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Factors affecting technology transfer in the Mekong Delta

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ABSTRACT

According to experts and managers in science and technology, technology transfer (TT) activities in Vietnam have not achieved the desired results that reflected the limited research results applying in production, number of TT contracts were few, and not many businesses considered investing in research and TT activities. This study is aimed to evaluate the current situation of TT and to determine the factors that affect the TT activities in 13 provinces and cities in the Mekong Delta (MD). The survey involved 80 respondents of organizations related to TT activities such as research institutes, universities, and enterprises. The exploratory factor analysis was used to analyze 12 observed variables related to the TT. The results showed that the TT activities were evaluated at average level due to some disadvantages on TT organization, methods, plans, and diversification of TT activities; professional qualifications of labor forces involved; ask-give mechanism in research and TT; limited awareness of enterprises in TT; and complicated financial payment procedures. The results of factor analysis showed that there were three factors: state governance, commercialization, and satisfaction explored, in which the state governance factor had the strongest effect on the TT activities. To improve the current TT activities in the MD, some solutions were proposed.

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1 INTRODUCTION

Technology means a technical solution, process or know-how which is accompanied or not accompanied by a tool or means for turning resources into products. The content of TT is the transfer of ownership or use of technology from one party with the right to transfer. If the technology is transferred relating to the protection of intellectual property (IP) the transfer will be done according to the IP Law. Stakeholders need to register IP and TT rights (Vietnam National Assembly, 2017). In recent years, Vietnam's economic and social development is very impressive. High economic efficiency has increased per capita income and reduced poverty. This means that many people's lives are better (OECD, 2014). However, in the context that Vietnam is accelerating world economic integration, if it does not want to regress, the development of science and technology (S&T) should be considered as a key issue. Besides, globalization is also impacting strongly on production and product quality of each country that force enterprises to change, improve, and promote TT to survive and develop. Currently, TT activities in Vietnam have

not achieved the desired results that are reflected in the limited rate of research results put into practice, the number and value of TT contracts are still less, and not many businesses notice investment in research and TT activities. Activities of Vietnamese enterprises on innovation, research and development (R&D) are still low when only about 5% of businesses have their own R&D facilities, and only nearly 7% of enterprises are implementing technology research and reception, and many businesses receive technology but do not have an R&D facility. Nearly 80% of Vietnamese enterprises do not have R&D facilities or do not have technology access strategies, so TT activities are slow, narrow, and not diverse (Thu Ha, 2017). In addition, TT from foreign countries to Vietnam is also modest, mainly the TT between the overseas parent company for its subsidiaries in Vietnam through FDI (foreign direct investment) projects (Pham Trung Hai, 2017).

In the Mekong Delta (MD), many research and TT activities have been implemented associated with policies and socio-economic development orientations of provinces and cities in the region. Most S&T projects and research topics in the region focus on agriculture and fishery processing industry. Typically in rice cultivation, many promising varieties used in large scale production with high yield, good quality, pest resistance that have been studied and selected. Technological advances in farming are transferred to farmers effectively in paddy fields and orchards as an integrated pest management program, application of the programme of three reductions, three increases (reducing the amount of seeds, reducing pesticides and fertilizers, but still helping to increase rice yield and quality, and economic efficiency) in rice production; techniques of off-season flowering stimulation, vegetable growing with drip irrigation system to save water in Vinh Long, Tien Giang, Ben Tre, Tra Vinh provinces. The research results on livestock are also applied bringing efficiency such as leaning pigs, beef quality, improvement of goat stocks and waterfowl in the direction of collecting milk, eggs. In the aquaculture sector, researches have been conducted to test models of tiger prawns, giant freshwater prawns and fish, and disseminate technical procedures for farmers. In addition, in the field of industry, the investment in supporting enterprises to innovate equipment and technology is paid attention by the provincial authorities in the region, acquire advanced technology and put into production for contributing to raising high productivity and product quality. Typically the technology applications were processing coconut products (Ben Tre and Tra Vinh provinces), rice polishing (Dong Thap and Tien Giang provinces), sugar (Soc Trang, Can Tho, and Tra Vinh provinces), aquatic products and seafood (Bac Lieu, Ca Mau, and Soc Trang provinces), and pharmaceutical preparation technology (Can Tho, Vinh Long, and Dong Thap provinces) (Kieu Anh, 2010). In the period of 2016-2018, to be a prerequisite for TT, the localities in the MD region have implemented 631 projects and research topics, of which 9 natural science tasks accounted for 1.4%; 158 social and humanities tasks accounted for 25%; 282 agricultural science tasks accounted for 44.7%; 94 scientific and technological tasks accounted for 14.9%, and 88 medical and pharmaceutical tasks accounted for 13.9%. After studying the scientific results were created products with high S&T content that can be applied in production with high efficiency (MOST, 2018).

With a natural area of 3.96 million hectares, agricultural production of the MD region accounts for 50% of rice production, 65% of aquatic production, and 70% of fruit production of all kinds. Along with that, the crop cultivation and fishery industry has many opportunities to develop. However, to take the above advantages, there must be big changes in awareness. Currently, agricultural resources (rice, shrimp, and Pangasius) in the MD are contributing significantly to national exports with over US$1 billion per year. From these advantages, the MD agriculture has received much attention from scientists, experts, and many large enterprises and corporations involved in investment (VCEN, 2018). Investment of technology in production is considered the most effective way to help the MD to promote agricultural restructuring and sustainable development, especially in the context of climate change taking place faster than forecast (Quynh Nga, 2018). The Government has a policy to develop the regional economy, the localities need to coordinate and make use of the technology of industry 4.0 to improve the skills of labor, high S&T application in production especially create a development space for private businesses (Phuoc Tuan, 2019). However, according to experts and managers, the role of S&T in socio-economic development in the MD has not been as expected, S&T has not really been considered a key driver. The smart and advanced technologies that contribute to increasing productivity and product quality, increasing the competitiveness of goods have not been widely applied. The changes from traditional agriculture to modern agriculture have been slow. Many scientific research results have been transferred and put into application, but the commercialization is not high, the ability of research results multiplication of local

units is limited (Hong Dang, 2018). Activities of TT between institutes, universities, and research centers to enterprises that are still passive, local area and small-scale, and lack of links between technology offers and receivers. In addition, the technology innovation after the TT is less attention (Pham Trung Hai, 2017). Therefore, it is necessary to have a survey and find out the main factors that have important influences on TT activities in the MD.

2 MATERIALS AND METHODS

The study was carried out from December 2018 to April 2019 in 13 provinces and cities in the MD applying stratified, non-probability sampling method. The sample size was chosen to investigate, according to criteria greater than 25 or 30 (Hogg and Tanis, 1983). Interviews were conducted by online and direct interviews with prepared survey form that included the questions of TT status and assessment of TT activities. The evaluation questions performed with the Likert scale from 1 to 5 (1: very poor/very few; 2: poor/few; 3: average; 4: good/much; 5: very good/very much). There were three target groups selected in 13 provinces and cities in the MD consisted of (1) state management agencies (e.g. Department of S&T, Department of Agriculture and Rural Development, Center for S&T management) included 26 units with 39 S&T officials interviewed; (2) Research institutes, universities, and research centers included 8 units (e.g. Can Tho University, Can Tho University of Medicine and Pharmacy, Tay Do University, Cuu Long University, Vinh Long University of Technical Education, Kien Giang University, Tien Giang University, Mekong Delta Rice Research Institute), in which 31 subjects were Associate professors, PhDs, Masters, experts interviewed; and (3) enterprises included 10 companies that performed TT to serve production, of which 10 subjects were interviewed. A total of 80 respondents were involved.

The chi-square (χ^2) test was performed to compare the frequency of evaluation levels of observed variables (survey questions). The Spearman correlation was applied to determine the correlation between observed variables. The exploratory factor analysis (EFA) method was applied with the aim of exploring the main potential factors of TT from a set of observed variables. Sapnas and Zeller (2002) reported that a sample size of 50 investigated objects could be used in factor analysis. The ratio between sample size and number of observed variables (N/p) should be in the ratio of 3/1, 6/1, 10/1, 15/1 or 20/1 (Williams *et al.*, 2010). In this study, the ratio of N/p was about 6/1 (80 subjects/12 observed variables), so it was possible to apply factor analysis. The Varimax orthogonal rotation method was chosen to structure independent factors from a set of observed variables. The Kaiser criteria for eigenvalue > 1 was used to select factors extracted from observed variables. For factor loadings, the absolute value below 0.5 was applied. The factor scores were created by the Anderson-Rubin method to check the independence (orthogonality) of the extracted factors. Based on analysis of the situation of TT implementation in Vietnam (Pham Trung Hai, 2017), 12 observed variables of Law on TT, Procedures of TT, Incomes of TT, Costs of TT, Supply-demand of TT, Information about TT, Enterprise human resources, Demand of TT, Efficiency of TT, Supports of the State, Infringement of IP, and Handling of IP Infringement were analyzed. Explaining the results of the factor analysis involves examining the variables that are attributed to a factor and suggesting a name or subject for that factor. Each factor should be formed from at least two variables. The Cronbach's Alpha reliability coefficient was used to check the internal consistency of observed variables.

3 RESULTS AND DISCUSSION

3.1 Evaluation of TT activities

The results of the chi-square test showed that the evaluation frequencies in the twelve observed variables were statistically significantly different (Table 1). The level of evaluation of nine variables as Procedures of TT, Incomes of TT, Costs of TT, Supply-demand of TT, Information about TT, Enterprise human resources, Efficiency of TT, Infringement of IP, and Handling of IP infringement that was at average level and was statistically significantly different compared to other levels of evaluation. Overall, the evaluation results showed that many contents of TT activities were still not highly effective. This was quite consistent with the judgment of Pham Trung Hai (2017) and Hong Dang (2018). However, the positive side had also been shown through the law on TT which was promoted efficiently, the supports of the State on TT was evaluated well, and the demand of TT was increased in the MD.

Evaluation of the Ministry of S&T showed that in Vietnam, the use of outdated and very outdated equipment accounted for more than 50% of the total amount of equipment, and modern equipment was only about 10%. For small and retail enterprises, the level of outdated equipment use was up to 70%. In the context of global integration and trade liberalization, the competitive pressure has been created that forces enterprises to constantly innovate technology. In Vietnam, however, small and

medium sized enterprises do not have the potential to buy expensive and modern machinery and equipment, so they can only import second-hand machinery from developed countries or new inexpensive and inefficient machines. Many experts stated that one of the reasons for the above situation is that the Law on TT has not kept up with the trend of reform and innovation in the development of economy and S&T. The regulations on technology market development have not fully covered such issues as intermediary organizations, technology supply, and technology demand sources. The open policy in TT management has also caused negative impacts on the process of receiving TT. In addition, the review of the TT in the investment projects has not been fully regulated, creating a loose in management, inspection, supervision of technology in the process of investment and project implementation (Nhat Minh, 2018). In recent years, the State has issued a number of preferential regulations on technological innovation and technology improvement, investment in industrial development and new products. The interest rate support, new products are supported 30-50% of TT costs and 100% of technology ownership registration costs (in Tra Vinh province) that has accelerated the TT in the localities (Kieu Anh, 2010). The amended Law on TT 2017 has many new regulations to create a favorable legal environment, promote innovation, apply and transfer technology, serve sustainable development of the country in a new context. According to this law, the State issued policies to support innovative startup enterprises in the following areas: determining ownership and use rights of assets arising from scientific research results and technology development; fund for development of S&T, National Technology Innovation Fund and credit institutions are entitled to receive this property to ensure investment loans, projects to start creation and innovation, and production development. Organizations and individuals who invest and support startup innovation are entitled to tax incentives (Hanh Nguyen, 2017).

Table 1: Evaluation of TT activities (use of frequencies)

No.	Contents (*)	Very poor/ Very few	Poor/ Few	Average	Good/ Much	Very good/ Very much	χ^2	Sig.
1	Law on TT	-	10	26	38	6	32.8	p<0.001
2	Procedures of TT	-	5	42	30	3	54.9	p<0.001
3	Incomes of TT	-	10	41	26	3	43.3	p<0.001
4	Costs of TT	2	22	43	10	3	72.9	p<0.001
5	Supply-demand of TT	3	21	47	8	2	90.1	p<0.001
6	Information about TT	5	26	37	10	2	55.9	p<0.001
7	Enterprise human resources	3	10	51	14	2	101.9	p<0.001
8	Demand of TT	5	10	29	32	4	45.4	p<0.001
9	Efficiency of TT	-	11	54	13	2	80.5	p<0.001
10	Supports of the State	1	6	33	37	3	76.5	p<0.001
11	Infringement of IPR	4	30	34	9	3	55.1	p<0.001
12	Handling of IP infringement	2	12	42	22	2	70.0	p<0.001

(Source: Survey data in 2019)

(*): Law on TT: effectiveness of TT Law; Procedures of TT: open and clear TT procedures of the research institutes, universities, and research centers; Incomes of TT: incomesfor author(s) in TT (e.g. at Can Tho University the collective or individual that creates a technology is entitled to 75% of the proceeds from the contract on the TT); Costs of TT: TT costs comparing with the financial capacity of the enterprise; Supply-demand of TT: connection of supply and demand of TT with enterprises; Information about TT: information about TT of research institutes, universities, and research centers; Enterprise human resources: capability of human resources to receive TT of enterprises; Demand of TT: demand for TT of enterprises; Efficiency of TT: TT efficiency of research institutes, universities, and research centers; Supports of the State: Supports for TT of the State (e.g. fundings, infrastructures, human resources); Infringement of IP: status of IP infringement; Handling of IP infringement: handling effects of IP infringement of the State.

According to experts, the TT activities have made a great contribution to the agricultural achievements of the MD with over 30% of the added value of agricultural production (VCEN, 2018). Therefore, in order to have a better development it should be to strengthen the TT activities according to the needs of enterprises. Therefore, in order to have a better development step attention should be paid to strengthening TT activities according to the needs of enterprises. The event TechDemo (2018) in Can Tho City showed that it received and treated 100 TT needs of enterprises and organizations in the Southern region; provided 2,500 sources of information of domestic and foreign technology on

technological data system and technology manual; more than 500 products/processes of technologies/equipment of 128 domestic and international units were exhibited and performed at the event (with nearly 100 technologies from Korea, France, Israel, and Japan). This event showed that the demand for TT of enterprises was increased (Bao Lam, 2018). The TT process can be called "push technology" or "pull demand". While new technology development methods are dominating the field of research attention should be paid to TT on demand. Companies that are capable of meeting technology needs pay close attention on demand of TT, which means companies must know and clearly explain the technology they need. In addition, the ability of company to use technology and also the open TT procedures are also important factors. Companies that are capable of using high technology are likely to succeed in TT on demand, which is contrary to previous simple thinking that companies want TT because they lack technology. The capability of the technology receiver can affect the quality of TT leading to successful TT or not (Jun and Ji, 2016).

According to Pham Trung Hai (2017), although there have been very encouraging results the TT activities have not yet to meet the requirements of socio-economic development in each locality as well as the whole region. The S&T potentials in most localities were still limited, the technical facilities and technological services were inferior, and the TT management departments were often integrated in scientific research units so did not have independent TT activities. Some financial mechanisms and regulations for scientific research were difficult that were being major barriers to S&T and TT activities throughout the region. In addition, research topics were often small scale, low scientific content, less novelty, practicality was not high that caused difficulties for TT to production and life (Kieu Anh, 2010). The above limitations reflected the average evaluation of many TT activities (Table 1), especially efficiency of TT (poor to average).

Table 2: Evaluation of disadvantages of TT activities

No.	Contents	Ratio %(*)				
		1	**2**	**3**	**4**	**5**
1	No systematic in TT management	7.7	48.7	25.6	10.3	7.7
2	Restrictions on the method of organizing TT management	12.8	35.9	35.9	15.4	0.0
3	Lack of initiative in developing TT activity plans	38.5	41.0	12.8	7.7	0.0
4	Lack of human resource for TT management	7.7	17.9	56.4	15.4	2.6
5	Restrictions on qualifications and capacity of TT managers	7.7	46.2	33.3	10.3	2.6
6	Complicated financial payment procedures	10.3	43.6	25.6	17.9	2.6
7	Poor diversification of TT activities	7.7	35.9	46.2	2.6	7.7
8	Ask-Give mechanism in research and TT activities	12.8	46.2	30.8	5.1	5.1
9	Restrictions of awareness of enterprises on TT activities	0.0	23.1	53.8	20.5	2.6

(*): 1: Do not agree; 2: Partially agree; 3: Agree; 4: Fairly agree; 5: Strongly agree

(Source: Survey data in 2019)

Table 2 showed that there were nine contents related to TT surveyed. The results agreed these were the contents that restricted TT activities in the MD. In general, the above contents focused on two major issues: the organization and management of TT, and the perception of TT of enterprises. This showed that the State management was crucial to TT activities and relationships with enterprises to help them to be well aware of the necessity of TT for improving production that was very important. According to Hanh Nguyen (2017), TT management activities in Vietnam so far had not regularly ensured the transfer of good technologies, modern and suitable technologies as well as limited outdated technologies that could affect the environment. Therefore, between State management and enterprises it is necessary to innovate thinking about TT to absorb foreign advanced technologies, but it must avoid technologies at risk to the environment and security, and national defense. Last year the connection point of technology supply and demand in the MD (TechDemo 2018) had officially opened at Can Tho City and put into operation. The operation of the TechDemo 2018 expected to support effectively enterprises in the MD to implement technological innovations, connecting scientists and enterprises to quickly bring about scientific and technological results and products into production and business (Bao Lam, 2018).

3.2 Correlation between observed variables

Hinton *et al*. (2004) said that the value of Cronbach's Alpha coefficient of 0.7-0.9 is highly reliable and good for factor analysis. The calculated results showed that Cronbach's Alpha coefficient of reliability was 0.843 which is suitable for factor analysis.

The first step in factor analysis is to examine existing relationships between observed variables by calculating the Spearman correlation coefficients R_s. Their values constitute the correlation matrix (Table 3). If the observed variables are independent variables (orthogonal variables) that mean a lack of common variance. Therefore, the correlation matrix will be a uniform matrix from which the factors cannot be extracted. The correlation coefficients were statistically significant (5%, 1%) that could determine a structural relationship between observed variables. In other words, a set of observed variables containing the common variance or community of variables could be identified. Hair *et al.* (2014) classified the correlation coefficients in the correlation matrix by using the rule of R, where $R = \pm 0.30$ is the minimum, $R = \pm 0.40$ is important and $R = \pm 0.50$ is practical meaning. The results of correlation analysis (Table 3) showed that there were 11 out of 12 statistically significant correlation variables (excepted for Handling of IP infringement) at 1% and 5%, and most of them have coefficient values >0.3. In order to increase the TT efficiency, it was necessary to increase the demand of TT of enterprises, to implement open TT procedures of the research institutes, universities, and quality of enterprise human resources to receive TT. The increase in efficiency of Law on TT was correlated with the implementation of transparent and clear TT procedures, handling IP infringement situation, and the satisfaction of TT incomes. The demand for TT of enterprises increased when strengthening information and efficiency of TT.

Table 3: Correlation matrix of observed variables

No.	Contents	Law on TT	Support of the State	Demand of TT	Procedures of TT	Information about TT	Efficiency of TT
1	Procedures of TT	0.500**	0.349**	-	-	-	-
2	Costs of TT	-	0.484**	-	-	-	-
3	Enterprise human resources	-	-	-	-	-	0.421**
4	Supply-demand of TT	-	-	-	-	0.675**	-
5	Information about TT	-	-	0.423**	-	-	-
6	Efficiency of TT	-	-	0.440**	0.356**	-	-
7	Infringement of IP	0.225*	-	-	-	-	-
8	Incomes of TT	0.409**	-	-	0.793**	-	-

**: Correlation is significant at the 0.05 level (2-tailed); **: Correlation is significant at the 0.01 level (2-tailed)*

(Source: Survey data in 2019)

The degree to which the correlation matrix is different from the homogeneous matrix is confirmed by Bartlett test, and the common variance measure is confirmed with the Kaiser-Mayer-Olkin test. The results showed that (Table 4), Bartlett (1937) test based on the chi-square, was statistical significance ($p<0.001$), and Kaiser-Meyer-Olkin test value (KMO) was 0.774 (required >0.5). The results of these two tests showed an approval to extract the factors.

Table 4: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.774
Bartlett's Test of Sphericity	Approx. chi-square	389.719
	df	66
	Sig.	0.000

3.3 Factors

The interpretation of the individual effects of observed variables may limit the general vision of the major effects on TT activities. Therefore, factor analysis was performed. Statistical results showed that the total variance accumulation rate was 60.458% with three factors extracted that had eigenvalues >1 meaning the three factors explained 60.458% of the total variance (Table 5). According to Hair *et al.* (2014), the variance explained is usually as low as 50-60%, so this result could confirm the reliability of the three extracted factors.

Table 5: Total variance explained

Comp.	Initial Eigenvalues			Extraction sum of squared loadings (*)			Rotation sum of squared loadings		
	Total	% of variance	Cumula-tive %	Total	% of variance	Cumula-tive %	Total	% of variance	Cumula-tive %
1	4.770	39.753	39.753	4.770	39.753	39.753	2.885	24.039	24.039
2	1.336	11.137	50.890	1.336	11.137	50.890	2.654	22.119	46.158
3	1.148	9.568	60.458	1.148	9.568	60.458	1.716	14.300	60.458
4	0.942	7.847	68.305						
5	0.861	7.177	75.482						
6	0.750	6.253	81.735						
7	0.582	4.850	86.586						
8	0.536	4.469	91.054						
9	0.397	3.311	94.366						
10	0.316	2.635	97.001						
11	0.230	1.915	98.916						
12	0.130	1.084	100.000						

(*): Extraction method: Principal Component Analysis

Table 6: Rotated component matrix

No.	Initial observed variables	Component		
		1	2	3
1	Law on TT	0.596		
2	Procedures of TT	0.880		
3	Incomes of TT	0.851		
4	Supply-demand of TT		0.732	
5	Information about TT		0.728	
6	Costs of TT		0.814	
7	Enterprise human resources		0.664	
8	Demand of TT			0.506
9	Efficiency of TT			0.514
10	Handling of IP infringement			0.783

The factor loadings were all >0.5 indicating that the observed variables were statistically significant (Hair *et al*., 2104), and there were a total of 10 observed variables that formed three factors (Table 6). The two observed variables Support of State and Infringement of IP was removed after factor rotation because they were not the same type of response to other observed variables to combine into factors (eigenvalue <1, factor loading <0.5).

The first factor was the most important factor (eigenvalue was 4.77 explained 39.75% variance) formed from the observed variables that were Law on TT, Procedures of TT, and Incomes of TT. This factor could be named ***State governance***. State governance is the management of all resources (legal, regulatory, infrastructures, human resources, etc.) to serve socio-economic development (Huther and Shah, 1998). Within the scope of this research, it referred to the role of the State in TT activities. State governance plays an important role in providing long-term orientation for TT ensuring that resources for the TT are adequate. However, the current management of TT activities still has many shortcomings possibly related to the encouragement and rewarding of human resources to participate in TT of research institutes, universities, and research centers, lack of engagement effectiveness, combination, coordination, and implementation of TT, etc. Leaders with a vision and political commitment to TT can contribute to improving the relationship between related parties in TT activities. The coordination between research units and management agencies and the participation of enterprises in the development of TT policies and strategies that need improving. The State has supplemented and revised many legal foundations for TT activities through the Law on TT 2017 (Vietnam National Assembly, 2017) and established many organizations to participate in directing and supporting S&T development. Advances in developing a modern institutional framework for TT need to be continued and have a realistic, timely, and transparent assessment process. The assessment results will help to improve policy making and introduce tangible economic and social benefits of TT to contribute to the sustainable development of

the MD. According to Thu Hang (2019), the Government has advocated that the process of preparing and developing a national development strategy for the next 10 years that requires to have a breakthrough policy mechanism for S&T. It can not be S&T that is considered a top national policy, but budget investment is decreasing, the investment rate of GDP decreased gradually from 1.8 to 1.4%, only 1/3, 1/4 of other countries. Without a breakthrough in S&T, it will surely be difficult for Vietnam to catch up with Asian countries in economic development. Regarding to the incomes of TT, the Law on TT 2006 regulated the collective or individual that creates a technology is entitled to between 25% to 35% of the proceeds from the contract on the TT (Vietnam National Assembly, 2006). However, the Law on TT 2017 did not assign the sharing incomes from the TT created with the State budget funds, so the research units should pay attention to that in order to encourage scientists to participate in the TT.

In order to enhance the effectiveness of State governance in TT activities some solutions may be noted, such as training on knowledge and TT in the education system, building and strengthening a culture of entrepreneurship, thereby, it is possible to mobilize the public to pay more attention to the TT. Research institutes, universities, and research centers need to organize a TT office to manage TT activities and promote the commercialization of research products. The TT motivation for researchers through reward regulations should be created to encourage researchers with new ideas of study, and having a desire to get TT achievements. Short and long term strategies and plans for TT activities should be made and created systematic technology management levels. Supporting finance for S&T and TT activities and simplifying financial procedures should be considered.

The second factor was explored from the observed variables such as Supply-demand of TT, Information about TT, Costs of TT, and Enterprise human resources. This factor could be named ***Commercialization***. Nazary (2010) defined that the process of commercialization is to transfer knowledge and technology from research institutions to existing industries or businesses. Commercializing new technology products, processes or services based on meeting current market needs and/or creating new demands in the market and meeting market demand that can be efforts to transfer research results into new products and services and successful marketing. To be able to commercialize research products, the universities need to have an entrepreneurship orientation through the formation of its startup type to sell technology products to businesses or consumers. Decision 844/QĐ-TTg dated on 18/5/2016 of the Government approving the "Project to support the national creative entrepreneurship ecosystem to 2025" has introduced the concept of startup business as a new business type that can be able to grow fast and apply technology (Nguyen Minh Hong, 2019). This is an advantage for TT activities. Market research and market analysis need to be conducted to determine the demand and supply of TT that can help to penetrate the market and establish business relationships through information networks, and also to know the potential and ability of human resources to use new technologies of the enterprises. Startups can benefit from interaction with businesses and university lecturers, and students in university technology incubators. In addition, licensed startups with commercialization of research results may make other business investments to develop products or services (Bercovitz and Feldman, 2006). Currently, one of the most difficult tasks is technology pricing. The transferor and transferee should consult with experts in this field as well as information on the market to have got the most suitable price in TT. In addition, solutions to streamline production and technological innovation of enterprises in the production process can help to reduce TT costs and increase productivity and product quality.

Some solutions may be proposed to develop commercialization of scientific research products such as to organize a good network of relations between the research institutes, universities and research centers with enterprises and investors to facilitate the commercialization of research results; advise and support knowledge of TT for businesses to have the ability to recognize the opportunities of the market and the motivation to invest in new technologies; enhance knowledge of technology pricing methods to facilitate harmonization of benefits between the transferor and the transferee; and with the advantages of agriculture in the MD businesses should be encouraged to invest in commercialization of technology in agriculture.

The third factor was formed from observed variables such as Demand of TT, Efficiency of TT, and Handling of IP infringement. It was possible to name this factor as ***Satisfaction*** that means the demand for TT is implemented effectively and legally protected. The demand for TT of enterprises and TT efficiency has shown through the development of TT services in recent years. Nguyen Dinh Phuc *et al.*, (2017) reported on the survey results of Ministry of S&T in the period of 2006-

2016, in which 200 investigated enterprises who had TT activities 87.5% said that there was a need for at least one (or many) TT services (consultancy, brokerage, promotion; evaluation, pricing, and appraisal). Survey results with the owners, technology authors also showed that up to 89.0% of respondents needed support from TT service providers. Thus, it can be seen that the demand for TT was huge. However, the State management of TT also faced many difficulties such as managing technology inspection, technology pricing; lack of support activities on technology assessment and warning; the linkage between TT service providers and with management agencies was not closed; lack of human resources to manage and develop TT services; lack of appropriate sanctions for infringement of TT services; not ensuring IP of technology owners. Besides, the management of TT services still faced many legal barriers; lack of effective channels for resolving disputes related to TT; lack of legal guarantee for entities participating in TT; Law on IP relating to the TT is being applied, but it has not really come to life.

In order to ensure the satisfaction between the technology offers and receivers in TT activities, some solutions may be suggested, such as strengthening technological innovation research for enterprises to increase efficiency of TT, and application of effective Law on TT in dealing with infringement of IP issues.

4 CONCLUSIONS AND POLICY IMPLEMENTATIONS

The research results showed that the status quo of TT activities in the MD was evaluated mainly at medium level due to many existing limitations. These were mainly organization and management of TT and awareness of enterprises in TT. There were three potential factors that impacted TT activities in the MD such as State governance, Commercialization, and Satisfaction, in which the State governance was the most influential factor. To help the TT activities become more effective some policy implementation should be concerned, such as there is a policy to prioritize TT in the field of technology 4.0 consistent with the current production and climate change conditions. The commercialization of technological products from scientific research results should be encouraged and promoted. Funding to develop scientific research results with potential for TT need to prioritize. The specific methods and regulations on technology pricing to increase the effectiveness of the commercialization of scientific and technological products should be developed. It needs to have an effective sanction to prevent infringement of IPR in TT. Finally the administrative procedures should be simplified to avoid costs for businesses in TT activities.

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