EMERGING OF REGIONAL INNOVATION SYSTEM IN VIETNAM: A CASE STUDY OF AREA OF DA LAT SAFE VEGETABLES

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Abstract:

Practice in Vietnam shows that technological innovation in agriculture is not only undertaken in the form of knowledge transfer from S&T institutions to producers, but it also takes place in many other ways, especially through interactive learning between producers and different entities in the process of market exploration. In other words, innovation is not implemented in isolation but through the interaction of entities and institutions in the innovation system. Studies highlighted that regional innovation system (RIS) naturally formed in developing countries was the original foundation for the process of shaping and development of the national innovation system. With producers operating in the same industry concentrated on a long tradition region, the appearance of individuals with start-up entrepreneurship, and the presence of many supporting organizations and institutions, it has made Da Lat and its surroundings become a distinct region and possess a RIS on agricultural production. This paper analyzes the safe vegetable industry of Da Lat where innovation derives from learning based market interactions. This case study serves as an argument to the above statement.

Keywords: *Innovation system; Regional innovation system; Technological innovation in agriculture; Safe vegetables.*

Code: *14061201*

1. Regional innovation system

Regional innovation system (RIS) is understood as *"a series of clusters of industry which are backed up by innovation supporting organizations" (Lundvall et al, 2009)*. Industry cluster means the concentration of producers, businesses in the same industry or in related industries located in the same geographic area. Originally, the concept of RIS was developed and inspired from the success of some places like Silicon Valley. RIS in this sense is often described as a good practice innovation system whereby its component entities are actively interactive, mutually compete and support each other, other institutions facilitate the interactive learning, and

all of these provides impetus to the success of regional development *(Lundvall et al, 2009*).

A notable characteristic of the RIS approach is the attention given to the analysis on clusters of the industry concerned with focus placed on small and medium enterprises (SMEs), along with organizations, institutions supporting for innovation of enterprises. In terms of methodology, the RIS approach can be seen as an extension of *the theory of industrial clusters*[1] with added interaction of the innovation supporting organizations and institutions such as universities, research institutes, technology transfer centers, organizations in charge of standardization - metrology - quality control operating in the region.

It can be seen that when the concept of *regional innovation system* was invented it was born under the context of industrialized developed countries, based on typical success stories. For developing countries, RIS should be used as a master planning based on a certain starting point. Local organizations, institutions in RIS of developing countries often have limited capacity, capital and the knowledge is often driven by outsiders and foreign entities who often play a decisive role in the formation of industrial clusters in the region. With such characteristics, RIS should be used as a policy tool to answer the question: What conditions are the must for RIS to be able to support *the absorption of knowledge and building the technological capacity* of local businesses in the area? (*Lundvall et al, 2009).*

As mentioned above, it does not necessarily mean that RISs in developing countries start from zero. Experience of many countries shows that RIS was set up in an imposing style, based on the will of managers, so it often failed. The policy desire should be directing to those areas where there are sufficient conditions to form a RIS to ensure a greater success in a natural way. In Vietnam, Da Lat is such an example region. With distinct geographical and climate conditions, a long tradition area of concentrated production on vegetables and flowers, the appearance of individual start-up entrepreneurship and FDI enterprises, the presence of many universities, specialized research institutes, and many other supporting organizations and institutions, it has made Da Lat and its surrounding area become a RIS in agriculture. In the sections below of this paper, focus will be placed on the analysis on the case of safe vegetables production in Da Lat with

[1] A theory was developed by M. Porter, primarily focused on the competitive advantage based interaction of firms operating in the same industry and located in the same geographic area.

innovations derived from the market interaction, and the interaction between different entities operating in the region.

2. Vegetable growing industry in Da Lat

Vegetable growing industry in Da Lat has a long tradition. With the advantage of year-round cool climate, fewer pests, since 1939 Da Lat has become an intensive vegetable growing area providing products for the entire Southern part of Viet Nam. Until 1990, Da Lat was almost the exclusive vegetables supplier in the South. In later years, many Southern provinces also grew vegetables, it made Da Lat gradually shift to be the main vegetable supplier for the market of Ho Chi Minh City and in recent years be increasingly export oriented.

According to local officials, as of 2013, Da Lat had about 4,600 hectares of arable land for vegetables and over 1,700 hectares for flowers. There were about 1,450 hectares (vegetables and flowers) of hi-tech agriculture, whereby using net houses/greenhouses, mainly for export and meeting hi-class demand segment in domestic market (hotels, restaurants, foreigners residing in the country,...). The majority of vegetable production households in Da Lat are of small scale, the average cultivated area per household is only about 0.3 hectares. The main export markets, in descending order, were Japan, Taiwan, Singapore and Malaysia, and the main export vegetable varieties included: cabbage, Chinese cabbage, spinach, onions, lettuce, assorted spices. The estimated export volume accounted for about 15% of the total vegetable production, more or less fluctuated from year to year. Apart from a few vegetables that could be self-breeding such as carrots, white cauliflower (old varieties), potatoes (by tissue culture technique), most breeds of vegetable grown in Da Lat came from Japan (namely, varieties of Taki, Toku, Tokyta, Sakata), U.S, France and Thailand, and were distributed through the three large companies, i.e, Hoa Sen, Trang Nong, and Hung Nong.

3. Imprint of individuals with start-up entrepreneurship spirit

Safe vegetable growing in net houses, nylon houses in Da Lat is associated with the name of an individual with start-up entrepreneurship spirit, namely Dr. Nguyen Ba Hung. Originally being a student of Da Lat University, obtained Ph.D degree in biology in France, Dr. Hung had many years of experience in the field of local agriculture, he was sensitive to the market

and determined to creative work, therefore he played an important role in the development of safe vegetable production in Da Lat during the past of more than 20 years.

In mid-nineties, the wave of foreign investment into Vietnam was on uptrend, the number of foreigners living and working in Vietnam increased sharply along with numerous hotels, restaurants of Western style set up in Ho Chi Minh City and Hanoi. Thus, the demand for temperate vegetables to satisfy the eating habit and tastes of this kind of customers began to appear. Taking this opportunity, Dr. Hung shook hands with an American businessman to build a temperate vegetables nursery to provide seeds for farmers in the region. After a period of cooperation, he established the Hung Thien Company of his own. The company used local inherent knowledge and the relationship with foreign seed suppliers, applied process of safe vegetable production developed by himself, he rented land for the nursery and for producing vegetables to serve high-class domestic and export market.

At the beginning of the business start-up, land was the biggest challenge in the Company's operations. Production sites changed frequently due to excessive requirement of land-owners. In this context, signing contracts and providing technical guidance to farmers was the situational solution. This arrangement brought problem of quality management of products produced by participating households. However, this was an opportunity for farmers to learn production process and standards, thus creating a platform for Da Lat safe vegetables development in later years.

Compliance with on-farm standards was the determining factor in the process of safe vegetable production, however, vegetable processing was also an equally important stage, and here, once again the innovator made it different. In late 2004, Hung Thien company built a vegetable processing center, small in scale but standardized and modern in substance. This center included a raw material reception area, a hygiene, standard processing unit and a cold storage warehouse with capacity of about 6 tons of vegetables. In addition, the company invested a vacuum refrigeration equipment with capacity of 5 tons/day, allowing instant in-depth cooling to ensure vegetables not be crumbled down when being frozen by conventional method. Vegetable processing process was performed according to EUROPGAP standards and Hung Thien was the only company in Vietnam at that time could obtain this kind of certification.

Pioneered in quality and unique products, Hung Thien had provided, up to end of 2004, with 85 categories of product to high-class hotels, restaurants in Ho Chi Minh City and Hanoi. In addition, the company also developed a network of households, consumer groups (mainly in Ho Chi Minh City) using home delivery service of the company. Next, the company was the successful bidder to supply vegetables for two onboard catering services companies, and Metro distributor also began placing orders for the company to supply high-class vegetables. By 2007, Hung Thien successfully exported their products to German market after satisfying the standard requirement of this market. It could be said that with innovations in technology, organization and market access it enabled Hung Thien to win market share, laying the first bricks in the development of safe vegetable growing in nylon houses in Da Lat.

After 10 years of development of safe vegetable production in Da Lat area, by 2007, the application of GAP safety standards became popular with many vegetable growing businesses, cooperatives and farmer households. Although the quality of products still varied, safe vegetable growing technique was widespread in the region. Facing serious competition of many producers, Hung Thien once again pioneered in implementing innovation project on organic vegetables.

The standards applied in organic vegetable production are much more rigorous than those applied in safe vegetable production. For safe vegetable, producers are allowed to use a certain amount of fertilizers and plant protection products specified in the permitted list, provided that vegetables are only harvested after decomposition period as prescribed instructions on the use of insecticides and inorganic fertilizers. In production of organic vegetables, in contrast, it is not allowed to apply fertilizers and pesticides on plants as mentioned above. Cultivated land must be the land without applying chemical pesticide and fertilizer for at least 3 years, and located far from the field where chemical fertilizers and pesticides applied. Irrigated water must not be contaminated with the above listed substances.

In order to prepare the project on organic vegetable production, right from 2005, Hung Thien company bought a plot of 4 hectares of land located in a valley of Xuan Tho area, Da Lat City. This piece of land had never been cultivated, was away from other cultivated areas, surrounded by mountains, limited pest immigration from neighboring fields during spraying season. Mr. Hung directly designed indoor and outdoor vegetable plantations at

different heights. The farm has office, processing, storage areas and more importantly, a water treatment tank using aeration method, 4m deep, supplying water for the entire farm. Irrigation systems in nylon houses were improved by using sprinkler technique learned from Taiwan. With this way of working, it allowed the company to save plenty of funds compared to the imported irrigation systems.

To realize pest control without using pesticides, Mr. Hung has applied many pest preventing layers such as planting pest-expel trees, flowers, applying crop rotation method between leaf and root vegetables. With this technique, leaf eating insects surviving from leave vegetables crop can die of starving in next crop where there are only root vegetables planted. The effect is similar with the root vegetables eating pests. With some vegetables are attacked by jumping beetles, he conducted studies and discovered that this kind of insect could not jump higher than one meter, from this discovery he designed high rack systems to grow these sensitive vegetables.

With the above efforts, Hung Thien added into their list of items in service of customers with organic vegetable products alongside traditional safe vegetables of the Company. Though the price is somewhat higher, organic products were quickly welcomed and accepted by Hung Thien's customers. Currently, the company is making necessary preparations for the international certification on organic vegetables, a prerequisite for export of organic vegetables to fastidious markets. Self-producing effort of the company together with effort of cooperative farmers in growing safe vegetables under contracting basis has allowed Hung Thien to have sufficient quantity and varieties to satisfy diversified needs of customers.

The economic success of the project may need more time to evaluate, but the technical success is undebatable. Different from growing safe vegetable, the dissemination and spread of organic vegetable growing method is not of an easy and quick task. Everything is more difficult from the angle of market promotion, business reputation, scientific knowledge and experience, specific and diversified techniques, to the requirement of perception and responsibility of those who involved in the production.

It shall be interesting to observe whether the innovation system of Da Lat formed under vivid interactions as shown in the case of safe vegetables can help or not growers here to be more innovative with differences and can bring about prosperity to this vegetable growing area in the future.

4. Learning through interaction and spread of technology

The interaction of Hung Thien with other vegetable producers created a technology spillover effect among those using nylon houses in Da Lat. Many cooperatives, farmers had learned how to work and achieved certain success. The cooperative Xuan Huong is an example.

Right from the establishment as a cooperative group in 1997, Mr. Quang, chairman of the group had thought of safe vegetables production with the aim to protect the health, first of producers and then of consumers. In 2003, responding the desire of farmers to produce their outputs in a stable manner under incentive policy of local government, the group expanded and converted into Cooperative Xuan Huong with 21 household members, 34 workers, 5 hectares of land for vegetable growing, out of which 3 ha for nylon houses.

Since 1997, with the assistance of Dr. Ba Hung (in his individual capacity) the cooperative group had conducted trial and error experiments on safe vegetable production. Initially, vegetables were grown in net houses, but the experiment failed because net houses could only prevent hail, insects and be appropriate for certain types of vegetable. Switching the experiment using nylon houses, initially using bamboo as frame but it was not so solid, then moved on to iron/steel frame with inclined and cross roof, and then Hasfarm style with steel frame and steel dome. The process of learning was essentially on "trial and error" basis, there was no standard design, no models available, mostly learning by doing with an investment of about VND 50 million/“sao” (a traditional measurement of Vietnam). At a later stage, the cooperative was supported by local government with VND 100 million for building the sample model.

Vegetable production at that time was not stable, dependent on imported seeds, in other words, dependent on seed suppliers. They used to keep trade secret, never told about official name, origin of the imported varieties, because of fear that buyers could find the supplying sources to buy. Seed suppliers conducted experimental growing in the cooperative‘s garden, but using particular signs that one could never know what name and what kind of vegetable varieties. They signed contract with cooperatives and the cooperatives did planting, took care of the garden and enjoyed the whole product together with a small remuneration; suppliers took only a few kilograms for testing purposes.

Sample products were tested at the Institute of Nuclear Research (at very high cost, around VND 1 million/sample, in despite of subsidy by 50%) and all met the requirement of safe vegetables. The safe vegetables production process was certified by the Department of Agriculture and Rural Development of Lam Dong province. At present, the cooperative is the learning place for many organizations, agencies and universities to visit.

Currently, the cooperative production takes place according to customer's orders, out of which about 40% is for export and the rest for domestic market. The cooperative also supplies products for Golden Garden, Metro companies. Requirements of the Metro are pretty tight, they often conducted unexpected, on-spot quality checks, they go there and take 1-2kg of sample to test and then feedback the result. Test results of Metro thus are trusted by so many other customers, so the cooperative can use this report as reference to promote their products in the market.

Mr. Quang said that there were not so many people like Dr. Ba Hung, and we needed such a people, without Dr. Ba Hung's support, our cooperative could not be like today. He added, state agencies, institutions had not really played an effective role. Training provided by extension agencies were effective in raising awareness of farmers, but the capacity of extension agencies remains limited in many other respects.

In addition to Xuan Huong cooperative, there are many other cooperatives and farmers in Da Lat area also learn from and cooperate with Dr. Ba Hung in growing safe vegetables. Learning through interaction between cooperatives, farmers in Da Lat is very impressive. This is probably thanks to the farmers in Da Lat themselves have a certain capacity accumulated over many years of hard, seriously working on this land.

Besides the effort of Hung Thien, activities of FDI enterprises in the sector is also an important motive source to promote safe vegetable industry of Da Lat. Another respect should be mentioned is the positive involvement of local authorities, technical support organizations in the area. This is really the interaction which help to form a RIS in Da Lat.

5. FDI enterprises in the region

If Hung Thien is the pioneer enterprise in vegetables growing technology in nylon houses, the FDI enterprise of Mr. Col, an Australian businessman, is the leader in large scale outdoor vegetable production. Being present in Da

Lat in 1996, Mr. Col started trading vegetables for export, then he made investment in vegetable production. In 2007, the company exported 80% of production of lettuce of all kinds to Malaysia, Singapore by air. According to the information obtained, these products have been supplied to the outlets of the McDonald system in both above countries having tropical climate. For those unqualified products for export, they are for domestic consumption, mainly in Ho Chi Minh City.

Production on open beds, the company applied advanced drip irrigation system with vegetable beds covered with white painted plastic canvas to reduce solar energy absorption, sunscreen (previously white canvas was imported from Malaysia, but it service time lasted only for 2 weeks as the canvas could not affordable to the Vietnam's conditions, therefore the company had to use Vietnamese canvas of dark color with improvement by making it white painted on surface). The key point of the technology is the on-farm vegetable caring process, especially the irrigation and fertilizer application methods.

This company had a cultivated area of approximately 10 hectares in Da Lat, more than 20 hectares in Don Duong. The total number of employees in Da Lat was 17 people. Harvested vegetable was transported to the company's cold storage facilities, keeping in stock for one day before packing and shipping to Lien Khuong airport nearby to export abroad. The majority of vegetable seeds was imported from the Netherlands. The company had a principal engineer graduated from Da Lat University with 4 years of experience, he had worked in many places before moving to this company.

Different from case of Hung Thien, the company of Mr. Col operated in a quite close circle, with little interaction and technology transfer to other farmer households. It seems as if they came to Da Lat, had land rented to produce for the orders already placed using stable processes. The interaction with other producers was not so high. However, with the presence of a foreigner growing vegetables in Da Lat it makes people curious and implicitly learn experience. This was also the way of learning of Da Lat farmers from other FDI enterprises such as Hasfarm, a Dutch FDI company well known with the process of growing flowers in greenhouses using advanced caring technologies.

Hasfarm is very self-contained, outsiders are restricted to visit the factory. However, their operations is still a source of learning for many farmers in the region. With flower growers, they gradually learn flower-growing technology from workers working in Hasfarm. For vegetable growers, they could also observe the design of Hasfarm greenhouse for them to get better design of greenhouse that it can be affordable.

Recently, some Japanese farmers came to Da Lat for vegetable growing and got certain successes. Foreign farmers brought technical experience in growing safe vegetables, organic vegetables, which was successfully applied in Da Lat. A typical case was Mr. Masazumi. Mr. Masazumi came to Da Lat in 2007 with the intention of planting flowers but he failed and had to switch to growing vegetables such as tomatoes, cucumbers, sweet chili, eggplant, strawberries, etc. using varieties derived mainly from Japan. His vegetables farm of 20.000 m^2 is about 20km far from the center of Da Lat. All products were exported to Japan and sold to Japanese living in Vietnam at high prices thanks to good quality, absolutely chemicals free. In particular, the process of land preparation was of very thorough care, it helped increase productivity, make the plant life cycle longer, vegetables become cleaner, safer. Although he was willing to share experience, the diffusion of his land care, cultivation techniques to farmers of Da Lat was still limited. According to him, people of Da Lat was conservative, he had already provided training to farmers on how to handle with Da Lat land to cultivate strawberry, but people said that strawberries had been cultivated for 10 years and it still worked very well. However, there were on-going exchange of knowledge, interactive learning between him and other farmers in agricultural technique related subjects. On the other hand, the success of a foreign farmer in Da Lat was a motive force for farmers in Da Lat, sooner or later, to learn and promote innovation.

In addition to FDI enterprises making investment in vegetable production in the area, it should mention about many representatives of foreign companies playing the role of supplying vegetable seeds, agricultural inputs, providing technical consultation and other services of concern. With the dissemination of cultivation process for each specific variety, the method of using agricultural materials suitable for each product, foreign firms have become important knowledge sources to complement to knowledge and experience of local producers. It can be affirmed that learning interactions take place more frequently and at a high intensity in this region.

6. Technical support organizations and local authorities

6.1. Agriculture center of Da Lat City

The development of safe growing vegetables in nylon houses has involved the active participation of technical support organizations and local authorities in Da Lat, where the Agriculture Center of Da Lat City is an important agent. With more than 10 staff, most have university degrees,

working for Da Lat for many years the center has conducted many activities to introduce safe vegetable production in the area.

In order to promote the production in accordance with the process of safe vegetable production issued in 2000 by Lam Dong Department of Science and Technology, the center had provided guidance for 06 cooperatives to register with safety grassroots standard and building brand name for their products, however, due to high cost, there were only 02 cooperatives could complete the registration of grass-root standard and trademarks for their products. The center also supported 02 cooperatives by sharing 50% of the cost for analysis of sample vegetables conducted 3 times/year as per requirement of the process.

The samples were previously analyzed by Da Lat Nuclear Research Institute, however the analysis and testing of the Institute for Nuclear Research significance was only of scientific nature. They should have been analyzed by an accredited organization in Ho Chi Minh City which has relevant functions determined by laws. But the travel and transportation of samples to Ho Chi Minh City takes a lot of time, effort and expense, so it is recommended that additional functions be given to the Nuclear Research Institute in order for them to be able to provide official services with lower service charge and more convenient for people. Currently, the certification of VietGAP standards compliance for vegetables in Da Lat is granted by the Quality Control Center for Agriculture, Forestry and Fishery, Area 3, located in Nha Trang City.

6.2. Department of science and technology of Lam Dong province

The Department is the agency to allocate budgets for scientific research of Lam Dong province and it is the focal point of the province to liaison with the Ministry of Science and Technology. Since 1996, the Department has begun providing funds for local research activities including the development of processes for safety vegetables growing. In 2002-2003 period, the Department recommended Dr. Ba Hung to be director of a ministerial equivalent level research project in respect of experimental production, with a budget of VND 500 million. This project was successfully completed and the project returned to the state 80% of the funds received as agreed upon in the contract. It should be mentioned that this recovery was an important success indicator of the project. In 2009-2010, the Department funded for the Southern Institute of Agricultural Science and

Technology to implement a pilot production project in regard of tomato high tech production in Lam Dong with a financial support VND750 million. The project built a membrane house with an area of 6,500m2 producing a yield of over 350 tons/ha (normally it was only of 50-70 tons/ha), with products compliant to safety standards and provided for Saigon Co.opmart supermarkets nationwide. The project had trained and granted certificate for 100 farmers producing tomatoes following VietGAP high-tech standards.

6.3. University of Da Lat

Da Lat University is a multidisciplinary university like the model of university in Western countries with green campus, images look like universities in Europe and America. Among many others, the Biology and recently the Agriculture and Forestry faculty have not only provided qualified human resources for agricultural production but also implemented many field studies, providing important scientific and technological knowledge for the region's production development.

Involved in teaching in these two above faculties are not only core teaching staff but also many top visiting experts from other institutions such as Institute of Tropical Biology, Institute for Nuclear Research, Pasteur Institute, Agricultural Crops Research Institute and especially the participation of businesses in the region.

The presence of an education establishment as active as Da Lat University in the agricultural production region is an important motivation for research and training activities. Graduate students can easily find a suitable job. The environment here is very conducive for students and faculty members, who can involve in learning and teaching, career start-up, running market, turn scientific knowledge, innovative ideas into useful products, thus bringing their value not only for themselves but also for this special land.

7. Conclusions

Capturing market opportunities, basing on the diversified relationship, farmers in Da Lat have for a long time learned how to grow vegetables, applied properly advanced techniques, mastered the use of many types of machinery in cultivation, post-harvest conservation. Many innovations on breeds, cultivation process, production organization, exploitation of market have been initiated from very early by producers. There was a strong effort to spread knowledge and skills to other producers in the region, attracting

local authorities, technical assistance institutions, agricultural extension agencies concerned in the region to involve in the development of the vegetable growing sector. On the other hand, public agencies, organizations were also proactive in supporting producers in the region, thanks to this inter-connectivity, the linkage among producers is strengthened. Interactions also take place between local and foreign producers, between local suppliers and overseas customers. This facilitates the mobilization of the production sector support for research in Da Lat. Public institutions such as universities, research institutes also have a lot of interaction with producers to assist them in innovation programs, in return, producers have the opportunity to participate in research carried out in this area. The agricultural extension agency of Da Lat, although their operation has not been so effective, a lot of effort has been made to provide technical support for producers, especially for those of small scale. In conclusion, a RIS has gradually been formed in Da Lat in a natural manner. It is regulated by the specific regional climate; the long tradition of vegetables growing of the region; the excellence of scientists, farmers, individuals with entrepreneurial start-up spirit; the concentration of diversified producers in the area; the interaction of domestic and international markets; and the active participation of state technical assistance organizations./.

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