論文 / 著書情報
Article / Book Information

Title	Perception Gap among Japan, Thailand, Vietnam and Philippine in Technology Transfer and Academic-Industrial Collaboration
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Citation	PICMET 2010 TECHNOLOGY MANAGEMENT FOR GLOBAL ECONOMIC GROWTH, , , pp. 545-550
Pub. date	2010, 7
Note	This paper has been presented at PICMET'10 (Portland International Center for Management of Engineering and Technology) Conference on July 18-22, 2010 in Phuket - Thailand, and published in the Conference Proceedings

Perception Gap among Japan, Thailand, Vietnam and Philippine in Technology Transfer and Academic-Industrial Collaboration

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***Abstract*–This paper focuses on the perception gaps among Japan, Thailand, Vietnam, and Philippine in technology transfer and academic-industrial collaboration from the view point of technology management. The authors could find the differences among these countries based on the questionnaire survey. The business activities have been rapidly expanding across country borders with economic globalization. In order to strengthen relationships and fruitfully live together in Asian countries, we need to promote technology transfer and academic-industrial collaboration to grow the local industries. Especially, Thailand Vietnam and Philippine are rapidly developing, and come to play important roles in Asian economy.**

The authors have conducted research on the real needs and obstacles in this field from the view point of technology management. In order to understand the Asia region comprehensively, it is required to understand cultural background behind such needs and obstacles. To find difference among these countries in technology transfer and academic-industrial collaboration, we have conducted questionnaire survey on these countries. We could collect questionnaires from administrations, universities, companies, etc. As a result, we could extract factors regarding technology transfer and academic-industrial collaboration by factor analysis, and analysis of variance was used to compare means among four countries.

I. INTRODUCTION

In white paper on Science and Technology 2009, by MEXT (Ministry of Education, Culture, Sports, Science and Technology - Japan) it is said that Japan must promote international activities in the strategic science and technology fields and should make efforts to enhance cooperation with Asian countries [9]. In the activities of technology transfer and academic-industrial collaboration, we often meet many difficulties in legal systems and tax systems, and we also meet difficulties in culture, which includes custom, language, etc. In this paper, we try to focus on perception gaps that include one's sense of value, a way of thinking, and sensibility in technology transfers and academic-industrial collaboration, because few researchers have discussed the differences in perception gaps in technology transfer and academic-industrial collaboration.

As it is essential for Japan to cooperate with Asian countries, Japan should find proper solutions for technology transfers and academic-industrial collaboration. From these points of view, we have studied technology transfers and academic-industrial collaboration in Asian countries, especially Thailand, Vietnam, and Philippine. Japan has made strong economic relationships with Thailand. Vietnamese economy has grown after Vietnam joined WTO. Philippine is close to Japan geographically, and many Filipinos can speak English fluently. These are the main reasons why we chose these countries.

Regarding the studied of academic-industrial collaboration, Mowery, Nelson, Sampat, and Ziedonis [10] analyzed the effects of the Bayh–Dole Act of 1980 on universities. Colyvas [2] studied the development of technology transfer in the life sciences at Stanford University from 1968 to 1982. Watanabe and Sumikura [14] studied the process of development of Stanford University Office of Technology Licensing in 1970's and they also referred to CASTI, which is technology licensing office of Tokyo University. Nelson and Byers [11] argued the synergies between entrepreneurship education and technology transfer. Washburn [13] analyzed how conflicts of interest have led to a loss of independence in research. Smith and Parr [12] also studied the conflict of interest in research fields. Regarding technology transfer to developing countries, Cohen [1] studied the system for effective technology transfer and its environment, which explains the effects of local and enterprise culture, and foreign investment, etc.

Hofstede [5] and [6] analyzed a large data base of employee collected by IBM, in 74 countries and regions, and he extracted 5 dimensions; Power Distance, Individualism, Masculinity, Uncertainty Avoidance, Long-Term Orientation. Regarding the study on Thailand, Intarakumnerd, Chairatana, and Tangchitpiboon [7] studied the national innovation system in developing countries by using a case study. Liefner and Schiller [8] proposed a conceptual framework based on the case of Thailand. Higuchi and Tanaka [3] and [4] studied technology transfer and academic-industrial collaboration between Japan and Vietnam. Still, not much scholarly worked has been performed to find cultural differences and perception gaps in technology transfers and academic-industrial collaboration in Asian countries. This study is aimed at finding cultural differences and perception gaps for mutual understandings.

II. DATA AND METHODOLOGY

In order to find cultural differences and perception gaps in technology transfer and academic-industrial collaboration, we have collected our questionnaires from government, university, and company in Japan, Thailand, Vietnam, and Philippine. As we mentioned, Hofstede [5] analyzed a large data base of employee collected by IBM, and he extracted 5 dimensions; Power Distance, Individualism, Masculinity, Uncertainty Avoidance, Long-Term Orientation. We extracted cultural characteristics related to technology

transfer and academic-industrial collaboration, from these five dimensions. After these extractions, we tried to develop these characteristics to technology transfer and academic-industrial collaboration. Moreover, we examined historical backgrounds of academic-industrial collaboration in United States and Japan. Based on these characteristics and problems that might be happened in the future, we added some items on cooperation with foreign countries, holder of patent in employee's invention, identification with country, We used Likert scale in our questionnaire survey (Likert scale: "strongly agree" 4 points, "agree" 3 points, "disagree" 2 points, "strongly disagree" 1 point).

Tab. 1 shows the result of questionnaire survey in Japan, Thailand, Vietnam, and Philippine. We excluded data which have missing values from the result of questionnaire survey. Regarding the attribution of respondents, Japanese respondents include government officials, who major in intellectual property, who are involved in public administrations or research institutions, local government officials, staffs in technology licensing offices of university, and employees who work for medical device company, etc. Thai respondents include government officials, who major in intellectual property, or trade, staff and lecture of university who major in intellectual property, employees who are in charge of marketing or engineering etc. Vietnamese respondents include government officials, who major in intellectual property, who work for research institutions, local government officials, staffs who work for institute of technology, employees who work for Software Company and pharmaceutical company etc. Philippine respondents include government officials, who major in intellectual property or law, lecturer or staff of university, employees who are manager or in charge of accounting etc. We used survey questions in Japanese, Vietnamese, and English.

TABLE 1: RESULT OF QUESTIONNAIRE SURVEY

		Occupation				Sum
		Government	University	Enterprise	Others	
Nationality	Japan	24	15	51	23	113
	Thailand	11	13	81	9	114
	Vietnam	45	19	38	13	115
	Philippine	17	11	53	11	92
Sum		97	58	223	56	434

III. RESULTS

A. Procedure of factor analysis

At first, we excluded data which have missing values from the result of questionnaire survey. We calculated average and standard deviation of 37 items of questionnaire which we collected from Japan, Thailand, Vietnam, and Philippine. We excluded three items which showed ceiling effect or floor effect from the result of questionnaire survey.

Secondly, we analyzed residual 34 items by factor analysis. We chose Principal Factor Method. We concluded that four-factor structure is appropriate, by analyzing variations of Eigen value and scree plot. Therefore, on the supposition that four-factor structure is appropriate, we analyzed items by factor analysis. We chose Principal Factor Method and Varimax Rotation. After we excluded 12 items which don't show adequate factor loading, we analyzed items by factor analysis. We chose Principal Factor Method and Varimax Rotation (cumulative proportion; 42.72%).

Tab. 2 shows Rotated Factor Matrix. Statistical analyses were performed with SPSS.

One of the clusters found was composed of questions that seemed to have something to do with cooperation between nationalities of respondent and foreign countries (American, Russian, European, and Chinese). From the questions in this cluster we selected the five that were most strongly related. We called the first cluster "Cooperation with foreign countries" factor.

One of the clusters found was composed of questions that seemed to have something to do with academic-industrial collaboration, for example, "necessity for a university to sell an invention to companies," "cooperation between professors and companies" "necessity of an organization which connects a university with a company." From the questions in this cluster we selected the six that were most strongly related. We called the second cluster "Academic-Industrial collaboration" factor.

One of the clusters found was composed of questions that seemed to have something to do with willingness to contribute to Asia, the world, country, organization. From the questions in this cluster we selected the four that were most strongly related. We called the third cluster "Willingness to contribute" factor.

One of the clusters found was composed of questions that seemed to have something to do with technology transfer-induced development, for example, "a Japanese senior partner should teach you technology-related matters," "Tolerance of copied products in your country," "purpose of acquisition of patent is to grow local industry." From the questions in this cluster we selected the six that were most strongly related. We called the fourth cluster "Technology transfer-induced development" factor.

By presuming Rotated Factor Matrix, we could calculate factor score, "Cooperation with foreign countries" score, "Academic-industrial collaboration" score, "Willingness to contribute" score, "Technology transfer-induced development" score.

TABLE 2: ROTATED FACTOR MATRIX

	Ⅰ	Ⅱ	Ⅲ	Ⅳ
Cooperation with European	**0.87**	0.12	0.00	-0.05
Cooperation with American	**0.78**	0.04	0.02	-0.06
Cooperation with Russian	**0.70**	0.16	0.00	-0.08
Cooperation with Chinese	**0.62**	0.09	-0.02	0.01
Cooperation with people of your nationality overseas	**0.46**	0.17	0.07	0.28
Necessity for a university to sell an invention to companies	0.11	**0.64**	0.06	-0.20
Cooperation between professors and companies	0.05	**0.59**	0.12	0.25
Necessity of an organization which connects a university with a company	0.03	**0.56**	0.18	0.20
Necessity for professors to start their researches based on the needs of companies.	0.08	**0.51**	0.04	-0.10
Necessity for university to exchange information on intellectual property with companies	0.12	**0.46**	-0.07	-0.01
Role of university in technology transfer	0.06	**0.43**	0.06	-0.03
Venture businesses by professors motivate universities	0.08	0.39	0.11	0.14
Willingness to contribute to Asia	0.04	0.03	**0.90**	0.16
Willingness to contribute to the world	0.08	0.06	**0.82**	0.16
Willingness to contribute to your country	-0.06	0.19	**0.55**	0.38
Willingness to contribute to the organization you belong to	-0.04	0.25	**0.55**	0.28
A Japanese senior partner should teach you technology-related matters	-0.01	0.15	0.16	**0.71**
Tolerance of copied products in your country	-0.07	-0.11	0.16	**0.51**
A senior partner of your country should teach you technology-related matters	0.08	0.17	0.14	**0.51**
Possibility of academic morality among students in the researches based on the rewards of company	0.02	-0.23	0.10	**0.49**
Necessity for professors to conduct their researches based on the rewards of company.	0.14	0.38	-0.02	**-0.49**
Purpose of acquisition of patent is to grow local industry	0.03	0.16	0.15	**0.44**

B. Analysis of variance based on factor score

Analysis of variance was used to compare means among groups. Independent variables are nationalities (Japan, Thailand, Vietnam, and Philippine) and dependent variables are "Cooperation with foreign countries" score, "Academic-industrial collaboration" score, "Willingness to contribute" score, "Technology transfer-induced development" score. Fig. 1 shows the average of factor score for each country.

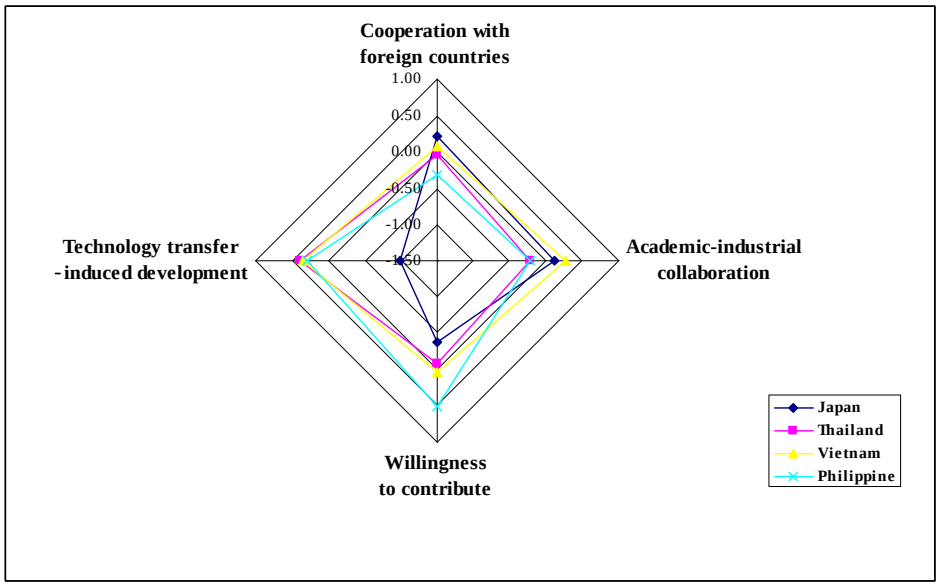

Figure 1: Average of factor score for each country

1). Cooperation with foreign countries

One-way analysis of variance was used to compare means among four countries. Tab. 3 shows the average and standard deviation of "Cooperation with foreign countries." Tab. 4 provides one-way analysis of variance of "Cooperation with foreign countries." The F ratio for the one-way analysis of variance was significant (F (3,430) =5.99, p < 0.01). Post-hoc analysis was performed with Tukey's test. Tab. 5 provides the result. Mean of factor score of Japan was significantly higher than that of Philippine. Mean of factor score of Vietnam was significantly higher than that of Philippine (P < 0.05).

TABLE 3: AVERAGE AND STANDARD DEVIATION OF COOPERATION WITH FOREIGN COUNTRIES

	Number	Average	Standard Deviation
Japan	113	0.22	0.79
Thailand	114	-0.03	0.93
Vietnam	115	0.07	0.94
Philippine	92	-0.31	1.01
Sum	434	0.00	0.93

TABLE 4: ONE-WAY ANALYSIS OF VARIANCE OF COOPERATION WITH FOREIGN COUNTRIES

	Sum of squares	DF	Mean Square	F ratio	p-value	
Between groups	15.07	3	5.02	5.99	0.00	**
Within groups	360.43	430	0.84			
Total	375.50	433				

** $p < 0.01$

TABLE 5: POST-HOC ANALYSES (TUKEY'S TEST) OF COOPERATION WITH FOREIGN COUNTRIES

Nationality		Difference	p-value	
(I)	(J)	(I-J)		
Japan	Thailand	0.25	0.16	
	Vietnam	0.15	0.59	
	Philippine	0.53	0.00	*
Thailand	Japan	-0.25	0.16	
	Vietnam	-0.10	0.84	
	Philippine	0.28	0.14	
Vietnam	Japan	-0.15	0.59	
	Thailand	0.10	0.84	
	Philippine	0.38	0.02	*
Philippine	Japan	-0.53	0.00	*
	Thailand	-0.28	0.14	
	Vietnam	-0.38	0.02	*

* $p < 0.05$

2). Academic-industrial collaboration

One-way analysis of variance was used to compare means among four countries. Tab. 6 shows the average and standard deviation of "Academic-industrial collaboration." Tab. 7 provides One-way analysis of variance of "Academic-industrial collaboration." The F ratio for the one-way analysis of variance was significant (F (3,430) =9.28, p < 0.01). Post-hoc analysis was performed with Tukey's test. Tab. 8 provides the result. Mean of factor score of Japan was significantly higher than that of Thailand, and it was also higher than that of Philippine. Mean of factor score of Vietnam was significantly higher than that of Thailand, and it was also higher than that of Philippine (P < 0.05).

TABLE 6: AVERAGE AND STANDARD DEVIATION OF ACADEMIC-INDUSTRIAL COLLABORATION

	Number	Average	Standard Deviation
Japan	113	0.12	0.91
Thailand	114	-0.22	0.87
Vietnam	115	0.28	0.87
Philippine	92	-0.21	0.73
Sum	434	0.00	0.88

TABLE 7: ONE-WAY ANALYSIS OF VARIANCE OF ACADEMIC-INDUSTRIAL COLLABORATION

	Sum of squares	DF	Mean Square	F ratio	p-value	
Between groups	20.28	3	6.76	9.28	0.00	**
Within groups	313.14	430	0.73			
Total	333.42	433				

** $p < 0.01$

TABLE 8: POST-HOC ANALYSES (TUKEY'S TEST) OF ACADEMIC-INDUSTRIAL COLLABORATION

Nationality		Difference	p-value	
(I)	(J)	(I-J)		
Japan	Thailand	0.34	0.01	*
	Vietnam	-0.16	0.50	
	Philippine	0.33	0.03	*
Thailand	Japan	-0.34	0.01	*
	Vietnam	-0.50	0.00	*
	Philippine	-0.01	1.00	
Vietnam	Japan	0.16	0.50	
	Thailand	0.50	0.00	*
	Philippine	0.49	0.00	*
Philippine	Japan	-0.33	0.03	*
	Thailand	0.01	1.00	
	Vietnam	-0.49	0.00	*

* $p < 0.05$

3). Willingness to contribute

One-way analysis of variance was used to compare means among four countries. Tab. 9 shows the average and standard deviation of "Willingness to contribute." Tab. 10 provides One-way analysis of variance of "Willingness to contribute." The F ratio for the one-way analysis of variance was significant ($F(3,430) = 17.30$, $p < 0.01$). Post-hoc analysis was performed with Tukey's test. Tab. 11 provides the result. Mean of factor score of Philippine was significantly higher than that of Japan, and it was also higher than that of Thailand and Vietnam. Mean of factor score of Vietnam was significantly higher than that of Japan ($P < 0.05$).

TABLE 9: AVERAGE AND STANDARD DEVIATION OF WILLINGNESS TO CONTRIBUTE

	Number	Average	Standard Deviation
Japan	113	-0.38	0.96
Thailand	114	-0.08	0.81
Vietnam	115	0.04	0.89
Philippine	92	0.51	0.88
Sum	434	0.00	0.93

TABLE 10: ONE-WAY ANALYSIS OF VARIANCE OF WILLINGNESS TO CONTRIBUTE

	Sum of squares	DF	Mean Square	F ratio	p-value	
Between groups	40.73	3	13.58	17.30	0.00	**
Within groups	337.45	430	0.78			
Total	378.18	433				

** $p < 0.01$

TABLE 11: POST-HOC ANALYSES (TUKEY'S TEST) OF WILLINGNESS TO CONTRIBUTE

Nationality		Difference	p-value	
(I)	(J)	(I-J)		
Japan	Thailand	-0.29	0.06	
	Vietnam	-0.42	0.00	*
	Philippine	-0.88	0.00	*
Thailand	Japan	0.29	0.06	
	Vietnam	-0.13	0.70	
	Philippine	-0.59	0.00	*
Vietnam	Japan	0.42	0.00	*
	Thailand	0.13	0.70	
	Philippine	-0.46	0.00	*
Philippine	Japan	0.88	0.00	*
	Thailand	0.59	0.00	*
	Vietnam	0.46	0.00	*

* $p < 0.05$

4). Technology transfer-induced development

One-way analysis of variance was used to compare means among four countries. Tab. 12 shows the average and standard deviation of "Technology transfer-induced development." Tab. 13 provides One-way analysis of variance of "Technology transfer-induced development." The F ratio for the one-way analysis of variance was significant ($F(3,430) = 123.27$, $p < 0.01$). Post-hoc analysis was performed with Tukey's test. Tab. 14 provides the result. Mean of factor score of Thailand was significantly higher than that of Japan, and That of Vietnam and Philippine were also higher than that of Japan ($P < 0.05$).

TABLE 12: AVERAGE AND STANDARD DEVIATION OF TECHNOLOGY TRANSFER-INDUCED DEVELOPMENT

	Number	Average	Standard Deviation
Japan	113	-1.00	0.49
Thailand	114	0.39	0.69
Vietnam	115	0.36	0.73
Philippine	92	0.29	0.62
Sum	434	0.00	0.87

TABLE 13: ONE-WAY ANALYSIS OF VARIANCE OF TECHNOLOGY TRANSFER-INDUCED DEVELOPMENT

	Sum of squares	DF	Mean Square	F ratio	p-value	
Between groups	152.22	3	50.74	123.27	0.00	**
Within groups	177.00	430	0.41			
Total	329.22	433				

** $p < 0.01$

TABLE 14: POST-HOC ANALYSES (TUKEY'S TEST) OF TECHNOLOGY TRANSFER-INDUCED DEVELOPMENT

Nationality		Difference	p-value	
(I)	(J)	(I-J)		
Japan	Thailand	-1.39	0.00	*
	Vietnam	-1.36	0.00	*
	Philippine	-1.28	0.00	*
Thailand	Japan	1.39	0.00	*
	Vietnam	0.04	0.98	
	Philippine	0.11	0.63	
Vietnam	Japan	1.36	0.00	*
	Thailand	-0.04	0.98	
	Philippine	0.07	0.85	
Philippine	Japan	1.28	0.00	*
	Thailand	-0.11	0.63	
	Vietnam	-0.07	0.85	

* $p < 0.05$

IV. CONCLUSION

This paper focuses on technology transfers and academic-industrial collaboration, by our questionnaire survey, from the view point of cultural difference and perception gap. We could extract four factors "Cooperation with foreign countries" "Academic-industrial collaboration" "Willingness to contribute" and "Technology transfer-induced development." By presuming Rotated Factor Matrix, we could calculate factor score, "Cooperation with foreign countries" score, "Academic-industrial collaboration" score, "Willingness to contribute" score, technology transfer-induced development score.

Analysis of variance was used to compare means among four countries. Independent variables are nationalities (Japan, Thailand, Vietnam, and Philippine) and dependent variables are "Cooperation with foreign countries" score, "Academic-industrial collaboration" score, "Willingness to contribute" score, "Technology transfer-induced development" score.

Regarding "Cooperation with foreign countries," mean of factor score of Japan was significantly higher than that of Philippine. Mean of factor score of Vietnam was significantly higher than that of Philippine. We should consider the difference in the international technology transfer with United States, Europe, Russia, and China.

As for "Academic-industrial collaboration," mean of factor score of Japan was significantly higher than that of Thailand, and it was also higher than that of Philippine.

Mean of factor score of Vietnam was significantly higher than that of Thailand, and it was also higher than that of Philippine. The score of Vietnam is noticeable, compared with Thailand and Philippine. Since the end of 1990's, Japan has tried to develop the Academic-industrial collaboration on the model of the United States, and gained experience by practice. Japan should play an important role in the establishment of Technology licensing office, and the enactment of regulations on the conflict of interest in universities.

Regarding "Willingness to contribute," mean of factor score of Philippine was significantly higher than that of Japan, and it was also higher than that of Thailand and Vietnam. Mean of factor score of Vietnam was significantly higher than that of Japan.

When Japanese collaborate with them in the research field, Japanese should explain the contribution of the project to country, local economy, organization, etc.

As for "Technology transfer-induced development," mean of factor score of Thailand was significantly higher than that of Japan, and that of Vietnam and Philippine were also higher than that of Japan. To solve these gaps, Japan should promote technology transfer and academic-industrial collaboration to develop the society.

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