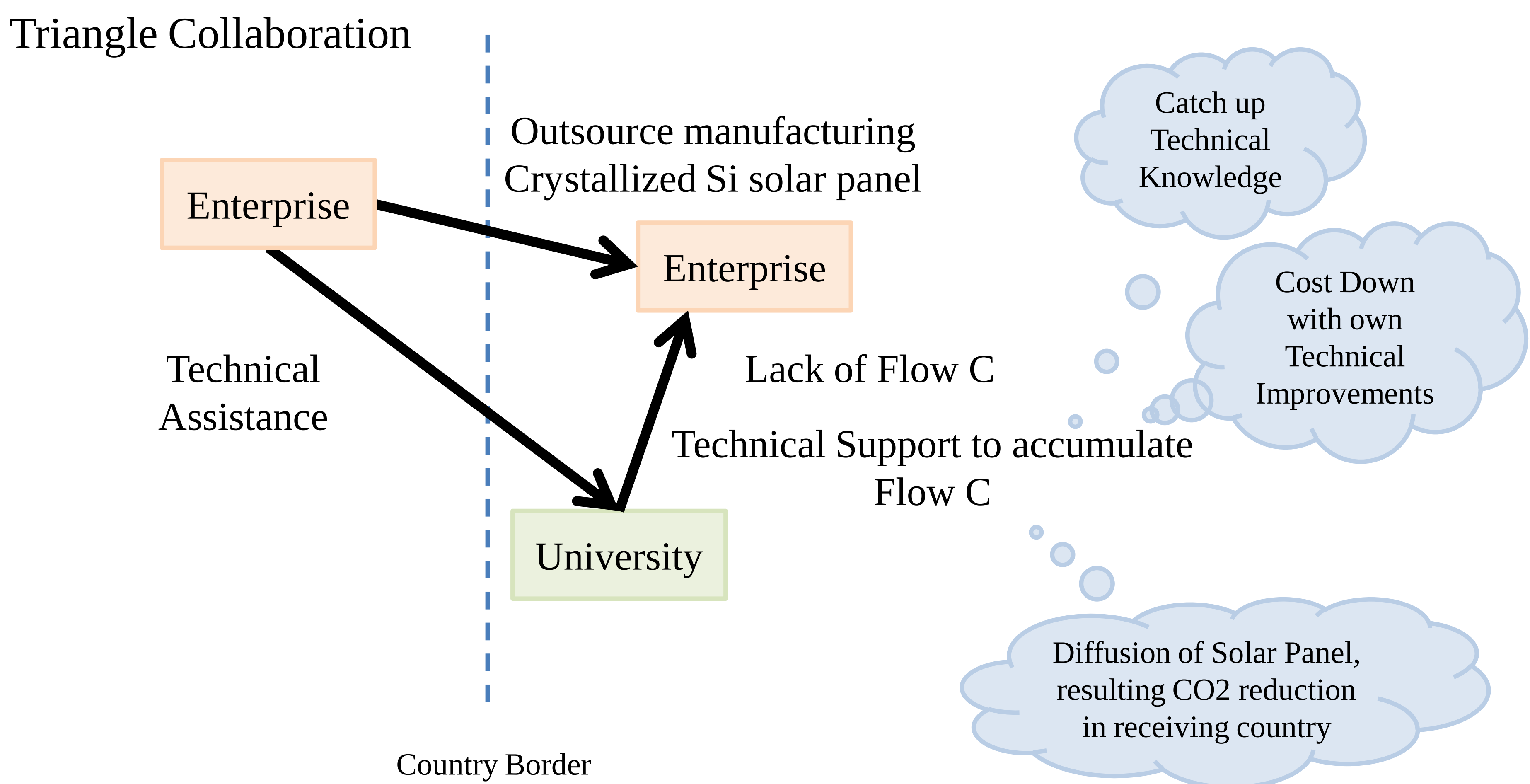
【Suggestion】

- Engage in cost-effective transfers by using the three transfer-obstacle characteristics as guides to determining what technology to transfer in order to mitigate climate change.

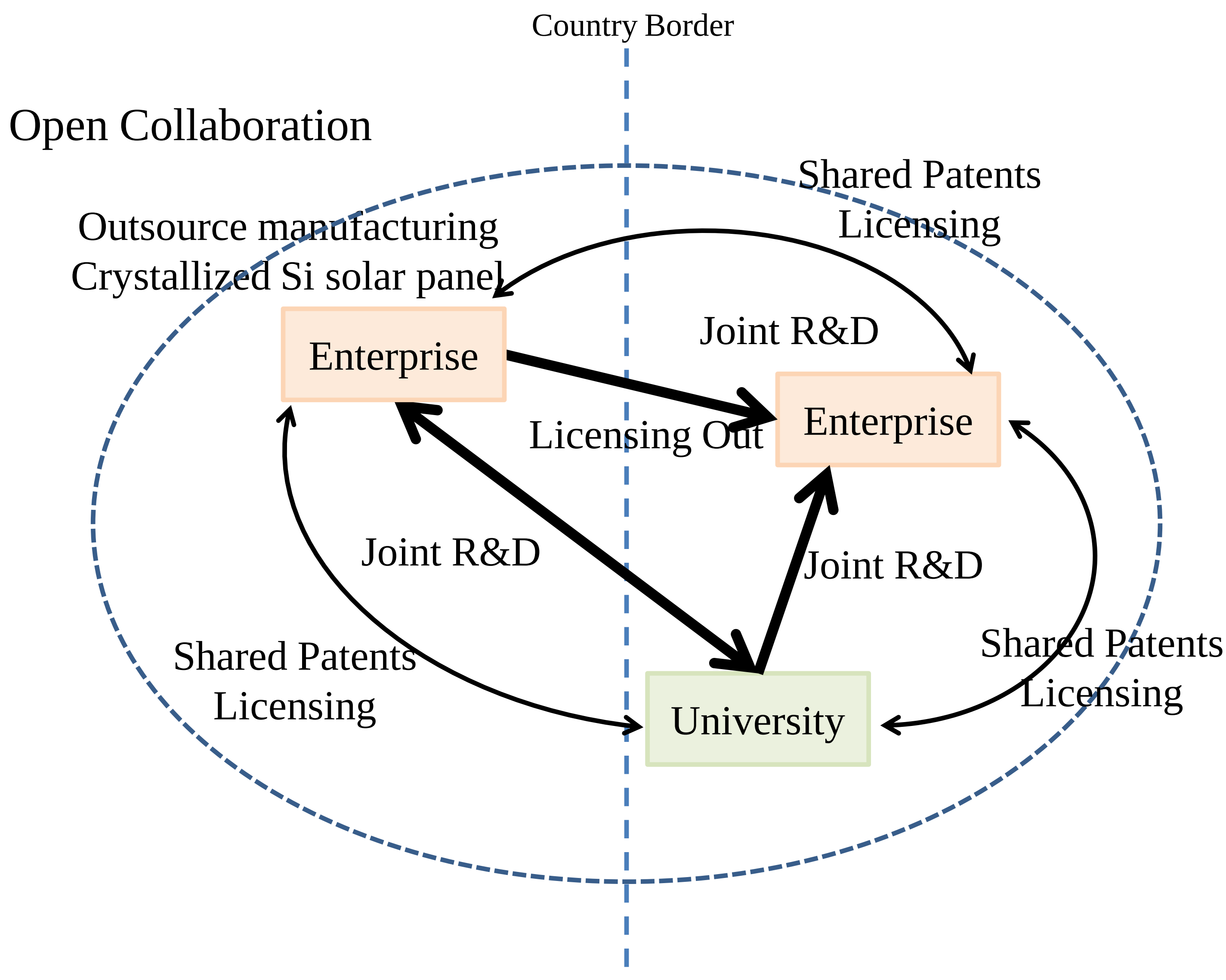
【Future Research】

- Investigate patents of developing countries to verify that innovation of wind power technology is more active than that of PV power.
- Assessment of other kinds of technologies
- Perspective of product life cycle
- Patent data analysis of other nations

One of the roles of Cross Border Collaboration between University and Industry



Challenge Cross Border Open Innovation



Topic 8; Summary

1. Started from “Wao! So Difficult! That’s Impossible! Are you Serious?”
2. Understand the Difficulty for cross border collaboration.
3. Start from University-University Collaboration, involving Enterprise afterwards to establish Triangle Collaboration.
4. Define the Joint Research Theme. Specify the Research Theme/Technical Field
5. Analyze the Technical Characteristics through Patent Information.
6. Find out the way for cross border Collaboration by Patent Information Analysis.
7. Analyze the Technical Capability of both countries.
8. Grasp the Market Needs in the developing country side.
9. Select the proper partner in both countries.
10. Confirm the Shared Objectives together.
11. Grow the International Management Skills. Business Plan and Commercialization
12. Promote Patent Awareness.
13. Challenge an International Open Innovation.
14. Share and understand the Different Cultures.

Let’s Overcome the Difficulty of Cross Border Collaboration！
Work together!

Thank you for listening.

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