

PROMOTING TECHNOLOGY TRANSFER AND INNOVATION FOR DEVELOPMENT OF INDUSTRIAL CLUSTERS: THEORETICAL FRAMEWORK AND POLICY IMPLICATIONS FOR VIETNAM

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Abstract:

Industrial clusters have been formed and developed in many countries around the world and so far there have been many studies made by international organizations evaluating and summing up successful experiences. Vietnam has had a number of industrial clusters operating in the early stage and their scale of operation is yet limited. Recognizing the important role of industrial cluster in the economic and science and technology (S&T) development, the Government has recently taken active actions in the promulgation of a number of supportive policies. International experience also shows that, in addition to creating a favourable infrastructure and business environment in order to attract investment, the development of supportive policies for technology transfer and innovation is important to improve efficiency of industrial clusters.

This article focuses on developing an analytical framework for assessment of the role of technology transfer and innovation as well as major factors promoting technological transfer and innovation for successful development of industrial clusters. Finally, a number of policy implications are proposed for Vietnam.

Keywords: *Technology transfer; Innovation; Industrial clusters.*

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1. Introduce

Vietnam has now a number of industrial clusters which operate in the early stage and the scale of their operation remains limited (*Nguyen Dinh Tai, Nguyen Binh Giang, Pham Thi Thanh Hong, 2015; Nguyen Ngoc Son, 2015; Truong Thi Chi Binh, 2008*). Provided with more advantages than traditional models do, industrial clusters play important roles for enhancing innovation based competitiveness of businesses and make contributions to S&T and socio-economic development of localities, regions and the country in whole.

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Different from industrial zones which are geographically centralized locations of businesses with production-trade activities as main operation, industrial clusters make focus on formation and development of interlinks between involved actors and promotion of technological transfer and innovation activities.

International experiences on industrial clusters summed up factors causing important impacts to development of industrial clusters (*European Union, 2010; England's Regional Development Agency, 2004*). Many lessons of success and failure from development of industrial clusters show well that a zone gathering multiple businesses cannot be seen as industrial cluster without getting a dynamic institutional framework to support technological transfer and innovation activities.

This paper makes focus on analysis of some concepts and features of industrial clusters, the roles of technological transfer and innovation activities by businesses and related actors for promotion of development of industrial clusters and also provides some suggestions for supportive policies by the Government.

2. Concepts and specific features of industrial clusters

2.1. Concepts of industrial clusters

Industrial clusters are not a novel phenomenon or model. Many studies give different definitions depending on various objectives and scopes of their studies. Industrial clusters are an economic concept having appeared long years ago which was used first by A. Marshall in his work "Economic principles" (*Marshall, 1890*) as "geographically centralized industries to achieve advantages through this concentration". Industrial accumulation is one of the most driving forces to form industrial clusters. A. Marshall indicates factors to make accumulations including labour market, sharing of inputs, sharing and propagation of knowledge and technologies. Also, many researchers recently add and emphasize certain other factors which cause important impacts to industrial accumulations such as natural resources, transport costs, consuming styles, R&D and innovation level, development of supporting industries (*Nguyen Binh Giang, Pham Thi Thanh Hong, 2015; UNIDO, 2013; Truong Thi Chi Binh, 2008*).

The concept of "industrial clusters" generates from the term of "clustering" which gets studied by numerous international researchers. According to M.E. Porter, the network of industrial clusters gets formed from cooperative links between businesses of the same sector or related sectors with related service supplying organizations and institutions (such as research institutes, universities, standard organizations and vocational associations) where they simultaneously compete and cooperate (*M.E. Porter, 1990, 1998*).

Since 1993, UNIDO started a program to support development of industrial clusters in many countries. According to UNIDO, industrial clusters gather numerous businesses in a geographical area where they do production and consumption of related products and have common opportunities and challenges. Thanks to high level of concentration of producing businesses, they attract specialized suppliers (materials, intermediate products) and intermediate service providers (technological services, training, market and etc.) (*UNIDO, 2013*).

According to a study by World Bank, industrial clusters are spaces which gather multiple businesses, material suppliers, service providers and other related organizations in a concrete sector (financial organizations, educational organizations and Government agencies). These organizations are linked each with other for mutual supports and, in many cases, closely operate. Actors in industrial clusters have specific advantages better than outside-cluster competitors, namely they have better access to sources of appropriate technologies, human resources, suppliers and learning opportunities (*World Bank, 2009*).

In a study by OECD on the roles of industrial clusters towards promotion of innovation, the concept of industrial clusters is focused on mutual links and dependence between related organizations in a value chain. Cooperation networks in an industrial cluster are also multiform and connected larger than the one in a transversal structure (networks of businesses in the same sector of products or industries where they cooperate for realization of an idea or activity such as R&D activities, show events, marketing activities and etc.) In many cases, industrial clusters are inter-sectorial cooperation networks which are set up from different businesses on basis of synergise supports and specialization in a segment of value chains (*OECD, 1999*).

Innovation clusters, high tech clusters, science-technology clusters

In certain cases, the terms “innovation cluster” and “high tech cluster” are used in many studies on high tech zones where research institutes and universities play important roles in creation of and support for technological renovation activities. For example, the enhancement of the roles of innovation clusters are noted in studies on models of high tech zones, science parks and science cities (*UNESCO-WTA, 2006, 2008, WIPO, 2020*). Silicon Valleys, Hsinchu Science City and some others usually marked as successful innovation clusters are seen as platforms for formation and development of regional innovation systems².

With promotion of technological transfer and innovation activities as important objectives, the concept of industrial cluster in this paper is interpreted as a

² Types of those industrial clusters with many features different from the traditional ones are not in scope of study of this paper.

location highly concentrated with inter-related businesses and actors in a geographical area, which operate in activities of production and consumption of products in certain value chains and form cooperation networks for technological transfer and innovation. In this model, businesses play center roles while other related actors (research/training organizations and intermediate service organizations) play supporting roles.

While traditional industrial zones are mainly administratively connected businesses, the industrial clusters focus more attention on cooperative and innovative links between related actors.

2.2. Specific features of industrial clusters

In comparison to many other models, industrial clusters have certain specific features. A clear analysis of features and characteristics of industrial clusters is necessary to help policy makers and managers issue appropriate policies (selection of industrial clusters to get supports, set up of support indicators and etc.). This section provides analysis of some specific features causing impacts to objectives of promotion of technological transfer and innovation.

(1) Geographical proximity of actors in industrial clusters

This feature facilitates cut down of transaction costs and sharing of information. The proximity between actors facilitates formation and development of permanent mutual links, easy access to sources of appropriate technologies, skilled human resources, favourable capital mobilization for innovation activities and in-time access to market information and quality standards.

(2) Level of concentration of businesses

The high concentration of businesses is the condition necessary for formation and development of cooperative links, particularly for technological transfer and innovation activities. Some international studies show, for effective activities, industrial clusters need to attract a so-called “critical number” of businesses. The critical number is the quantity of businesses necessary for creation of a volume of cooperative links to exploit innovation potentials and to maintain stable competitive positions in market. As shown by many studies for assessment of activity of industrial clusters, the fixation of the critical number is quite difficult in practice. Some studies also emphasize that the number of participating actors is not important as the structure and operation of cooperative networks between actors are (*European Union, 2010, 2016*).

(3) Links between actors in industrial clusters

Actors in industrial clusters cooperate and get linked in various ways. In general, there are two models: vertical networks and horizontal networks. Vertical networks are the models used between businesses and related

organizations in the same sectorial value chain (including, for example, producing businesses, material supplies, transport services, sales services, marketing services, after-sale services and etc.). In initial stages of development of industrial clusters, the form of cooperation between actors is mainly realized in the model of vertical networks with focus for production activities. Horizontal networks are the models used between businesses in the same sector (between competitors) which target cost cut down and enhancement of scales of production-trade operations. In comparison to vertical networks, the possibility of cooperation between actors in horizontal networks is very limited since the sharing of information in a cooperative project can reduce competitiveness of local businesses.

(4) *Specific features of actors in industrial clusters*

Industrial clusters, in general, include various groups of actors, namely: (i) Businesses (large businesses, small-medium enterprises and etc.); (ii) Research and training organizations (research institutes, training organizations and etc.); (iii) Intermediate organizations (service providers, consulting organizations); (iv) Government agencies (local administration). Then the preparation of policies to support technology transfer and innovation needs to have a clear understanding of roles of these actors in each stage of development of industrial clusters. This would help policy makers define the scope of support policies, groups of beneficiaries and objectives of actions (R&D, technology transfer, training and etc.) and the range of actions of support policies (local, regional or national).

Studies on technology transfer and innovation in many countries, especially in developing ones, sum up certain success experiences (*Kim, 2015, UN-ESCAP, 1999, Lundvall, 2009*). Basically, these lessons can be applied for promotion of technology transfer and innovation activities in industrial clusters. Some of them are remarkable as follows:

- Businesses are lead actors and innovation activities of the group of businesses play center roles. Here, large businesses (including FDI ones), with their advantages in technology and market positions are to guide production-trade and innovation activities, and SMEs would play the roles of satellite actors and suppliers/providers;
- Research institutes/universities would support businesses, especially SMEs, through research and training activities, provision of services and technological solutions. The latters would assist better activities of transfer and absorption of new technologies;
- Other service providers and institutional organizations (vocational associations, service providers, consulting organizations for innovation in aspects of legal rules, market, finance, investment and etc.) would support businesses through provision of services for information, financial investment, technologies and legal rules.

- (5) *Industrial clusters are also diversified in forms and scale of activities. But, in general, there are two ways of development: self-promoted development and guided development (under programs of the Government or international organizations).*

The self-promoted development comes usually from practical needs of production-trade activities which make them linked. Large businesses, with their technology and market advantages, would play guiding roles in initial stages of formation and development. The guided development, with initiatives from Government agencies or international organizations, is the case where an entity gets set up from private businesses and local government agencies to carry out the governance of development of industrial clusters. Organizations with charges to coordinate and develop industrial clusters are also to monitor, support and evaluate technology transfer and innovation activities in industrial clusters.

- (6) *Life cycle of industrial clusters*

Basically the process of formation and development of industrial clusters passes 5 stages, namely: (i) Formation; (ii) Growth; (iii) Saturation; (iv) Decline; and (v) Rehabilitation. Each of these stages has its own specific features.

- *Formation stage* has the clearly increasing trend of the market activities and the number of businesses with limited networks. In many cases the community of businesses has the lead roles and, here, the specific support policies by the Government play important roles for promotion of industrial clusters;
- *Growth stage* is characterized by the state where businesses gather enough conditions necessary for independent development (seen through quantity and quality of actors, and networks between actors). At this stage, new actors get involved such as research institutes, universities and financial organizations. Also, governance organizations of industrial clusters push up the development of cooperation networks. Development of industrial clusters at this stage starts attracting businesses where they get more resources such as high qualified human resources and capital sources for innovation activities;
- *Saturation stage* of industrial clusters comes when the market declines. The competition between businesses mainly is based on cost cut down and pricewise solutions instead of innovation of technologies and renovation of products. Many businesses select the extension of production scale, enhancement of effectiveness and efficiency of operation as solution. This stage is characterized by the reducing number of businesses as result of M&A activities. The number of newly established businesses reduces also;
- *Decline stage* is characterized by negative growth. The number of actors as well as networks experience reducing trends;

- *Rehabilitation stage* comes after the decline stage thanks to new driving forces, market growth, competition, motivation for innovation and attraction of new businesses.

Table 1. Specific features of industrial clusters during stages of development

	Formation	Growth	Saturation	Decline	Rehabilitation
Number of actors	Increasing	Increasing (critical level)	Reducing (critical level)	Reducing	Increasing
Connection networks	Low	Increasing		Reducing	Increasing
Market growth	High	High	Low	Negative	High

Source: European Union, 2010,

Therefore, policy makers should make periodical assessment keep up with development of industrial clusters for preparation of appropriate support policies. The Government can also provide supports to push up the growth stages and to mitigate negative impacts of the decline stage.

(7) *Objectives for the stages of development*

For the initial stages, the efforts are focused on formation and development of connecting networks (including vertical networks and horizontal networks) which target promotion of innovations for better production-trade activities of businesses.

When the number of businesses and the operation of cooperation networks between businesses come to certain level, the industrial clusters make focus on development of infrastructure (extension of scope of activities) with participation of service providing organizations (development of business operations, supports for innovation activities) and research-training organizations.

3. Roles of technology transfer and innovation, actors to promote technology transfer and innovation for development of industrial clusters

According to Law on Technology Transfer (2017), the technology transfer is defined as the process to transfer the property rights or rights of use of technologies from owning sides to receiving sides. In general, technology transfer activities are subject to technological needs, capacities of involved sides (transferrers, transferees and intermediate partners) and related regulations (contracts, formality, registration rules and ect.).

According to international experiences of development of industrial clusters, there are three groups of impacting factors: (i) Group of factors deciding successful development of industrial clusters (renovation of technologies, cooperation networks and human capitals); (ii) Group of supporting factors

(infrastructure, involvement of large businesses, access to finance sources and entrepreneurship); and (iii) Group of factors of supplementary roles for faster development (support services, market access and operational environment) (*European Union, 2010; England’s Regional Development Agency, 2004*).

As to meet the objectives and scope of this study, we focus attentions on analysis of some factors related to technology transfer and innovation which impact development of industrial clusters in developing countries, including Vietnam, as shown in the following analysis frame.

Roles of technology transfer and innovation and promoting factors for development of industrial clusters	
Technology transfer and innovation	<ul style="list-style-type: none"> • Technological renovation • Technology transfer between businesses • Technology transfer from research institutes and universities • Adaptation and improving modification of transferred technologies
Factors promoting technology transfer and innovation	<ul style="list-style-type: none"> • Cooperation networks • Human capitals • Infrastructure • Involvement of large businesses • Access to finances • Services supporting technology transfer and innovation

Source: European Union, 2010, 2015; EPAR, University of Washington, 2015; England’s Regional Development Agency, 2004.

Accordingly, technology transfer and innovation play important roles for successful development of industrial clusters including technological renovations by businesses (which are lead actors of industrial clusters), technology transfer and innovation between businesses, technology transfer from research institutes and universities, adaptation and improving modification of transferred technologies. From another side, the group of technology transfer and innovation promoting factors includes cooperation networks, human capitals, infrastructure, involvement of large businesses, access to finance sources and technology transfer and innovation supporting services. They are, in many aspects, related to policies to promote technology transfer and innovation³.

3.1. Roles of technology transfer and innovation for development of industrial clusters

Being subject to mentioned innovation activities, some cases of innovation are, in fact, technological renovations. The technological renovation is the term

³ See Chapter IV, Law on Technology Transfer (2017), for measures to stimulate technology transfer and development of S&T markets.

used for changes of technologies narrowly applied for actual subjects while the technological innovation is used to indicate not only technological renovation but other related aspects such as organizational structure, governance, marketing and etc. In this study, the notion of innovation is understood as indicated in Oslo Guidelines by OECD. Accordingly, the OECD definition can be interpreted as follows: an innovation is the implementation of a new or significantly improved product or process of a business which are supplied to potential customers (for products) or applied by itself (for processes). Innovation activities include development, finance and commerce activities for making innovations such as R&D, designing, techniques, finance, training and etc. (OECD, 2018).

The formation and development of industrial clusters with involvement of new actors (businesses, research and training organizations, service organizations and etc.) and application of new technologies and internationalization of production-trade and R&D activities. Innovation activities, essentially the one by businesses - the group of lead actors - are emphasized as one of the factors deciding the long term development of industrial clusters. Due to high concentration of businesses and related actors, the pressure from competition gets high and then requires continuous efforts for innovation (European Union, 2010; EPAR, University of Washington, 2015. England's Regional Development Agency, 2004).

Since capabilities and strategies are different between businesses, activities for technological renovation also vary which can be self-made or received and absorbed from external sources through technology transfer.

In developed countries, R&D organizations (research institutes and universities) are seen as important driving forces for development of industrial clusters, especially the ones which attract high tech businesses in key sectors (biology, renewable energy, information technologies)⁴. Generally speaking, R&D organizations play roles to orient and guide technology transfer and innovation activities in industrial clusters. This study, however, also shows, in many cases, the involvement of R&D organizations is not compulsorily required for successful development of industrial clusters. As shown by practice, many industrial clusters in wood processing and agriculture sectors (USA, Malaysia) and garment-textile industries (China, India) get high success without involvement of R&D organizations (England's Regional Development Agency, 2004). In developed countries, R&D organizations focus efforts on support businesses in absorbing, mastering and improving new and advanced technologies from external sources.

⁴ In addition to the term "industrial cluster", some studies use the term "innovation cluster" to emphasize the roles of research institutes and universities for technology transfer and high tech businesses as important lead actors.

For developing countries, technological renovation activities of businesses are still based on technology transfer. Therefore, the technology transfer plays important roles of successful development of industrial clusters in developing countries (Hair Awang, 2013; UNIDO, 2013). More than 90% of businesses in industrial clusters are SMEs which have limited endogenic capacities for development of technologies, and then the technology transfer remains the main source for renovation by businesses. The important roles for development of industrial clusters are seen from the following analysis.

- Many international studies recently show that many industrial clusters exhibit low efficiency, after certain time of operation, due to lack of technology transfer activities and connection between actors. Many businesses, especially SMEs, in neighbouring areas do not have chances to cooperate with large businesses and consulting organizations for technology transfer and innovation, then industrial clusters reduce their attraction for businesses from neighbouring areas;
- Higher technology transfer activities would attract more domestic businesses, especially local SMEs, and stimulate formation of cooperation networks in value chains⁵. By other words, the businesses in industrial clusters have more chances to get technology transfer than the outside ones;
- Domestic businesses while connected to large businesses with leading positions in sectors (technologies and markets) would enhance their market positions thanks to received information and technologies. Activities in industrial clusters are bridges to connect domestic businesses for participation in global value chains. However, for better exploitation of these opportunities in initial stages, learning initiatives are required from businesses to enhance innovation capabilities and then to be capable to meet demands from customers. Promotion of technological transfer activities make domestic businesses, especially SMEs, fastly enhance renovation process of products to meet requirements of standards, productivity and delivery terms. With limited capacities and chances to get direct technology transfer, they get technological renovations through contact channels such as training-based learning, technological propagation, imitation and technological decoding;
- Promotion of technology transfer activities attracts research institutes and universities to cooperate with businesses in industrial clusters through provision of technology consulting, adapting and mastering services. For higher efficiency of application of transferred technologies, the receiving sides, in many cases, are required to carry out adaptation activities to meet actual conditions. So, higher technology transfer activities would create service

⁵ See “connections between actors in industrial clusters”.

markets for consulting organizations, research institutes and universities and, by this way, to form and develop connecting networks between these actors.

3.2. Factors promoting technology transfer and innovation for development of industrial clusters

3.2.1. Cooperation networks

Networking activities play important roles for successful development of industrial clusters. The promotion of connecting networks between actors is seen as one of the important requirements in development strategies of industrial clusters in many countries (*UNIDO, 2013*).

Many studies emphasize the networks create knowledge flows (technology and information) between actors which lead to development of industrial clusters. Accessibility to knowledge sources offers learning possibilities and enhances competitiveness of businesses in industrial clusters and by this way attracts more businesses. Networks also help build trusts and individual relations which lead to formation of social resources - important driving forces for development of industrial clusters.

The formation and development of such networks require time. In many cases the networks get set up through social and cultural contacts naturally existing in industrial clusters. However, there are also many networks which get set up through Government supports from the Government. Non-official networks are based on social links and workforce mobility between organizations in industrial clusters which give contributions to technology transfer and knowledge diffusion. Capacities to meet demands and benefits gained by members are important conditions for networking new members.

Network-based knowledge sharing can be realized through direct contacts or internet networking (web-based links). In many cases, the organizations in charge of development of industrial clusters use information gates of industrial clusters to promote information sharing activities and mutual interaction between actors.

Networks in industrial clusters offer not only chances to meet but also formation of “community of practice”⁶. “Communities of practice” help businesses share ideas and propagate good practice of technological transfer and innovation (selection, evaluation of technologies and technology providers, capital mobilization and workforce training). The building and development of groups of businesses with identical interests are new trends of many industrial clusters in the world. Regional development organizations and local policy

⁶ Communities of practice (CoP) is defined as an organized group of professionals which have the same interests in settling problems, improving skills and learning mutual experience.

makers should have efforts to issue support and stimulation measures through the setting-up of cooperation centers (direct or internet-based).

3.2.2. *Human capitals*

The qualification of workforce causes important impacts to needs and effectiveness of technology transfer and innovation activities (UNIDO, 2013; Kim Long-il, 2015). Businesses having skilled and experienced engineers would give good supports for technology transfer, adaptation and improvement of transferred technologies. Capacities to learn and absorb technologies are important factors to stimulate demands to receive technologies and investments for innovation activities (Hair Awang, 2013). Regarding research institutes and universities, from another side, successful activities of technology transfer and commercialization of research results require more capabilities for research works with higher quality and feasibility.

Success lessons in the world emphasize possibilities to supply and develop skillful workforces including managerial and technical staffs for businesses and other actors in industrial clusters. Chances of access to skillful workforces are important conditions to attract more businesses and related actors to industrial clusters as well as to promote technology transfer and innovation activities for success of industrial clusters.

3.2.3. *Infrastructure*

Material and information infrastructure, location and space environment cause also considerable impacts to successful development of industrial clusters. The industrial clusters with good infrastructure, comfortable road connections and good information systems offer better access to information sources, potential providers, low cost transactions, better technology transfer terms, mutual learning and technological absorption.

For high and advanced technologies (biotechnologies, high tech agriculture), there exist some models of S&T zones such as incubators, innovation centers, show facilities, pilot centers, high tech zones and etc. which play important roles for promotion of technology transfer and innovation in industrial clusters.

3.2.4. *Involvement of large businesses*

In many countries, the successful industrial clusters are seen usually with involvement of large businesses including FDI ones. Large businesses play important roles for promotion of technology transfer and innovation in industrial clusters. With advantages in technology, workforce and market terms, large businesses attract SMEs which play roles of suppliers. Participation of SMEs in production networks of large businesses is important channels to get information on specification, quality and technologies required by external markets as well as possibility and ways to access these markets. However, for

better profits from these opportunities, SMEs are required to enhance innovation capabilities to meet demands for standards, costs and delivery terms. In addition to their own capabilities, SMEs should develop mutual connections with suppliers, lead businesses (large businesses) and other partners as stimulation for learning and enhancing innovation capabilities. From another side, large businesses are seen as actors with important roles for managers and policy makers in building strategies for development of industrial clusters.

3.2.5. Access to finance sources

For better use of technology transfer and innovation opportunities, businesses in industrial clusters are usually dependent to availability of middle and long term financial supports. Proximity between businesses and financial organizations (State support foundations, banks, private investment funds and etc.) in the same area would enhance chances of access to suitable financial sources for technology transfer and innovation activities of businesses. Many successful industrial clusters are seen with presence of financial organizations as well as coordination between public and private sectors in supports for technology transfer and innovation activities (*UNIDO, 2013; European Union, 2010*). Formation of capital supports is multiform including sponsorship, supports, loans or venture investments.

From vision by financial organizations, the close contacts to businesses would help them catch better actual operational status and capital needs of businesses for better offer of proposals. From another side, managers and policy makers would be easier in developing links between businesses and specific financial organizations.

3.2.6. Support services

Support services do not play deciding roles for success of industrial clusters but they are capable to shorten the development process of industrial clusters (*European Union, 2010; England's Regional Development Agency, 2004*). Here, technology transfer and innovation services can include technology transfer brokering and consulting services and services for evaluation, appraisal and examination of technologies and etc.

4. Some proposals for policies of promotion of technology transfer and innovation for development of industrial clusters in Vietnam

In Vietnam, measures for support and stimulation of technology transfer are governed by many legal documents such as Law on Technology Transfer (2017), Law on Investment (2020), Law on Intellectual Property (07/VBHN-VPQH, 2019), Law on Enterprises (2020), Law on Supports for Small and Medium Enterprises with their implementation guidelines, S&T development strategies, development strategies of sectors and etc.

Policies are also focused on supports and promotion for businesses to apply and innovate technologies, to promote commercialization of research results and to develop intermediate businesses in S&T market. Basically, the frame of support policies includes policies for S&T development, policies for training and development of workforces, policies for development of infrastructure, policies for financial supports and policies for technology transfer services.

In addition to completion of global policy frames for technology transfer and innovation activities, the development of industrial clusters requires additionally some specific mechanisms and policies. Policies to promote technology transfer and innovation activities should be designed to meet demands of different stages of development of industrial clusters. Also, the businesses which are members of industrial clusters without conducting technology transfer and innovation activities should be disqualified for support measures. Therefore, local government agencies may set up an organization for management of development of industrial clusters. The organization can include representatives from groups of actors to monitor and evaluate technology transfer and innovation activities as well as to make consulting services for support policies.

Based on global analysis of international experiences of development of industrial clusters, the following session offers some proposals for policies to promote technology transfer and innovation activities for development of industrial clusters in Vietnam.

4.1. Policies for S&T development

- Building the list of technologies encouraged for transfer and the list of machines and equipment attached to technology transfer. The lists would be background for preparation of support policies for businesses and related actors in industrial clusters;
- Checking, amending and adding solutions for S&T development in existing strategies and policies (regional development strategies, sectorial development policies) with priority supports for businesses in industrial clusters and for cooperation with businesses in industrial clusters to enhance technology transfer and innovation capabilities, especially the ones to receive, absorb and improve transferred technologies;
- Adjusting and adding priority orientations and renovation of managerial mechanisms for S&T tasks to stimulate technology transfer and innovation activities by businesses and related actors in industrial clusters;
- Adding and amending rules of technology transfer in investment policies to stimulate advanced technology using FDIs to commit technology transfer and to support training works and set-up of R&D facilities in industrial clusters.

4.2. Policies for training and development of human resources

- Enhancing coordination between State administration agencies (central and local) and large businesses to build up and implement programs to support training activities for businesses in industrial clusters. Large businesses are to provide experts, lecturers and costs for them. They are also in charge to evaluate post-training level of workforces. State agencies are to offer partial supports for technical infrastructure and training costs;
- Adding and amending the policy solution of “training and development of human resources” as stipulated in Decision No. 32/QĐ-TTg on 13th January 2015 by the Prime Minister which approves the Integrated program for developing and upgrading sector clusters and value chains for production of products with competitive advantages, namely: electronic products and information technologies, garment-textile industry, food processing, agriculture machinery and tourism. Large businesses in industrial clusters are encouraged to cooperate with local government to hold short term and regular training courses for enhancement of technology transfer and innovation capabilities for members in industrial clusters.

4.3. Support policies for infrastructure development

- Supporting the set-up and development of technology transfer and innovation centers in some potential industrial clusters for better reception, adaptation and improvement of transferred technologies;
- Upgrading or developing some key specific laboratories and systems of control and examination of quality and technologies according to international standards to meet technology transfer and innovation needs in industrial clusters;
- Offering supports by State agencies for industrial clusters with high tech industries, high tech agriculture and new technologies for formation and development of specific types of S&T zones (business incubators, technology incubators, innovation centers, high tech zones, and high tech agriculture zones) or offering solutions for effective exploitation of these special industrial clusters.

4.4. Financial policies

- Offering supports in information and financial consulting activities: local governments should coordinate with cluster managers in provision of information on potential financial sources for businesses and related actors. Also, governance agencies, with assistance from web-based networks and local intermediate consulting organizations, can build up suitable channels to call investment and capital sources for businesses;

- Offering supports for access to financial sources: financial policies, in many cases, can be used to promote cooperation connections between actors of industrial clusters for technology transfer and innovation activities (training and S&T activities for adaptation and improvement of transferred technologies). Supports can be made through programs and foundations set-up with priorities for businesses in certain selected industrial clusters. For example, it is needed to add contents, tasks and mechanisms of support from S&T programs and National Technological Innovation Fund for businesses in industrial clusters to receive, adapt and improve transferred technologies.
- Issuing support mechanisms to monitor, control and evaluate priority realization of S&T tasks offered to businesses in industrial clusters with cooperation from S&T organizations. Such support mechanisms should promote formation and development of networks between actors in industrial clusters;
- Designing necessary support mechanisms, for better efficiency of financial policies, according to specific needs and development opportunities of different industrial clusters. Accordingly, financial policies should be oriented to connect businesses in industrial clusters with financial organizations to build up support packages, combining different financial sources (support programs, State support foundations, commercial banks and etc.).

4.5. Policies for service supports

- Offering supports for formation of service networks for technology transfer and innovation: businesses, for realization of technology transfer and innovation activities, need not only technical-technological supports but also the ones in terms of capitals, market, intellectual property and skills in relation to innovation management. In countries with high rate of SMEs, the full package services have increasing important roles. Large technology transfer centers would play roles to connect specific organizations for formation and development of technology transfer networks. From another side, the State should support the formation and development of networks for technological promotion on public-private basis to settle problems the businesses in industrial clusters face (e.g. knowledge and technologies commonly used by businesses in industrial clusters);
- Offering supports to build up communication campaigns and information gates to learn technology transfer and innovation skills which target diffusion and propagation of success models, good practice experiences, networks of experts, sharing of information on training courses, workshops and support policies in relation to technology transfer and innovation activities. They are also solutions for promotion of formation and development of cooperation networks between actors and “communities of practice” in industrial clusters./.

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