ENHANCEMENT OF TECHNOLOGICAL INNOVATION CAPACITIES IN ENVIRONMENT FRIENDLY APPROACH

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Abstract:

Technological innovation capacity is one of important factors impacting technological innovation activities of enterprises in general and of technological innovation activities in environment friendly approach in particular. This topic gets attention from many researchers and managers in a target to enhance technological innovation capacities of enterprises and by this way to push enterprises to innovate technologies and to mitigate environment negative impacts from technologies. However, the awareness from enterprises and State policies in this field is not high. This paper is to give answers to the following questions: (i) How to interpret the technological innovation and technological innovations in environment friendly approach?, (ii) How is the actual situation of technological innovation capacities of enterprises in environment friendly approach?, (iii) What should the State authorities do, and in what priority order, to enhance technological innovation capacities of enterprises in environment friendly approach?

Keywords: *Technological innovation; Environment friendly; Climate change.*

1. Technological innovation and technological innovation capacities in environment friendly approach

Environment friendly technologies remain a controversial concept with various points of view. M.Henzler (2000) believed that environment friendly technologies, including required services and supports, as the ones having necessary functions to mitigate environment impacts while maintaining business-production activities. They are not individual and single technologies but are the whole system of know-hows, commodities, services, equipments and management procedures. In pollution context, however, environment friendly technologies can be interpreted as technologies of procedures and products producing, even not, a little of wastes to prevent pollution. They are also to include “terminal” technologies to process pollutions they caused [4, p.23]. Environment friendly technologies are a kind of changing and evolutive concept of relative nature. They are changing with time, use purpose and in conformity to actual conditions of regions/nations. Therefore, environment friendly technologies are interpreted as the ones to meet requirements of

environment standards, saving use of resources in sustainable approach and produce a little or even do not produce wastes to protect environment[1], and at the same time to remain in conformity to national strategies of socio-economic and technological development.

Technological innovation in environment friendly approach is interpreted as activities to change radically or globally technologies in use by more advanced technologies which cause less pollution, use resources in a more sustainable way, recycle more waste and used commodities in a more reasonable way. Technological innovations in environment friendly approach include innovation measures to: (i) Save resources or replace less polluting input materials (which may include recycling procedures in production process), (ii) Recycle wastes to make economically valued products, (iii) Treat on-site polluting agents before discharging, and (iv) Replace wholly production chains in use to meet environment protection standards. Therefore, technological innovation capacities in environment friendly approach are interpreted as the ones to change the process of technological research and development in effective manner to mitigate negative environment impacts in application of technologies and saving use of resources. Technological innovation capacities include capacities of adapting, copying, upgrading, researching and creating technologies in more environment friendly approach.

2. Actual situation of technological innovations and technological innovation capacities of enterprises in environment friendly approach

Actually, there is no official data on the situation of technological innovations by enterprises in environment friendly approach. However, as recent studies show, the technological level of enterprises is not high, the speed of technological innovations remains low and the investment rate for technological innovations are still limited, namely:

- *Technological level*: As reported by World Economic Forum, Vietnam is ranked 92/117 (2006) and 98/142 (2011) among listed nations in terms of technological level. Next, as assessed by technological standards (UNIDO, 2006) the technological level of Vietnam is low, namely only 20.6% of enterprises use advanced technologies, 20.7% of enterprises use medium technologies and 58.7% of enterprises use low technologies. Survey figures of 119 Hanoi based enterprises conducted by the paper author (2012) showed that only 23.5% of enterprises use advanced technologies, 47.9% of enterprises use medium technologies and 28.6% of enterprises use low technologies;
- *Technological innovation rate*: many last studies [3,5,12,13] had shown

[1] Environment protection includes direct activities to prevent, reduce or remove polluting agents or bad environment impacts caused by production process and product/service use (WB, 2003).

that the speed of technological innovations of Vietnamese enterprises is low. They are single and small sized only to settle problems raised in business-production process of enterprises. The innovation is mainly based on imported technologies while self-raised new technologies or utilities are almost minor. Particularly, enterprises are limited in technological mastering, information searching, capital mobilizing, output market searching and technological service implementing. From another side, studies of competitive and technological capacities at level of enterprises for 63 Vietnam provinces/cities [7] showed that only 11.9% of enterprises conduct R&D activities, 16.4% of enterprises innovate existing machines/equipment without doing R&D activities, the remaining 71.7% of enterprises do not carry out any activities related to technological innovations including the ones in environment friendly approach;

- *Investment rate for technological innovations*: As reported by German Technical Cooperation *(GTZ, 2009*) among 1,200 Vietnam enterprises, there are only 0.1% of annual turnover is allocated for technological innovations (while the same figure is 5% for India and 10% for South Korea) [12,13]. Also, there is no adequate attention by enterprises reserved for environment protection investment [8]. There is an increasing trend of environment pollution from production activities of enterprises, particularly by SMEs, namely: the check of 5 Hochiminh City industrial zones shows that 44/45 water samples exceed permitted limits, even in some cases it gets 100 times higher than permitted ones. They do not also do regular environment monitoring. In Hai Phong, 100% of inspected enterprises violated environmental regulations. Many of them violated regulations for emitted gases and dangerous wastes [10];
- In the surveys of 119 Hanoi based enterprises conducted by the paper author, the answers to the question: “Do you think to do technological innovations to meet environment standards?” turn out to be: 7.6% highly agree, 52.1% agree, 31.1% hesitate, 8.4% disagree and 0.8% highly disagree (average is 3.57 and deviation 0.787). This shows the awareness of necessity by enterprises for technological innovations in environment friendly approach. However, during innovation process, enterprises face certain difficulties such as technological human resources and capital mobilization. They are the two biggest problems hindering activities of technological innovations in environment friendly approach by enterprises [7].

Technological innovation capacities of enterprises are seen through their capacities of adapting, copying, upgrading and conducting R&D activities to produce new products, new processes which are assessed as low developed. Namely:

- Majority of Vietnam enterprises comes to the stage of passive absorption of technologies through imported machines/equipments. Technological innovation capacities are scored at super average level (2.6 point))[2], the operational capacities are scored at 3.6 point, absorption capacities are scored at 3.4 point and absorption supporting capacities are scored at 2.9 point [3, p.70];
- During the surveys of 119 Hanoi based enterprises conducted by the paper author (2012, Fig. 1), the answers to the question: "Do you think that enterprises have good technological innovation capacities?" turned out to be: 8.4% very agree, 26.1% agree, 36.1% of normal capacities, 28.6% disagree and 0.8% very disagree (average score is 3.13 and deviation is 0.953) This show the inner average level of technological innovation capacities in general and technological innovation capacities in environment friendly approach by enterprises. Enterprises still remain at the level of import of technologies without copying, improving and upgrading import technologies at considerably rate.

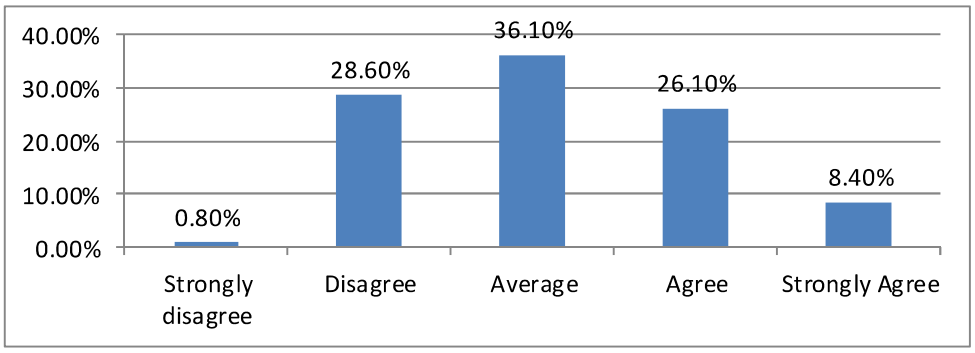

Figure 1: Assessment of technological innovation capacities by enterprises

Therefore, the technological level and the technological innovation capacities by Vietnam enterprises remain at inner average level of the region and the world. However, activities to enhance the technological level and technological capacities do not get adequate attention which are clearly seen through the low innovation rate and limited investment for technological innovations and environment protection. The causes are identified from the two sides: State and enterprises.

2.1. From State management side

- The legal system for environment protection and for encouragement of enterprises to innovate technologies is not strong and integrated enough, in

[2] In the score system, 1 point is for bad level, 2 points for average level, 3 points for inner good level, 4 points for good level and 5 points for very good level.

general to push enterprises to do investment for technological innovations in less pollution approach and use of clean technologies. State management agencies do not have the full capacities to monitor and to control the legal implementation of environment protection by enterprises which lead to the low effectiveness of implementation of the legal system [10]. Even recently the State management agencies have issued many policies to push enterprises to do technological innovations in general and technological innovations in environment friendly approach in particular to enhance the technological innovation capacities of enterprises which are seen through the promulgation of the Science-Technology Law (2000), Environment Protection Law (2005), Technological Transfer Law (2006), High Techs Law (2008) and multiple Resolutions, Decision and Circulars...

- Measures of incentive taxation, credits and direct supports from State agencies for technological innovation investment and enhancement of technological innovation capacities could not stimulate enterprises to invest for technological innovations in general and for technological innovations in environment friendly approach in particular. Regulations related to these advantages about taxation, credit and direct support are assessed by enterprises as complicated and low benefits. They could not bring in positive effects as enterprises desire to get and they remain in many instances far behind technological innovation activities by enterprises [13]. Next, many legal documents are issued for incentive measures to encourage R&D organizations and S&T based businesses to conduct scientific researches as well as application of technological advances in production process, competitiveness enhancement and environment protection. But organizations and enterprises almost could not evaluate the effectiveness of these incentive measures for real activities. Even competent organizations in charge of preparation and issue of taxation policies as well as State management agencies in S&T sector could not evaluate results and effects of these incentive measures for development of science-technologies and technological innovations in enterprises. There is no reports to make public statistic data of the annual incentive money volume as well as positive results they could make for technological innovations by enterprises. Indeed, measures and policies remain at the stage of being issued without any assessment of their impacts to the society and enterprises [9] and for technological innovations in environment friendly approach in particular.
- Activities in field of training, information and propaganda in order to enhance awareness by enterprises for enhancement of technological innovation capacities in environment friendly approach recently were focused on the final stage.
- Activities of training, information and propaganda to enhance awareness by

enterprises for enhancement of technological innovation capacities in environment friendly approach recently were focused on the final stage of production processes without providing actively guidelines and supports for enterprises to do investment for technological projects to prevent pollution [10]. Particularly there are no policies for information and consultation supports for enterprises to use advanced technologies and environment friendly technologies. At the same time there is no effective methods of training and propaganda in raising awareness of benefits from technological innovations which could help enterprises to conduct efficient business-production activities as well as to prevent negative environment impacts.

2.2. From enterprise side

- Enterprises, in general, are not pro-active in activities to enhance technological innovation capacities and technological innovations in environment friendly approach. This can be interpreted as being caused by big value of initial investment for technological innovations, environment protection while 95% of Vietnam enterprises are SMEs [6]. Therefore, enterprises face difficulties in capital and capital mobilization for technological innovations [11]. Also, human resources for technological innovations in environment friendly approach remain limited which lead to low effects from searching, assessing and absorbing technologies and mobilizing capitals for technological innovations by enterprises.
- Awareness by enterprises for technological innovations in environment friendly approach is not high, then the access to incentive policies for technological innovations and environment protection by enterprises is not pushed actively. This can be interpreted by the absence of long-term investment plans by enterprises for technological innovations and technological innovation capacities in environment friendly approach then they do not have motivations to study incentive policies and access procedures for existing policies.

3. Solutions for enhancement of technological innovation capacities of enterprises in environment friendly approach

In order to enhance technological innovation capacities in environment friendly approach, the State should improve policies to push enterprises to do technological innovations in environment friendly approach, namely:

First, State agencies in field of technological innovations and environment protection need to re-check legal documents related to activities of research, development, adaptation, improvement of technologies in environment friendly approach. Then the road map will be set up for technological innovations by

enterprises and their technological innovation capacities. In this spirit, the State agencies should force enterprises to do technological innovations if the ones in use could not meet requirements of environment protection, product quality and common benefits of the whole society. For doing it, the State agencies should make comparison of Vietnam standards and international ones and then adjust gaps, complete missed items. They are also to be active in checks of output products for conformity to requirements of Environment Protection Law (2005). From other side, State management agencies, every year, should conduct assessments of environment impacts from technologies used by enterprises then, in combination with the existing technological level of enterprises, encourage them to do technological innovations or force them to do technological innovations for their own existence. Also, the State should issue Environment Taxation Law which would be the legal background to force enterprises to use environment friendly technologies, otherwise they are obliged to pay high taxes or halt business-production activities.

Second, an incentive taxation system should be issued integratedly for enhancement of capacities of R&D and technological innovations in environment friendly approach. This system should have a reasonable structure and contribute to realization of social equality in conformity to market mechanism. Environment Taxation Law will impose these taxes to those enterprises which still use outdated and environment polluting technologies. They are to limit the application of environment unfriendly technologies in Vietnam. Also the State should establish the regular two-direction information channel between taxation authorities and enterprises through it enterprises would give feedbacks of their difficulties and problems as well as give their proposals during their access to incentive benefits or their taxation claims. From other side, taxation authorities will give supports and recommendations for enterprises. They are also to improve and adjust regulations to fit wishes of enterprises for their efforts of technological innovations in environment friendly approach.

Third, for purpose to support enterprises to do technological innovations and enhance technological innovation capacities the State should encourage the establishment of independent organizations for project appraisal including the ones for technological innovations in environment friendly approach. These organizations will supply banks with necessary information of projects for technological innovations as well as provide enterprises with consultations to settle contradictory visions between enterprises (as capital users) and credit organizations/commercial banks (as capital suppliers), namely: (i) commercial banks and credit organizations do not want to make loans to SMEs and newly set-up enterprises because of the conflict of the low credibility of the later versus high risks of investment for technological innovations (human resources of enterprises cannot meet requirements of technological innovations and/or

unclear definition by enterprises of their output products, markets and competitors; (ii) decisions of loans, as rules, depend on many factors including the size of projects of technological innovations, efficiency of activities of enterprises in past and present, values of assets for mortgage (in many cases SMEs have low valued assets for mortgage). On this basis banks and credit organizations will fix the rate of loans which could not meet needs of technological innovations by enterprises in terms of loan volume, loan terms and loan interest rates. Also, based on information provided by independent appraisal organizations, banks and credit organizations will decide the loan volume, loan terms and loan interest rates, payback plans and other conditions. As always the decision of loans is not purely based the financial reports presented by enterprises. The decision of loans also meet existing regulations of credits to facilitate conditions for enterprises adapting, mastering and absorbing technologies as well as doing investments for technological innovations in environment friendly approach in particular.

Fourth, in order to promote the enhancement of technological innovation capacities in environment friendly approach, the State should issue early guidelines and set up the operational framework for the National Fund for Technological Innovation. This fund operates as a financial organization and does not cause any difficulties to enterprises desiring to access preferential credit sources for activities of technological innovations by enterprises, particularly the technological innovations in environment friendly approach. Then it is necessary to re-check operations of Science-Technology Development Fund and the National Fund for Technological Innovations so that these two funds do not overlap each other in terms of functions, tasks and preferential credit terms. Also, administrative procedures for consideration-approval for selection of beneficiaries should be amended and revised to be more simple, compact, extended and promotional for non-SOEs also. The form of mortgage, credit and guarantee for enterprises in their activities of technological innovations in environment friendly approach.

Fifth, the State should develop technological markets, promote supply-demand links for environment friendly technologies. At the same time, the State should build up Internet-based database of public information which reflect annual activities of enterprises where the focus is for those enterprises who have conducted activities for technological innovations in environment friendly approach and the actual technological situation of existing enterprises. Then the State confers awards for those enterprises who conducted successful technological innovations as well as measures of treatment of those enterprises who still use outdated technologies causing environment impacts.

In addition, the State should focus on the enhancement of awareness for enterprises, particularly their key leaders about contributions of enterprises for

communities and themselves though activities of technological innovations in environment friendly approach. It can be made through short term training courses with participation of experts in fields of technologies and environment, technological policy makers and State management agencies in field of technologies. By this way enterprises would raise their awareness for technological innovations and change their mind for investment for technological innovations and then enhance their technological innovation capacities in environment friendly approach./.

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