Talent Mobility Model at the National Level: A Case Study of Industrial Technology Assistance Program in Thailand

Songphon Munkongsujarit
National Science and Technology Development Agency, Thailand Science Park, Pathumthani, Thailand

Abstract--**Science and technology capability is one of the critical factors in developing the nation's competitiveness and driving the economic growth as well as the well-being of the people. The mobility of talent between academia and industry contributes significantly to the stock of human resources in science and technology, thus talent mobility at the national level plays an important role in the country's strategy, especially in the developing country. Since Thailand has limited number of human resources in science and technology, the establishment of appropriate talent mobility policy and measures is necessary. This paper explores one possible model of talent mobility at the national level by using case study analysis of the Industrial Technology Assistance Program (iTAP) which facilitates the linkage between academia and industry via the intermediary process that provides university professors and/or researchers to help solving technical problems for small and medium enterprises in Thailand. The paper discusses multiple cases of talent mobility in Thailand from different sectors to show the appropriateness of iTAP model as one of possible talent mobility schemes for Thailand.**

I. INTRODUCTION

"The success of any national or business model for competitiveness in the future will be placed less on capital and much more on talent. We could say that the world is moving from capitalism to talentism [1]." This quote is a part of the opening speech at World Economic Forum Special Meeting on Economic Growth in 2011 by Klaus Schwab, Founder and Executive Chairman of World Economic Forum. It demonstrates the paradigm shift as well as the sense of urgency in the past decade for talent management in the global scale due to the changing of world population toward scarcity of working-age citizen. According to World Economic Forum [2], the world population of those 60 years old and older will exceed the number of young people (less than 15 years old) for the first time in history by the year 2050. The global and national demand for workers, especially those with special skills and talents such as scientific and technological manpower, is becoming higher than the available supply. Thus, the subject of talent management, specifically in the area of talent mobility, has caught the attention of academic researchers, industrial practitioners as well as governmental decision makers in both national and international level over the past few years. For example, the works of Lewis and Hechman [3] and Collings and Mellahi [4] demonstrated the critical review of talent management, while the work of Woolley et al. [5] particularly discussed the topic of talent mobility (or scientific mobility as defined by Mahroun [6]).

In this paper, the focus of talent mobility is in the national context by using Thailand as a case study. Thailand is a developing economy with fundamentally limited scientific and technological human resources. It takes time and money to invest in the development of human capital; hence in the short or medium term, the mobility of talent inside the country boundary as well as the inward movement of talent (the concept of brain gain and reverse brain drain) is the key to harness the maximum potential of limited human resources. International talent mobility including the topic of brain drain, brain gain and reverse brain drain is widely discussed in the literature (see [7]–[14]) and it is not the scope of this paper. Instead, the focus of this paper is to investigate an effective way to manage talent mobility scheme at the national level as demonstrated by a case study of the industrial technology assistance program (or iTAP). This paper addresses the relevant research questions by comparing and contrasting multiple iTAP projects (or cases). The research questions are as follows:

(1) Is iTAP model (or process) an effective way to operate talent mobility at the national level?
(2) What are the key success factors in implementing iTAP model for the talent mobility scheme at the national level?

This paper is organized accordingly. Section II presents the literature review of talent management and talent mobility, especially at the national level. Then, Section III explains the case study research methodology used in this paper, following by the explanation of the relevant iTAP projects in Section IV and the discussion of the aforementioned cases in Section V. The paper concludes with managerial implications and recommendations for all stakeholders involving in talent mobility scheme at the national level.

II. LITERATURE REVIEW

World Economic Forum [1] broadly defines talent mobility as "the physical movement of workers within or across organizations, industries or countries, and globally, or the professional movement of workers across occupations or skill sets. Mobility may be temporary or permanent and may also involve moving people from unemployed to employed, moving jobs to people or allowing for virtual mobility." In this paper, the scope of talent mobility covers subset of such generic definition by focusing on the movement of science and technology (S&T) personnel within the country (and not across national borders) in the temporary basis, meaning that

the personnel who move from source institutions will eventually return within a determined period of time. Nevertheless, the causes and effects as well as the characteristics of such temporary national talent mobility are still in line with the widely mentioned international talent mobility.

According to Organization for Economic Co-operation and Development (OECD) [15], [16], talent mobility is deemed to be important to socio-economic development of the nations because the movement of science and technology personnel (especially the scientists and the researchers) contributes to the creation and the diffusion of knowledge. The knowledge in this context includes both the codified knowledge, which can easily be documented in the form of books or manuals, and the tacit knowledge, which, on the other hand, cannot be codified and transmitted as information through the common communication channels. Such knowledge is disseminated both directly and indirectly from the mobilized scientists and researchers to their colleges and their contacts within their physical and virtual proximity – the closer the proximity, the more intense the transfer of the knowledge. This is also in agreement with the work of Coccia in spatial mobility of knowledge transfer [17], the work of Chabault et al. on the management of talent in clusters [18]. Knowledge, in turn, brings about the development of both the sending countries (in terms of remittances and human capital) and the receiving countries (in terms of highly-skilled personnel and spilled-over knowledge). However, there is still no consensus on best practice of talent mobility. Even though there are several works focusing on national or regional talent mobility in various countries, e.g. the work of Mellander and Florida on talent and wages in Sweden [19], the similar work of Qian on talent and economic performances in China [20], the work of Hartmann et al. on talent management of multinational cooperation in China [21], the work of Borowik on knowledge management and innovation policy of the Basque Country region of Spain and the West Midlands region of England [22], the work of Puteh et al. on the mobility of young talent in Malaysia [23] and the work of Zheng and Chen on the human resources management of Nordic countries [24], these works on talent mobility have not yet been thoroughly compared and contrasted and the generic models have yet to emerge. Thus, an insight from the temporary talent mobility model gathered from case study of iTAP in Thailand might provide one of the appropriate guidelines for talent mobility policy in national or regional context, and subsequently to the international talent mobility in general.

Moreover, regarding to the causes or determinants of talent mobility across international borders, Solimano [25], [26] identified seven different factors that affect the mobility, i.e. (a) differences in earnings and development gaps, (b) non-pecuniary motivations, (c) the demand for capital and talents, (d) technology and the demand for talent, (e) agglomeration and concentration effects, (f) linguistic capability, networks, and socio-cultural affinity, and (g) policy regimes and immigration policy. These elements can be easily categorized into two general reasons which motivated the talent to mobilize to different locations which are either the monetary benefit (extra earnings, special remittances, etc.) or the non-pecuniary benefit (ease-of-reach to peer network, social status, etc.) This generalization of determinants of talent mobility is applicable to the case of international talent mobility as well as the case of national or regional talent mobility. In particular, the case study in this paper can shed the light on the factors that promote talent mobility (due to the external elements such as governing policy of the talent home country/organization as well as the destination country/organization and the internal elements such as preference of working condition of the talents and their personal motivations).

III. RESEARCH METHODOLOGY

Three retrospective cases of iTAP projects were analyzed in this paper to answer two research questions as identified in Section I. These multiple case studies follow the case research methodology for the purpose of theory building (in identifying whether iTAP model is appropriate for temporary national or regional talent mobility scheme and what the key success factors of effectively using such model are) as explained by Voss et al. [27] (based on the groundbreaking works on case study research by Eisenhardt [28] and Yin [29], [30]). In each case, two types of data collections were used, i.e. (a) the analysis of project documentations (which include project proposal, project progress report and project final report prepared by the company and the expert as well as the project evaluation report prepared by the third-party evaluator) and (b) the open-ended interviews with all parties involved in the projects (which comprise the company seeking technical assistance, the experts providing the solutions to the company, and the iTAP personnel acting as intermediary between the company and the experts). The analysis of information from both the documents and the interviews with the informants would reveal the answers to research questions above.

The iTAP is a division of Technology Management Center of the National Science and Development Agency (NSTDA) – a government agency of the Kingdom of Thailand. The mandate of iTAP is to provide science and technology related assistance to small and medium enterprises (SMEs) in Thailand. This is done through the intermediary process between SMEs (who have the science and technology related problems) and the experts (who provide the appropriate solutions to such problems) via the personnel called Industrial Technology Advisors (ITAs). It should be noted that iTAP provides both technical support and financial support (in the form of partial reimbursement as an incentive at the conclusion of the project) for the SMEs. The detailed information of iTAP background and services can be found in the author's prior work on iTAP process [31].

In fact, the iTAP model is adapted from the Industrial Research Assistance Program (IRAP) of the National Research Council (NRC) of Canada. (See the work of Niosi [32] and Rasmussen [33] for the in-depth information of IRAP.)

The simplified operational model of iTAP is shown in Figure 1. This model explains how iTAP process could facilitate the talent mobility scheme between academia (university professors and researchers) and industry (SMEs in various sectors). Firstly, when iTAP receives the request from SMEs for science and technology problem consultancy, the ITA is assigned to initiate the "first visit" with the SME to evaluate the nature of the problem at the site (e.g. factory, warehouse, etc.) of the problem. Then, the ITA contacts the appropriate expert from the personal list or the iTAP database of experts to perform the "preliminary analysis" of the problem. If the expert agrees to work on the problem and the SME agrees to work with the expert, both parties would work together to develop the official project proposal to submit to iTAP for approval. Upon the approval of the project, the expert would perform the task of solving the problem according to the agreed proposal. Typical project would last between three months to twelve months. During the course of the project, the ITA would follow up the progress of the project at least every six months or more frequently. The project concludes with the submission of the final report by the expert and the evaluation of the result by the third-party experts nominated by iTAP. Finally, iTAP would provide financial reimbursement up to 50% of the project cost to the SME at the end of the project after the project has been evaluated by the third-party evaluator and all the paper works have been processed. The iTAP process clearly facilitates talent mobility as identified in Figure 1.

IV. CASE STUDY

Three example cases of iTAP projects pertaining to talent mobility scheme are presented as follows. All of these cases are a part of the total number of 410 iTAP projects in fiscal year 2013. For the project to be considered as talent mobility project in this case, the expert has to spend time working at the company for at least 20% full-time equivalent (FTE) or one day per five-working-day week. It should be noted that the duration of each project were less than one year from the date of project proposal approval to the date of the project conclusion (which signifies when iTAP receives the conclusion report from the expert and evaluates the result of the project by commissioning the external evaluators).

Company A: Hydraulic Equipment Manufacturer

This medium-sized enterprise is one of a few manufactures of hydraulic pumps and their components in Thailand serving both domestic and international markets of hydraulic equipments with the annual sales revenue of approximately 86 million Thai baht (or US$ 2.68 million) in the year 2012. One of the challenges that the company faces in its manufacturing process is the inconsistency of the internal non-circular grinding of cam rings for hydraulic vane motors. Since there is a constantly increasing demand for the motors, the intricate production of cam rings has to be ramped up. The company employs the computer numerical control (CNC) grinding machine to serve the production of

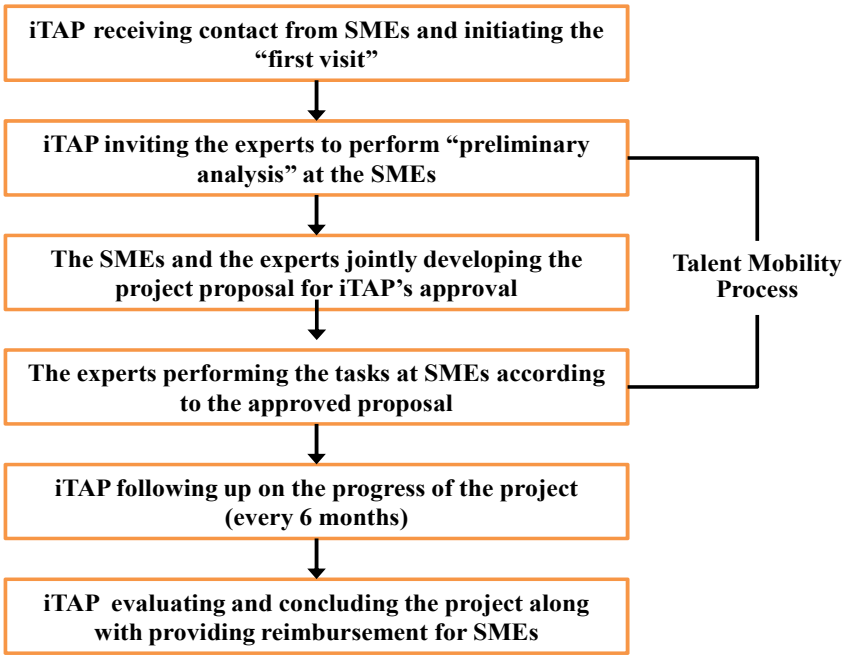

Figure 1 – Simplified operational model of iTAP reflecting the talent mobility process

different variations of cam rings according to the requirements of the company's customers. The company contacted iTAP for technical assistance on the development of computer software for controlling the grinding machine for cam rings. The ITA introduced the company to the expert on CNC machine who is a professor from the department of industrial engineering at one of the leading universities in Thailand. The professor and his team of graduate students (Ph.D. and Master's students) temporary mobilized themselves from the university to the company in a part-time basis to work on the development of appropriate controlling software for the internal non-circular grinding of cam rings with CNC grinding machine. The software development process consisted of data collection of technical specifications, software development and implementation, and testing of CNC grinding machine. In doing so, the company assigned an ad-hoc personnel from the maintenance unit to work closely with the expert and his team by providing the necessary information and receiving the proper training for the installation and the usage of the software for CNC grinding machine. The benefit of the talent mobilization scheme via iTAP process in this case is twofold. For the company, it can overcome the challenge of cam rings grinding process. For the expert; the professor along with his team of graduate students gained hand-on experiences by working on the real problem in the real industry setting.

Company B: Used Industrial Machinery Dealer

This small-sized enterprise is one of the first dealers of used and second-hand industrial machinery in Thailand (officially registered as business enterprise to Ministry of Commence since 1995 but established more than 50 years ago in the 1960s). The company buys old or outdated machines and performs an upgrade on some specific parts (retrofitting), and then resells the retrofitted machines to the customers. Normally, the company employs the development and operation team to retrofit the machines and hires external experts to solve various problems that the internal team could not (or choose not to) solve on an ad-hoc basis. One of the recent challenges of the company is the upgrade of robotic technology used in newer machinery – particularly the six axis industrial robotic part of the machine. In this case, the company was introduced to iTAP through one of the experts who used to solve problems for the company and previously participated in the other iTAP project. After the first visit, the ITA deemed the problem appropriate and the company is qualified to get assistance from iTAP, thus the ITA recommended the company to develop the proposal for this particular project with the expert for approval. The expert is a professor at one of the well-known universities in Thailand with a doctorate degree and expertise in mechatronic system engineering. Since the expert used to solve other problems at the company with the internal development team in the past, the financial support from this iTAP project acted as an incentive for the company to hire the expert again, thus enabled the mobility of the expert to the company for this particular problem. Upon the project approval, the expert jointly worked with the company's team at the company's machinery workshop at least two days a week to solve the problem on the six axis robotic machinery. During the course of the project, the company's development team learned not only how the solve the particular six axis robotic problem but also the necessary skill-sets for solving other problems related to the multiaxis machining. It is clear that this iTAP project and talent mobility scheme built the capability of the company's development team besides solving the particular problem for the company. Moreover, the professor also integrated the problems he encountered at the company (along with examples from mechanical parts sponsored by the company) to his coursework in manufacturing engineering process at the university, resulting in a better teaching material.

Company C: Chicken Meat Processing Plant

This food processing plant is registered as a medium-sized enterprise in food processing industry with the business focus on domestic sales of chicken meat products. The average annual sales revenue of the products in the past three years is 800 million Thai baht (or US$ 25 million). However, the domestic Thai poultry market is highly competitive, thus the company has to continuously improve its products and production processes in order to gain competitive advantages over its competitors. Chicken carcass is one of the by-products of chicken meat processing that the company deemed to be beneficial if there is a way to add value to the product for higher selling price, one of which is to process the carcass into dog food. Thus, the company contacted iTAP for technical assistance on the formula and the production process of dog food from chicken carcass. The ITA connected the company with an expert who is a veterinary physician and veterinary science professor at one of a few veterinary schools in Thailand. The expert proposed the production of dog food from chicken carcass in the form of wet food, which is the most famous form of dog food in the market, by using a retort pouch, which is the new way of packaging wet pet food, as a package. In this case, the expert initially spent time at the plant to collect the raw materials (chicken carcasses) and develop the appropriate ingredients for wet dog food formulas. Then, as the plant does not have the chemical and retort packaging testing facility, the expert had to bring all different batches and formulas of wet dog food in retort pouch to test at the testing laboratory in the university for the compliance with chemical, microbiological and packaging standards for commercial pet food. The final formula and appropriate production process was presented to the company to implement an additional production line at the processing plant. This iTAP project clearly mobilized the expert from veterinary school to assist the company in the way that is beneficial to both the expert (by getting the hand-on experiences on the new pet food formula development) and the company (by getting a value-added product in its product portfolio). This project also provides the benefit to

the economy by stimulating the needs for science and technology investment (for upgrading the company research infrastructure) in the private sector.

V. DISCUSSION

From three cases as described in section I, it is shown that iTAP process can be used to facilitate talent mobility scheme at national level in Thailand. Even though different industry sectors have different problems and require different experts for specific solutions, the cases demonstrate that talent mobility between different industries and academia is possible through the iTAP model and process which mainly relies on the experiences and knowledge of the ITAs. Thus, the readiness of innovation intermediary (the ITA in this case) is one of the main factors for realizing successful talent mobility scheme besides the commitment and the willingness to participate from both the talent-sending organizations (universities or research institutions) and the talent-receiving organizations (companies). If there is a lack of support from any parties involved, talent mobility would not be possible. For example, in the situation that the ITA identifies the best expert in the field for the company from one university, if the rules and regulations of that particular university don't allow its professor to work anywhere else, it would not be possible for that expert to mobilize to the company.

Moreover, once the expert has finally mobilized to the company via the iTAP process, the expert has to gain full trust and cooperation from the company in order to successfully work and solve the problem for the company. Trust in the capability of the expert and the ITA would lead to the cooperation of the company. Similarly, the expert has to trust the ITA for presenting the legitimate problem from the company. This reciprocal relationship of trust among all parties involved (the ITA, the expert and the company) agrees with the integrative model of trust as suggested by Mayer et al. [34]. However, trust alone is not sufficient for the successful talent mobility. Trust only creates a necessary environment for the cooperation between all stakeholders. Talent mobility is considered to be successful when the problem of the company is solved and the knowledge for particular problem-solving and beyond is successfully transferred from the expert to the company. There are a number of studies on knowledge transfer (for example, the work of Carlilie [35], the work of Szulanski [36] and the work of Cummings and Teng [37]); all of them agree that the challenge of successful knowledge transfer mainly depends on the transfer of tacit knowledge which requires close interaction between the knowledge owner (the expert) and the knowledge recipient (the company). Thus, for successful and sustainable knowledge transfer, the company has to prepare the appropriate personnel to work closely with the expert during the period of talent mobility. In addition, especially for the company with in-house research team, the company should avoid the not invented here (NIH) syndrome which is the situation that the personnel in the company resist the adoption of new technology or solutions from external sources (as explained by Katz and Allen [38]) by clearly communicating with the research team on the needs of external expert's solutions as well as cultivating the mentality of the research team to accept assistance from external experts.

From the above discussion, the answers to the two research questions of this paper are as follows.

(1) The iTAP model is indeed an effective way to operate talent mobility at the national level as shown through the example cases of three iTAP.
(2) According to the example cases, there are a number of key success factors in implementing iTAP model for the talent mobility scheme at the national level. Table 1 summarizes the list of such factors.

TABLE 1 – KEY SUCCESS FACTORS IN IMPLEMENTING ITAP MODEL FOR TALENT MOBILITY SCHEME

Stakeholders in Talent Mobility Scheme	Lists of Success Factors in Implementing iTAP Model for Talent Mobility Scheme at The National Level
ITAs	• Trustworthiness • Providing professional services • Ability to identify and analyze the technical problems • Access to the appropriate experts (via personal network and/or database of experts)
Companies	• Trustworthiness • Vision, commitment and determination • Availability of operating budget • Availability of specific personnel • Avoidance of not invented here syndrome
Experts	• Trustworthiness • Professional ethics • Responsibility (quick response to company) • Business perception • Rules and regulations of the university/research institutes

VI. CONCLUSION

For developing country like Thailand, one of the most important elements for improving the well-being of the nation is the upgrading of the country's science and technology through the development of human resource and human capital. Since it takes time to build up enough scientists, researchers and technologists with either national or international higher education system, temporary talent mobility is a key to fully utilize the limited resources of the country's science and technology personnel in the short period of time. The cases in this paper clearly show that it is possible to use the iTAP operational model as an effective way to implement talent mobility scheme at the national level. This is because the ITA acts as an effective intermediary or middleman connecting the right expert to solve the right problem of the company. The mechanism is in place for iTAP to support the company financially (50% of the project budget is subsidized by iTAP at the end of the project) as well as to ensure that the expert can mobilize and work at the full capability. The financial incentive which is provided at the end of the project acts as a mechanism to ensure the company's commitment and determination for the project because the company has to reasonably support the expert for the project success in order to get the budget reimbursement at the conclusion of successful project.

Lastly, from the example of three iTAP cases that demonstrate the talent mobility scheme at the national level in Thailand, it is possible to recommend the roles of expert to match the readiness of company as a recipient of technology transfer in Thailand. Typically, there are three levels of company categorized by the availability of research infrastructure and research personnel. At the basic level, the labor intensive or skill intensive company does not necessarily have the research laboratory and research personnel. In order for the company to be able to effectively receive the technology and sustainably building its capability for the future, the company should employ the expert to help implementing the laboratory as well as training the prospective research personnel from either the existing personnel or the new recruits. As for the higher level of technology intensive company, the company has the laboratory for testing or quality control of the product but has not performed research and development activity. The expert can help this type of company upgrading the existing laboratory to become the fully functional research laboratory along with training the appropriate research personnel. Finally, for the research intensive company which has research laboratory and dedicated research personnel, the expert can fully help the company by supervising and recommending the best research portfolio for the company. Table 2 outlines the recommendation for the roles of the expert for upgrading of R&D capability of the company to reach the ultimate goal of the sustainable increment of the country's science and technology personnel in accordance with the national strategy of Thailand on capacity-building to enhance the country's competitiveness [39].

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TABLE 2 – RECOMMENDED ROLES OF EXPERT FOR UPGRADING R&D CAPABILITY OF COMPANY

Company Profile	**Availability of Infrastructure & Personnel**		**Recommended Roles of Expert**
	Laboratory	**Dedicated Research Personnel**	
Type 1 (Research intensive)	Yes(R&D lab)	Yes	Supervising and recommending research portfolio
Type 2 (Technology intensive)	Yes (Testing lab or QC lab)	No	Upgrading the laboratory and training of research personnel
Type 3 (Labor intensive or skill intensive)	No	No	Implementing the laboratory and training of research personnel

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