

Technology transfer through FDI flows from Vietnam's perspective

Transferência de tecnologia através de fluxos de IDE na perspectiva do Vietnã

Transferencia de tecnología a través de los flujos de IED desde la perspectiva de Vietnam

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Abstract

This paper aims to study and analyze the efficiency of technology transfer through foreign direct investment projects (FDI) flows, on the basis of analyzing the specific case of Vietnam. Science and technology in general and technology transfer in particular, is considered as one of the key issues strongly promoted by Governments, and one of the most effective and economical solutions is to effectively exploit technology transfer through FDI projects. Hence, this paper concentrates to identify the positive and negative changes to technology transfer via FDI flows by assessing the current situation, trends and proposing recommendations.

Key words: technology transfer, FDI, Vietnam

Resumo

Este artigo tem como objetivo estudar e analisar a eficiência da transferência de tecnologia por meio de fluxos de projetos de investimento estrangeiro direto (IED), com base na análise do caso específico do Vietnã. Ciência e tecnologia em geral e transferência de tecnologia em particular são consideradas uma das principais questões fortemente promovidas pelos governos, e uma das soluções mais eficazes e econômicas é explorar efetivamente a transferência de tecnologia por meio de projetos de IED. Portanto, este artigo se concentra em identificar as mudanças positivas e negativas na transferência de tecnologia por meio de fluxos de IED, avaliando a situação atual, tendências e propondo recomendações.

Palavras-chave: transferência de tecnologia, IED, Vietnã

Resumen

Este trabajo tiene como objetivo estudiar y analizar la eficiencia de la transferencia de tecnología a través de flujos de proyectos de inversión extranjera directa (IED), a partir del análisis del caso específico de Vietnam. La ciencia y la tecnología en general, y la transferencia de tecnología en particular, se consideran como uno de los temas clave que los gobiernos promueven con fuerza, y una de las soluciones más efectivas y económicas es explotar eficazmente la transferencia de tecnología a través de proyectos de IED. Por lo tanto, este trabajo se concentra en identificar los cambios positivos y negativos en la transferencia de tecnología a través de flujos de IED, evaluando la situación actual, las tendencias y proponiendo recomendaciones.

Palabras clave: transferencia de tecnología, IED, Vietnam

1. INTRODUCTION

The stronger and deeper the integration, the greater the role of technology transfer in general and through FDI in particular for developing countries.

Technology is an abstract and broad concept. According to the Economic and Social Commission for Asia and the Pacific (ESCAP): “Technology is the systematic knowledge of processes and techniques used to process materials and information. Technology includes knowledge and skills, equipment, methods, and systems used in the production of goods and services.” (Nawaz Sharif, 1983).

The Technology Transfer issue is known when the world deals with the problem of the technological life cycle of a product that needs to be extended, introduced, and supplemented by Vernon, 1966; Dunning 1981, Scott Kennel, 2004.

Technology transfer through FDI was considered by Ogawa 1976, then it was divided into three forms in terms of production technology, management technology and administrative technology, revolving around specific contents such as building factories, equipment, machinery, skills, training local people to operate the machine...quality management, schedule, training engineers, managers during operation, and management skills. Among the forms of technology transfer, FDI is still considered as the cheapest channel, both indirect and direct, suitable for developing and transitioning countries (Blomström and Kokko 1997). FDI is also confirmed to be the most important technology transfer tool to help host countries catch up with international technology borders (Newman et al, 2015).

2. METHODOLOGY

Authors will evaluate the current situation and trend of technology transfer via FDI flows in ASEAN countries in the period 2010-2020. There were publications which survey the technology transfer through FDI projects and statistic method was used for this purpose. We also use this method to analyse the current situation of technology transfer through FDI flows among ASEAN countries and the trend of technology transfer in Vietnam during period from

2010 to 2020. Apart from that, assesment is also used to evaluate the technology level of these ASEAN countries.

3 RESULTS AND DISCUSSIONS

3.1 Situation of Technology transfer through FDI among ASEAN countries during 2010-2020

In Asia, the story of technology transfer through FDI projects has been noticed, and has created positive effects for Asian developing countries in their industrialization process, bringing a variety of technology transfer forms and channels. However, studies have shown "bottlenecks" for developing and transitioning countries when implementing the goal of technology transfer through FDI. Within the framework of countries in Asia, developed countries such as Japan, which is also the strongest FDI investor, outperforming Korea, the newly industrialized countries (NIEs) in Asia, are still blamed for being passive when transferring technology to developing countries in the region in the second half of the 1980s, later when they became more enthusiastic about technology transfer, Japanese MCNs often chose the FDI channel. Even when implementing technology transfer to ASEAN countries, Japanese enterprises do not perform it effectively (Tran Van Tho, 1991). Objectively speaking, there is a difference in the efficiency of Japanese technology transfer between Asian NIEs (good) and developing countries in Southeast Asia (poor), raising the question why? Impact at least at the plant level is certain, more optimal depends on many factors. Korea is a country with rapid growth in the field of FDI, transforming from an investment receiving country to a major investor in the region. Regarding the level of technology absorption of developing countries in Asia, the common ground shows that there is an increase in technology absorption capacity, related to the human factor, as reflected in the level of education of each country. Rosenberg, 1982 early identifies a link between success in absorbing transferred technology and a well-trained workforce. Regarding the investment climate, Asian governments are interested in attracting FDI, clearly seen from the NIEs, then spread to Thailand, Indonesia, Vietnam... and so on. Japan and South Korea are two new countries after RCEP was born,

which will actively contribute to technology transfer activities because the history of FDI activities of these two developed countries shows the achievements and potentials of technology transfer to developing countries to carry out industrialization through FDI projects. Studies in European countries have shown that vertical spillovers of technology through FDI are larger than horizontal spillovers (Jože P. Damijan, 2003), and similar results for RCEP developing countries.

In fact, there is inequality in the level of technology development across Asian countries. Most of the RCEP ASEAN members have accumulated technology to some extent, but it is also uneven in enterprises, only relatively large companies can have qualified labor to absorb technology transfer. Besides, the need for technology transfer is still demanded by businesses of all sizes. Up to three out of five countries holding a total of 85% of the world's technological patents, including China, Japan, and South Korea, are members of RCEP, showing more technological potential when RCEP was established. Moreover, the majority of RCEP member countries encourage free trade and FDI attraction, which will facilitate foreign direct capital flows and create a foundation for the implementation of technology transfer. Additionally, the rapid development of science and technology shortens the life of technologies, increases the need for transfer to prolong life, and saves research and development costs for the host country.

	Unskilled employment, % of 2021				Skilled employment, % of 2021			
	2021 Baseline	New Normal	Global Reach	Friend- shoring	2021 Baseline	New Normal	Global Reach	Friend- shoring
Russian Federation	91.8	83.3	82.9	83.0	106.5	99.0	98.7	98.7
Rest of World	101.1	100.3	100.0	100.0	122.9	122.5	122.4	122.3
World	114.6	113.4	113.6	113.0	166.3	165.3	165.6	165.0
<i>Memorandum</i>								
ASEAN (8 members)	111.7	111.0	112.4	110.8	166.7	166.2	167.2	166.0
CPTPP (11 members)	97.0	96.3	97.5	95.9	139.5	138.9	139.9	138.7
RCEP (15 members)	97.9	95.9	97.1	94.9	152.0	150.1	151.2	149.1
NATO+ (8 members)	90.2	89.9	90.2	89.7	119.8	119.6	119.8	119.5

ASEAN = Association of Southeast Asian Nations, CPTPP = Comprehensive and Progressive Agreement for Trans-Pacific Partnership, NATO+ = North Atlantic Treaty Organization and their member allies, nes = not elsewhere specified, PRC = People's Republic of China. **RCEP** = Regional Comprehensive Economic Partnership.

From the 1980s up to now, economists have soon realized and proved the fact that the efficiency of technology transfer is not always proportional to FDI scale into each country because it depends on other factors, especially the views and attitudes of the investing country towards technology transfer issue.

According to the World Economic Forum report in 2018, the ranking of countries in terms of technology transfer from foreign direct investment enterprises, there are prominent names in the same Asian region, such as Singapore ranked 2nd, Malaysia ranked 13th, China ranked 49th, Vietnam ranked 89th out of the total number of countries participating in the ranking...Vietnam is considered the lowest efficiency in technology transfer through FDI projects and tend to lag behind.

Table 1

Countries Ranking in technology transfer through FDI projects in Asia

Rank	Country	Point
2	Singapore	5.9
13	Malaysia	5.4
40	Thailand	4.8
44	Indonesia	4.7
49	China	4.7
54	Cambodia	4.6
63	Philippines	4.5
89	Vietnam	4.1

Source: World Economic Forum Report, 2018

Large FDI projects are often carried out mainly by transnational companies (TNCs). This is a resource in which developing countries interested in and has many priorities to attract investment. However, TNCs are limited in transferring new and highly competitive technologies to overseas branches due to concerns of technology copyright issues caused by imitation and technological modification of host countries. Besides transferring existing technologies, TNCs also invest in research and development (R&D) in the host countries. However, most of the R&D activities of TNCs overseas branches are to adapt technology to local conditions for usage.

With a 5-point scale (5 is the highest), the technology picture is compared with other countries in the ASEAN region as follows:

Table 2
Technology assessment in 10 ASEAN countries

Country	Singapore	Malaysia	Philippines	Thailand	Brunei	Indonesia	Vietnam	Myanmar	Laos	Cambodia
Point	3.8	3.0	2.8	2.6	2.6	2.2	1.9	1.8	1.5	1.3

According to the 2018 World Economic Forum report, ASEAN countries rank in terms of technology transfer from FDI enterprises of as follows:

Table 3
ASEAN countries rank in terms of technology transfer from foreign direct investment

Rank	Country	Point
2	Singapore	5.9
13	Malaysia	5.4
40	Thailand	4.8
44	Indonesia	4.7
49	China	4.7
54	Cambodia	4.6
63	Philippines	4.6
89	Vietnam	4.1

Source: World Economic Forum Report, 2018

In terms of technology qualification or efficiency of technology transfer through FDI in ASEAN, Singapore and Malaysia are at the top, but not such high. The overall ground is average and below average, showing that governments have room to develop technology transfer, and also increase technology absorption capacity to achieve better transfer efficiency, especially in the context of ASEAN has supplemented 5 members to form the RCEP Agreement in 2020.

3.2 Trends in Technology transfer through FDI in Vietnam 2010-2020

Vietnam is evaluated by the World Bank as the most dynamic developing country in the East Asia Pacific region. From 2002 to 2020, GDP per capita increased 3.6 times, reaching nearly 3,700 USD. Poverty rate (standardized at 3.65 USD/day, according to PPP in 2017) decreased from more than 14% in 2010 to 3.8% in 2020. Up to now, Vietnam has attracted 25,949 FDI projects with a total registered capital of 326.3 billion USD, of which 84% of investment projects are in the form of 100% foreign capital. In 2017, foreign investment concentrated in 19 industries, in which the processing and manufacturing industry attracted the attention of investors with 15.87 billion USD, accounting for 44.2% of the total registered capital.

In the period 2010 - 2020, most of Vietnam's technology transfer projects are through FDI projects. Through FDI projects, Vietnam has successfully received a number of technologies to serve the development of production and business, gradually improving the qualification of domestic production technology, partly supporting the promotion of Vietnam's export activities. Petroleum and communications are two economic sectors that, thanks to technology transfer and R&D associated with FDI projects, have developed at a fast and modern pace, keeping up with the regional level and creating good momentum for integration with the world in the near future. Petro Vietnam not only has mastered many modern and complex technologies in oil and gas exploration and exploitation activities, but also has the capacity to participate in a number of joint ventures abroad. In the field of communication, many modern technologies have been successfully transferred and applied such as digitized telecommunications networks, fiber optic networks, GSM and CDMA technologies, especially 4G technology. In the field of electronics, opto-mechanical - electronics, many FDI enterprises have organized the production and export of nearly 100% of products to foreign markets, such as Nidec Tosok Co., Ltd., Muto, Nissei... Other businesses have also invested in research and development such as Renesas Vietnam Co., Ltd. with the aim of researching, developing and designing hardware (microchips) and functional software for ICs semiconductor (integrated circuit)... Despite the number of hi-tech enterprises and enterprises applying high technology

in product production is still relatively modest in the total number of foreign-invested projects in Vietnam, the results achieved during recent time have gradually affirmed the Government's determination to commit to creating an attractive environment and favorable conditions for investors so that Vietnam becomes an attractive destination for investors, especially multinational corporations.

Despite of the fact that, the situation of technology transfer of FDI enterprises is still quite bleak, have not met the expectations of the Vietnamese government. Analysis results from World Bank surveys show that the rate of technology transferred through vertical enterprises (enterprises in different industries) between domestic and foreign enterprises is less than 10%. With the horizontal channel, the survey results show that only few technologies are transferred through enterprises in the same industry, regardless of being foreign or domestic. This is to say that technology transfer is quite limited from the FDI sector to the domestic enterprise sector.

Moreover, the efficiency of technology transfer from FDI projects is still very low. In the period 2006 - 2015, foreign-invested enterprises had about 600 technology transfer contracts, accounting for a very low rate (4.28%) compared to that of 14,000 FDI projects in the same period. The R&D investment in FDI projects is very limited, many projects only commit when appraising the application for an Investment Certificate, but when implementing, they do not perform as committed. Up to now, only over 100 of the world's top 500 TNCs are operating in Vietnam. Although the policy of attracting foreign investment has set the goal of absorbing source technology from TNCs, or leading industrialized countries, the actual implementation is still difficult and almost impossible to achieve.

Besides, the trend of technology transfer in Vietnam is also unstable. In 2009, only 1% of technology was transferred from abroad; in 2011 - 2012 it was 35%, but decreased to 10% in 2013. It would be more concerned when domestic enterprises started copying and adapting the experience of foreign invested enterprises, while foreign enterprises do not easily disclose their technological know-how. That means that policies and investment incentives (mainly tax reductions) to capture the spillover effects of technology from the foreign-invested enterprise sector have had little effect over time. Horizontal technology transfer can also come when there is interaction between foreign-invested enterprises and the domestic workforce through training

activities and sharing experience in technology, which can then be transferred to other domestic companies. However, the effectiveness of technology transfer by this method is still being questioned.

From this above analysis, it can not be denied that the demand for technology absorption of enterprises, especially for small and medium enterprises in Vietnam is very large, because this is considered the most optimal solution to increase the competitiveness of products in the context of integration. The fact is that the country's deep economic integration has been bringing many opportunities and challenges, forcing solving technology problems. The technology life cycle of the product has been shortened from 7-8 years to 2-3 years only. Given the fact that the financial capacity to allow investment in research and development of technology application is still low or nonexistent, the implementation of technology transfer through FDI is the right path to grasp. In addition, Vietnam's high-tech market is still developing at a low level and has not yet met the requirements of integration with the region and the world, the Government of Vietnam has emphasized the role of attracting technology transfer through FDI projects, especially when joining RCEP to strengthen capacity to deal with new integration challenges.

3.3 The increasingly impact of the private sector on technology transfer through FDI projects

As the private economy plays an increasingly important role in the economy with a number of large private economic groups having internationally competitive advantages, vertical technology spillover has the opportunity to intensify, both forward and reverse. Collective and cooperative economies have many new and effective models. Vietnam's business environment ranking has improved significantly, rising from the 88/183 in 2010 to the 70/190 countries and territories in 2019, showing the potential to improve the supply chain in which a link of FDI enterprises and technology transfer occurs more effectively.

Currently, technology transfer activities in Vietnam have become diverse and can be transferred in many different forms.

Delivering through transfer channel: Direct transfer by purchasing machine and equipment in order to gain transferred production process or indirect transfer by adopting horizontal, vertical, forward and reverse linkages. Depending on the scale and purpose of the receiving enterprise,

there will be different transfer methods to apply. Indirect technology transfer usually comes from cooperation between foreign-invested enterprises, also known as technology spillover. Spillover based on forward linkage is the interaction between domestic enterprises and foreign intermediaries. By buying inputs from foreign enterprises with advanced technology and service packages or other forms of support, Vietnamese enterprises benefit from being transferred knowledge and technological processes. Developing countries are interested in reverse linkage with favorable policies to attract FDI. Accordingly, Vietnam enterprises are benefiting from new technological processes to improve product quality standards for customers. Regardless of the technology transfer channel, Vietnam always expects the flow of new technology to go together with the capital flow of FDI.

Delivering through different types of technology transfer: Independent technology transfer contract; The technology transfer part in the investment project; Franchise contract; Industrial property rights transfer contract; Contract of sale of machinery and equipment with technology transfer...Technology transfer through FDI projects: Most investors are also technology providers and especially from holding company to subsidiary company through 100% FDI projects. Import of machinery and equipment into Vietnam is mainly through FDI projects, contracts to import equipment and technology lines between domestic enterprises and foreign suppliers. Technology transfer in Vietnam is mainly conducted through capital contribution and procurement of machinery and equipment, accompanied by training on management and operation of foreign partners. This method does not create much change in technological qualification and capacity. Moreover, this is mainly introduced by foreign investors and implemented according to market demand, not researched and proposed by Vietnamese enterprises, leading to limited technology absorption efficiency. In some cases, outdated technologies are also transferred, potentially causing environmental pollution. While the majority of technology transfer contracts registered at state management agencies in charge of science and technology focus on transferring of production processes (73%), technical assistance (77%), training (71%), while technology transfer is not much (13%).

From this assessment, the development of supporting industries, factors affecting the efficiency of technology absorption by reverse spillover with FDI enterprises in Vietnam, is

very important. According the General Statistics Office of Vietnam , up to 80% of enterprises produce final products, of which 20% produce both intermediate and final products simultaneously and 18% of enterprises produce only intermediate products. Thus, there are limited number of enterprises producing intermediate products and do not change over time, proving that supporting industries and intermediate input production are still underdeveloped and have little improvement.

From this point of view, the level of transferred technology needs to be improved in Vietnam. The majority of FDI projects focus on assembling and processing with the low localization rate, so the technologies that FDI enterprises bring in are mainly at average level. The annual report in 2021 of the Association of FDI Enterprises shows that the majority of FDI projects have medium technology (80%), outdated technology up to 15%, and only 5% of projects have modern technology. The shortage of high technologies in Vietnam caused by Vietnam's unqualified environment to receive, and research institutions are not capable of modifying and mastering technology. According to the assessment of the Ministry of Science and Technology, Vietnam's equipment and technology is 50 to 100 years lag behind compared to other countries with advanced medium technology in the world in terms of mechanical engineering industry, backward from 1 to 2 generations in assembling electronics, automobiles, construction machinery...The picture of an outdated technology shows that the technology level of Vietnamese enterprises is still extremely low. Tangible depreciation of common machinery and equipment is about 40-60%, and the consumption of energy, fuel and waste of raw materials due to technology is too high. With the aged machinery and equipment, the proportion of advanced modern technologies and equipment is also very low, mainly concentrated in a few industries such as posts and telecommunications, aviation. Combined with low equipment utilization coefficient, poor product quality, it is difficult to compete with similar foreign products, especially in the current trend of free trade. The medium and low level of technology transfer leads to the risk of becoming a technology landfill, and the competitiveness of products is not high because the technology has also been used in the home country. The assessment of foreign experts is also not much brighter than the self-assessment of domestic experts. In the ASEAN region alone, Vietnam's technological level is still low.

Moreover, legal rules regulating investment sector needs to be changed with more incentive policy. Up to now, FDI appears in 19/21 sectors in the sub-sector system of the national economy, in which the processing and manufacturing industry accounts for the highest proportion, about 59% of total investment. Next is the real estate business with approximately 15.4%; electricity production and distribution with about 8.7% of total investment capital. According to the Ministry of Science and Technology by 2017, among the technology transfer contracts have been registered, 63% the number of contracts in the industrial sector, agricultural product processing and food processing accounts for 26% and medicine, pharmaceuticals, cosmetics accounts for 11%. The legal documents is not strictly regulated, so the State is unable to control the technology imported into Vietnam, specifically, the regulations have not yet bound the signing of technology transfer contracts with authorized State agencies, not restricting unsatisfactory technologies, especially key issues including transfer pricing, appraisal of transferred technology, management of technology transfer. Statistics from the Ministry of Science and Technology show that there are a few technology transfer contracts under FDI projects registered with authorized agencies. By which, most of the contracts granted registration certificates are modified and supplemented technology transfer contracts. In this way, foreign enterprises can declare an increase in investment capital to raise costs, transfer prices to the holding company to evade taxes. In brief, the technologies through FDI projects are transferred in accordance with the interests of investors, so technology only allows Vietnam to exploit techniques and aspects that are beneficial for production and profit of investors, it is difficult for Vietnam to have the opportunity to access new technology, which is difficult to analyze, research and improve. Additionally, Vietnam's technology selection is really inactive, technology is transferred mostly by market demand, not by planned.

In the community of Southeast Asian nations (ASEAN) such as Malaysia, the Philippines, Singapore and Thailand have implemented programs to help build and strengthen the linkages between FDI and domestics enterprises, while some other countries in this region do not yet have these programs or receive funds (OECD and UNIDO 2019). For instance, Singapore offers a tax incentive program for foreign investors coming with advanced technologies, skills, knowledge, pioneering and innovative activities (Singapore Economic Development Board 2022). In the Philippines, an organization called “Actions 2021” for Corporate Tax Rehabilitation and Support

(CREATE) has extended tax incentives for businesses that conduct R&D research and development and technical training. In Thailand, tax incentive policy applied for foreign businesses that sponsor technology and human resources investment funds educational institutions and centers for specialized education in science and technology (Thailand Board of Investment 2021).

4 CONCLUSIONS

In summary, we see that FDI inflows into Vietnam contributes to increase technology transfer, in which direct investment capital from developed economies will have a good impact on the Vietnam economy, especially the potential of technology transfer and management experience. The relationship here is linear. Linear is recognized in both quantity and quality of FDI capital, which is expected to be enhanced in technology transfer efficiency.

Focusing on improving the absorption capacity of technology transfer for domestic enterprises, this is a key factor for developing and underdeveloped countries to take advantage of large economic cooperation to increase the capacity of technology transfer.

On the basis of analyzing the current situation of technology transfer in Vietnam, a middle-income developing country with plentiful natural resources and abundant labor, which is classified by many criteria, in the context of analyzing the current situation of technology transfer in the ASEAN region, authors identify some comments: 1) Technology transfer through FDI projects is the shortest and cheapest path chosen by all countries, especially suitable for developing and new industrialized countries, because the efficiency of technology transfer, in fact, is strongly influenced by factors of both the investing country and the host country; 2) Further studies are suggested on new industrialized countries with success in attracting technology transfer through FDI in order to find out the necessary factors to effectively support technology transfer. It is recommended to focus on solutions to improve the technology absorption capacity of domestic enterprises; 3) Promoting FDI to the network of small and medium-sized enterprises in developing and underdeveloped countries, because this economic

sector is increasingly playing an important role, and in need of high technology and problem solving to strengthen the integration of global value chains.

For developing countries like Vietnam, it should be recognized that: regional and international integration bringing many opportunities but also challenges at the same time, however, each government needs to sharply evaluate the impact on many aspects of the economy, politics and society in order to have proper strategies and strategies, which are suitable to the practices of the country, especially in technology and technology transfer.

The Vietnamese Government proposes policies to proactively select and screen out transferred technologies to meet the country's development plan, so that only technologies with high benefits can be obtained and meet the requirements of the industrialization and modernization process of the country, eliminating technologies that consume a lot of energy, emit greenhouse gases, and cause environmental pollution. To deal with cultural diversity, the Government in the process of choosing the direction of technology transfer needs to take into account the tools to control this difference, which requires regulations on behavioral, cultural and social standards.

Furthermore, the Government strengthens supporting organizations and businesses in research, training, analysis, assessment, appraisal, decoding, technology transfer; adopts a new policy on the cost of hiring overseas Vietnamese technology experts and foreign technology experts in connecting, searching, consulting on technology transfer.

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