

**SOME REFLECTIONS ON HI-TECH APPLICATION
FOR AGRICULTURE DEVELOPMENT IN VIETNAM
- EXPERIENCES AND LESSONS LEARNT FROM CHINA**

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Abstract:

In recent years, along with the strong development of industry, agriculture has also achieved new advances in respect of higher productivity and yield. However, our agricultural products have not yet had high competitiveness in terms of value and quality. Like developed countries, many countries in Asia are moving from quantitative towards hi-tech based qualitative agriculture through the application of biotechnology, automation technology, mechanization, informatics... to produce agricultural products with high productivity, high value and quality, safe and effective. In reality, however, the turnover value gained from export of agro-products of Vietnam was still very low. The fundamental cause of this was because most of agricultural commodities of Vietnam had been using outdated production technologies, exporting in raw form or, in other words, just supplying raw material for foreign companies to further process it into higher value items. It is therefore, technology innovation in agricultural development in combination with high-tech application in agriculture is the right direction for Vietnam to increase productivity, quality and value of agricultural products.

Keywords: *Hi-tech Agriculture; Production model.*

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1. Different models of high-tech application in agricultural production in Vietnam

In our country, research institutions such as research institutes, universities, research centers have in recent years conducted a number of studies to improve/upgrade many technical advance processes, create dozens of varieties of vegetable, flower, industrial tree, fruit tree and livestock breeds, which have been initially applied in production. Technologies such as biotechnology, new material technology have been used making crop, livestock productivity increased significantly, contributing to effectively address the issue of job creation, hunger eradication and poverty reduction. Many localities have built various models of high-tech based agriculture. According to assessment by Ministry of Agriculture and Rural Development, hi-tech based agriculture in Vietnam can be classified into the following models:

1.1. Agricultural high-tech zone

This type of model is now mainly concentrated in big cities, only in some pioneer provinces such as: Ho Chi Minh City, Hanoi, Hai Phong, Lam Dong, Vinh Phuc... This model is characterized by an state designated area of about 100ha or more, it is designed with different zoning to conduct continuous functions from research to production, processing and introduction of products. The state makes investment in development of a synchronous infrastructure, from general basic infrastructure to infrastructure of each specific functional area, provides specific technology standards and specifies priority products to be developed in the high-tech agriculture zone. Organizations and individuals of all economic sectors have the right to register and invest in the zone for product development.

- Ho Chi Minh City is the leading locality in the construction of a multi-function model of agricultural high-tech application, it links research, technology transfer demonstration with ecological tourism services, at the same time it attracts investment from business sector. The area of 88ha of the zone is supported by the City in the construction of its synchronized infrastructure. The institutional management model of the high-tech agricultural zone in the first phase is income generating, partially self-funding. After a few years of operation, if effective, it will move to a new management model operating as a business-like entity, probably a Joint Stock Company including investors doing business in the area.
- Lam Dong Province is realizing a planning project on high-tech agricultural zone of 300ha in scale in Lac Duong district. The products selected for development in this planned area are breeding of crops with high economic value by using plant tissue culture technology, disease-free seed production, vegetable, high-class flower, medicinal mushroom production. Businesses involved in the production of commodities in the area shall have centralized stock of products and can control product standards, quality, reduce unit costs of investment in infrastructure. They shall be also given a number of preferential policies of the state such as land tax... However, there are still constraints in terms of funding sources for such a large infrastructure development, possible slow capital recovery, these make enterprises having low capital hardly involve in investment in the area.

1.2. Agricultural high-tech application models

These models are normally invested by an enterprise, the scale of investment depends on the enterprise's ability on capital investment and products of the model are mainly products of the enterprise.

This modality has advantages, namely the scale of investment is appropriate to the production and sale capacity of the enterprise.

For example, in Lam Dong province, the Da Lat Hasfarm company produces high-class temperate flowers, in addition to supplying their products for domestic consumption the company also exports to Japan, Singapore, Thailand, Taiwan... Currently, the company owns three farms in Da Lat with an area of 250ha, including more than 41ha of greenhouse, so all kinds of flowers can be produced all year round with high quality.

Furthermore, other models invested by a number of businesses such as hi-tech vegetable, flower production models in Hai Phong and Ho Chi Minh City with modern net, greenhouse system using technology from Israel...

In Nghe An province, the TH Milk Joint Stock Company invested a model of centralized dairy farming and processing at industrial scale and high-tech oriented. The project started in October 2009 and now the cow herd size is over 29,000 heads, out of which 15,500 dairy cows being milked, the average yield reaches 26-28 liters/cow/day and the first stage of construction of the most modern milk processing plant in Southeast Asia, with capacity of 500 million liters/year, was finished. In general, the model of livestock focused on hi-tech application is the form of restructuring the livestock industry itself.

1.3. Agricultural hi-tech application regions

Initially, local authorities have created a number of agricultural high-tech application regions such as high-tech application safe vegetable area in Bac Ninh province; large sample field producing rice for export model, clean catfish farming model in Mekong Delta, the areas of coffee, tea, vegetable production with standard certification by 4C, Utz Kapeh, Organic, GlobalGAP in Lam Dong province.

At present, the Ministry of Agriculture and Rural Development is elaborating a master plan on agricultural hi-tech application areas across the country to be submitted to Prime Minister for approval.

2. Drawbacks and limitations in hi-tech based agricultural development in Vietnam

Besides some results have been achieved, the application of hi-tech in agricultural development in Vietnam still exposes some limitations/constraints, as follows:

- *In respect of technology*: No unified concepts and criteria on high technology in agriculture and its application in agricultural development.

We have just focused on research and application of biotechnology, not on other areas of high technology in service of agricultural production, such as: automation, new material, mechanical technology... Compared with advanced countries in Asia and the world, the level of technologies applied in agriculture in our country is still low and not systematic; we have not created new advanced, appropriate, synchronized technologies; In addition, a number of package of high technology imported from foreign sources was not really appropriate to each ecological region's conditions and the investment level of Vietnam;

- *With respect to human resources:* Though in recent years, the State has paid much attention to human resource development in biotechnology, it is still far from actual requirement. For other high technology areas applied in agriculture, we have neither many specialized S&T personnel, nor S&T manpower equipped with basic training, nor many managers having experience working at existing hi-tech agricultural production areas and hi-tech agricultural enterprises. On the other hand, not enough attention was given to training for technicians in high technologies resulting lack of qualified technicians;
- *Concerning investment and planning:* Although some localities have built by themselves a number of high-tech agricultural zones/ regions we have so far not had a specific master plan on high technology application for agricultural development. The state investment support for building physical facilities for research, application and demonstration of high technology in agriculture in our country is still limited; the investment support in infrastructure development at hi-tech agricultural zones was at a modest level and not synchronized. On the other hand, the investment in infrastructure of hi-tech agricultural zones was at rather high cost that many non-state enterprises could not afford it and hardly accept it;
- *Regarding policies and implementation arrangement:* So far, no specific and synchronized incentive policies to support high technology application in agricultural development, such as land, tax, preferential loan policies...; no multi-disciplinary, multi-sector coordination, especially no linkage between biotechnology with other technologies in the field of high technology application for agricultural development;
- *Market limitations and economic efficiency:* The production of certain agricultural products by high technology application was also small, production costs were high, the market for the products was not stable, competitiveness and economic efficiency of producing some products was low, not correspondent to the level of investment.

3. Some types of high-tech application in agriculture of China

3.1. Enterprise lead model

The type of model is the one in which enterprise is the core player (China called it as "dragon head enterprise"): Internally the enterprise links with production facilities and household farmers to conduct productive activities, externally it links with domestic and overseas markets. Taking advantages of production scale and based on the ability to grasp the market situation, inside and outside the country, and the consumption forecast, the enterprise imports appropriate high technologies, new varieties, new equipment... Then, through technical contracts, service agreements, cooperation under the joint stock modality to attach benefits of stakeholders from the introduction of these technologies into production, and on that basis to implementation and scale up the production of their hi-tech agricultural products.

The advantage of this enterprise lead model is that the enterprise is always placed in the forefront of the market, masters relatively firmly and can forecast development trends of the market which are beneficial to the production and consumption of high tech agricultural products. Disadvantages of this model are the incomplete operational mechanism towards commodity production, risk and benefit sharing mechanism not yet established in a reasonable manner. On the other hand, due to enterprises always pursue maximum profit, many high tech equipment have not, to a full and quickly extent, been studied and utilized.

3.2. Research institution lead model

This type of model lead by research institutions, derived from their willingness to introduce their research results into production and form an industry of their own.

Currently, this type of model is normally realized under two forms: first, the research institution establishes a business entity of their own to carry out the introduction of research results into production; second, the research institution contribute their research results as a share to cooperate with other stakeholders in the production of hi-tech agricultural products.

The advantage of this type of model is a system of relatively abundant research results with less indirect stages. The weakness of this type is lack of experience in business management under the enterprise/market mechanism.

3.3. Government steered model

This type of Government steered model is realized in pursuant to the general development plan to improve the S&T content in agriculture. In this context,

Government provides funding and administrative measures to support the acceleration of commodity production.

The advantage of this type is the involvement of government in those works which need decision for successful scale-up and spreading of hi-tech application into production. The downside of this model is that it often relies too much on government, less flexibility of both sides from the top to the bottom of the system, so it can only be relevant to a part of new agricultural high tech in the process of expansion of its development scale.

3.4. Modern agricultural development zone

This is the type of model which is jointly organized by government, enterprises, associations, household farmers to together build an area with basic and relatively good conditions for agricultural development in the way of forming a high-tech agricultural zone by conducting promotion, advocacy, attraction of businesses having conditions to work in the area, use of business like operating style. Through demonstration, guidance, orientation, training to introduce S&T achievements into production and then proceed with wide spread and expansion of the operation.

The successful construction of a number of agricultural high-tech parks in China has brought about remarkable achievement for the development of modern agriculture, production of new products, contributing to rural economic development and increasing incomes for farmers. For example: In Yunnan province, the Hong Ha high-tech agricultural zone established in 2002 is the national zone in China. Currently, this zone has completed the construction of the core (center) area of 1,200ha, the demonstration area of 5,600ha, the spillover area of 23,000ha, the total area of these completed "three zones" is 29,800ha. To date, the core and demonstration areas have generated a value of approximately 1,803 billion yuan (RMB), cumulative innovative spillover worth 7.3 billion yuan. In Shaanxi province, the national Duong Tuan high-tech agricultural zone chose the modality of combining production, learning and research to create a suitable business environment for the next development phases of S&T enterprises with the aim to enhance the attractiveness of the zone. Accordingly, the Duong Tuan zone attracts universities and research institutes to use their S&T results as equity in investment and cooperates with organizations and individuals to establish S&T companies forming a business community with close links between research institutions and companies, at the same time it creates three S&T demonstrators, namely university-company- high tech agricultural associations and tries to build a new paradigm to promote agro-forestry science and technology.

The advantage of this model is “using outstanding points to attract others”, risk screening, the drawback of this is the participation of government, research institutions, enterprises, production units, household farmers and the quality of fund mobilization... will directly affect the development and effectiveness of the zone.

Experience from development models in Yunnan, Shaanxi provinces shows that in order to make high tech agricultural zones efficient, the role of government should focus on the completion of physical conditions of the zone, promote the influence of modern technologies; attract and foster new series of industry; improve the operation mechanism of the zone; promote the advantage of major products of each zone; be a model for sustainable agriculture development and protection of natural resources and environment; actively promote the implementation of “locomotive” strategy; enhanced brand of each zone.

3.5. Universal agricultural association model

This type of model is led by Agricultural Technical Associations based on specific characteristics of the agricultural sector and specific situation of the region, through the association to attract advanced technologies and introduce them into practical production. The advantage of this model is that the solution provided tends to be more specific, practical and effective as it relies on the association’s analysis on the characteristics of each product and its corresponding market. Furthermore, the form of capital accumulation, risk sharing also helps improve the efficiency of the work of high technology transfer. The shortcoming of this type is the too scattered internal link, no timely and effective management existed, this drawback, as a result, has prevented the development trend of production of hi-tech agricultural products.

3.6. Some experiences of China

In spite of many points need to be improved, hi-tech application in agriculture in China basically has contributed partly to increase knowledge and skills in the production of agricultural products for society, in terms of both quantity and quality. The following are initial lessons learnt that we can draw:

a, Improved organizational structure of high-tech agriculture zones

The process of formation and development of high-tech agricultural zones is also the process of completion of their organizational structure. Presently, the organizational structure of a state-level high-tech agricultural zone of

China often includes the central/ nucleus area, the demonstration area and the spillover area.

- *Nucleus area* is the core subject of the high-tech agricultural zone in which it integrates all elements (technology, human resources, information, business incubation and dissemination of results, technical training and socialized services). It is the core source to diffuse/spread out its effects to outside the high-tech agricultural zone.
- *Demonstration area* is the production of commercialized agricultural products of the zone, the experimental base of agricultural S&T results, transforming such results through the adaptation of new technologies, new breeds, undertaking production according to standards. It is the main transformer of the high-tech agricultural zone, the target subject of the nuclear area, the place for farmers to be able to see, learn and thoroughly familiarize with the conditions required for producing agricultural commodities.
- *The spillover area* is a place to produce goods, mainly for new technologies from the nucleus, demonstration areas to reach farmers and spread out to surrounding areas. These new techniques and technologies will be diffused from the center area to the demonstration and spillover areas in a sequential order. It can be said that the spill-over area is the main place to produce hi-tech agricultural products, where businesses organize farmers to promote the production of commercialized agricultural products as well as a training place, improved scientific and technological knowledge, production management level for farmers towards industrialization direction (Duong Ky Truong, 2011).

b, Empowerment of agricultural S&T enterprises and fostering their participation in hi-tech agricultural zones

Currently, China has identified the main subjects involved in technology development, innovation and production, i.e, enterprises, companies. They are direct subjects in making contact with, organization for and giving guidance in terms of quantity, quality and timing to farmers with respect to the application of new technologies to produce agricultural products. In high-tech agricultural zones, they often receive support of professional agencies the zone to deal with procedures (banking, access to capital, legal, administrative, land, taxation, customs procedures, etc.) to ensure that production process, the link with farmers and S&T institutions, sale of agricultural products be in good order.

c, Promulgation and enforcement of preferential policies for farmers and hi-tech agricultural enterprises

China bears in mind that it is essential and inevitable trend to meet the demand of food for a nation of 22% of the world population with a cultivated land area of only 7% of the world's arable land, the application of high technology in agriculture to rapidly increase agricultural outputs, satisfying food need of over 1.3 billion inhabitants, ensuring social stability, creating products for export, raising farmers' income, filling the gap between rich and poor in urban and rural areas. Therefore, the Chinese government has issued many policies and measures to create favorable conditions for enterprises and farmers to engage in agricultural production and apply high technology in agricultural production, for example: increased investment in research and popularization/dissemination of S&T knowledge, well prepared planning of agricultural production, building infrastructure for agricultural production (particularly infrastructure of irrigation, plant and livestock breeding, construction of technical facilities for inspection and quality control of agricultural products, and incentives measures given to support farmers to access to agricultural machinery and mechanization...), facilitating access to information and legal issues to explore agricultural markets, making direct investment to encourage farmers to develop agricultural production per head of livestock or area of cultivated land,...

In general, high technology application in agriculture in China has an important impact on solving the "three agricultural concerns" (Tam Nong), i.e, improved life in rural areas, promoting the process of agriculture restructuring and increased income of farmers. Hi-tech agricultural zones under different models with corresponding operational mechanisms have helped to make business incubators, with S&T results, become important places to undertake the creative and start-up chain, enhance the use of S&T achievements in agricultural production, building new rural areas and agricultural regions producing commercialized commodities to develop a modern agriculture. The models of high-tech agricultural zones have been applied and implemented in most provinces/cities in China. Successful models are those which bring benefits for both producers (farmers) and enterprises. The establishment of a model should be need oriented and follow the principle: *“Directed by Government, operated by business, assisted by broker agency, benefited by farmers”*. It can be seen that the models of hi-tech application in agriculture in China is relatively close to the model being established and developed in Vietnam. Experience in institutional, special and linkage arrangement, as well as the intervention of public service providers in the models of hi-tech agricultural zone in Yunnan, Shaanxi, Beijing, Shandong provinces, is a good lesson for the shaping, replicating and developing high-tech agricultural zones in Vietnam.

Agricultural development based on high-tech application in general and specifically in the construction of high-tech agricultural zones, in particular being undertaken in China is of a very diversified form. Successes and failures drawn from the models of hi-tech agricultural zone in China shall be a valuable lesson for the development of relevant policies and mechanisms to promote effective models of high-tech agricultural zones of Vietnam.

4. Some lessons learnt for Vietnam in high tech application for agricultural development

As it can be seen, over the past two decades of building, learning experience and improvement, China has so far set up a relatively complete network of different types of agricultural high-tech application model nationwide with the specific stakeholders involved in investment, production, specific scale, scope of development depending on specific conditions of each region. The formation and development of agricultural high-tech application models in China has contributed to raising the level and quality of technology, providing significant volume of quality agricultural products for society. With geographic conditions, socio-economic characteristics and production practices relatively similar to Vietnam, it is expected that the experience of China in the development of high-tech agriculture will be a good lesson for shaping, replicating and developing high tech agricultural zones in Vietnam.

Along with the development of crops, livestock, forestry and fisheries, the living condition of farmers and the picture of rural economy has experienced big changes. Many household farmers in coffee, rubber, pepper growing regions, dairy farmers have achieved a better living standard. Socio-economic infrastructure in rural areas has been developed, many rural communes have now durable connecting roads, enough clinics, market places... Farmers are also supplied with clean water, can access to modern information and communication technology, as well as more convenient access to health, education services. Especially, the deployment of Resolution 7 of the Party at its X session on agriculture, farmers and rural areas has brought about many improvements in rural areas in our country creating a change of farmers' thinking on production, as well as a change in perception of government authorities at different level on the role of rural areas and agriculture in the local socio-economic development.

However, the efficiency of land use, the labor productivity is still too low and uneven. Additionally, apart from large specialized areas of commodity production the majority are small household producers of micro and small size using backward technologies, low commodity margin. In reality, the

gap between rich-poor, urban-rural, plain- mountain regions, rice-industrial crops growing-aquaculture areas is increasingly larger. Funding for research and application of science and technology in agriculture is still very limited and fragmented, not yet focused on the goal to establish an optimum value-added chain from research to final product.

In reality, our agriculture is still in the stage of small production, the content of science and technology in products is low compared to other countries in the region, export products are less competitive in the world market, low value-added to products. Especially, the participation of enterprises in projects of hi-tech agricultural products is limited. The linkage among 4 stakeholders (government, farmers, scientists and businesses) is not really close. Agriculture is the sector receiving low investment density and not so attractive to local and foreign investors. So, what measures should be taken to help bring agriculture into a large productive sector of commercial goods, attract funds from society instead of primarily relying on the investment of government as it is now.

Industrialization and modernization in agriculture and rural development also means more and more application of hi-tech, modern equipment in agricultural production. To go along with this direction, we should have entrepreneurs with enough conscience-mind-strength and highly qualified farmers. It also needs to pay attention to a proper policy system to encourage and protect entrepreneurs, farmers who are willing to produce agricultural products using high-technologies.

Nevertheless, in order for high-tech agricultural zones to promote their efficiency, in addition to natural preferential conditions, it also requires some necessary and sufficient conditions, as follows:

- It needs to develop and implement a human resources development plan, in terms of both quantity and quality, in the field of high-tech agriculture; establish links between training and R&D. Formation and development of S&T enterprises in production, business and services in high technology application in agriculture, focused synchronized investment in technical infrastructure for experimental areas related to selected fields of high-tech agriculture; it should have mechanisms and policies to attract every economic sectors, scientific enterprises to make investment in technological innovation and application of high technology for agricultural production; strengthen the cooperation between local and international institutions in the application of high tech for producing high-tech agricultural products.
- In order to promote the construction of a modern agriculture, narrow the gap compared with developed countries, especially in the current context

of integration, the development of high-tech agricultural zone is necessary. High-tech agricultural zones will play the role as a "locomotive", paving the way for the rapid introduction of scientific and technical progresses in agricultural production and the transformation of traditional agriculture, promote agricultural development towards rural modernization. High-tech agricultural zones shall support for the achievement of long-term objectives of agricultural development of the country, that is to form a commercial agriculture with high competitiveness in domestic and export market based on advantages of human and natural resources combined with the application of advanced S&T achievements. Thus, the high-tech processes need to be synchronized throughout the supply chain, the core task of high technology is to provide high quality products with large production scale, quality of product must satisfy three requirements with regard to technical aspect, function and services involved. High technology is only effective when conducting production at industrial scale and therefore it needs to establish centralized farms, link resources to get an appropriate financial scale and conditions for large production.

5. Conclusion

1. Development of high-tech agriculture is an inevitable trend of developed countries in the world to improve productivity, product quality and achieve high economic efficiency;
2. Hi-tech based agriculture has been developed in Vietnam in many fields and in many different localities, and achieved certain results. Some hi-tech agricultural production models have been built recently in the country, form a new direction in agriculture production practice towards higher productivity, economic efficiency, better product quality, food safety, compared with traditional farming methods;
3. In the condition the value of agricultural outputs account for a large share of the total national income, the development of hi-tech agricultural zones is essential and of urgent task, it needs to be synchronized from making investment in infrastructure, manpower empowerment to management work with a view to develop production zones applying hi-tech in a sustainable, eco-environmental safety manner;
4. There should be participation, close association of scientists, managers, producers and entrepreneurs in the construction and development of high-tech agriculture zones;

5. The agricultural sector of our country today and in the future always is an important economic sector of the national economy. Thus, agricultural development based on the application of high technology requires the implementation of multiple synchronized solutions from different dimensions, such as management, economic and technical requirements, ecological environment protection towards a stable and sustainable development./.

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