

## **DRIVING FORCES FOR SCIENCE AND TECHNOLOGY DEVELOPMENT - VISION FROM AGRICULTURAL SECTOR**

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***Abstract:***

*Science and technology (S&T), with large contributions to agricultural growths in recent time, is considered as breakthrough move in agricultural production. Even with exceptional growths during more than 30 years, Vietnam agriculture really did not develop as its potentials and advantages could make. The question is what to do to make S&T develop and produce more contributions to Vietnam agriculture. This paper shares some solutions of driving nature for S&T development in this sector.*

***Keywords:*** *Science and technology in agriculture; Driving forces for development.*

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### **1. Actual status of science and technology in agriculture of Vietnam**

#### ***1.1. Remarkable achievements of science and technology in agriculture***

During more than 30 years, S&T made considerable contributions to agriculture growths of Vietnam. It could not only meet domestic consumption needs but also export ones. Actually the export volume of agricultural, silvicultural and aquacultural products comes up to USD28.74 billion with USD10 billions of export surplus (figures of 2013). Some commodities pass the level of USD1 billions of export volume<sup>1</sup>. In 2001-2010, S&T was estimated to have made contributions of 35% of the total growths of agriculture sector, 30-50% of increased values of agricultural products [3]. It also contributed to increase the competitiveness of agricultural products.

Some achievements can be listed such as many varieties of high quality and productivity were developed and applied in production. Namely, rice varieties of 6.5 ton/hectare per crop, corn varieties of 12 ton/hectare per crop, mango varieties of 14 ton/hectare, Holstein Friesian cows of 6,500-

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<sup>1</sup> They include: rice (USD3 billions), rubber (USD2.5 billions), coffee (USD2.7 billions), aquatic products (USD6.7 billions), wood products (USD5.5 billions) and etc. Source: [Http://chinphu.vn](http://chinphu.vn). Socio-Economic Report by the Government, 2013.

7,600 kg of milk per milking cycle (1.5-2 times more than traditional local ones). New technological procedures were studied and applied and they permitted to increase 7-10% of productivity of raised animals. Considerable achievements were made in silvicultural fields, particularly in development of production of new species. More than 90% of cultivated varieties come from scientific research results. Some varieties of hybrid wattles of high quality and productivity such as BV10, BV16, BV32 were exported to China, Thailand, Malaysia, Indonesia and Australia not only for forest cultivation service but also for breeding purpose. Remarkable achievements were made also in aqua-cultural fields. Namely, some technologies of artificial breeding and commercial production were developed for new 30 varieties with high genetic quality and high growth rates. This contributed to diversify aquacultural production and to achieve high values of aquacultural products<sup>2</sup>. High attentions and focused investments were made for applied research of high techs in agriculture. Namely, genetic technologies, molecule indicator technologies and cell technologies were studied and applied for selection and fast production of plants and animals of high quality. Micro-biological and recombinant technologies were developed to produce biomasses and other products for plant protection, fertilizers, soil quality improvement, waste water treatment, use of agricultural by-products and waste. Many researches for application and localization of high techs were conducted and transferred to practical use. They contributed to enhance values and quality of products, productivity rate and to diversify domestic products<sup>3</sup>.

## ***1.2. Some problems and limitations***

*1.2.1.* Financial investments for S&T in agriculture remain much lower than required. Investments are still largely dispersed and then cannot make technological breakthrough steps. Annual budget for scientific research in agriculture of the whole country is VND1,500 billion (about USD70 millions). S&T tasks of provincial level (including 63 cities and provinces) have annual budgets of about USD30 million. Averagely, every S&T task, even of State level, has a budget of VND3.8 - 4 billion, and the ones of ministerial and provincial levels are very much lower. Despite increasing trends of investments for agriculture, the global shares of investments for

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<sup>2</sup> Including many varieties of fishes, sea crabs, sweet snails, sea slug and etc.

<sup>3</sup> Turnovers of TH - TrueMilk Corporation in 2012 were more than VND2,000 billions. It put targets of VND15,000 billion by 2015 and VND23,000 billion by 2017. 1 hectare of cultivation land used by TrueMilk makes a value of VND500-1,500 million which is much higher than the traditional one of VND70-80 millions. Agrivina - Dalat Hasfarm®, established since late years of 1990 produced about 100 millions of flower units by 2010 where 70% of products were exported to Japan, Australia, Singapore, Taiwan and Indonesia.

agriculture produce much lower rates of contributions to GDP growths and these rates are much lower than the ones of other countries in the region<sup>4</sup>. Actually, the total investments for agriculture and farmers can meet only 55%-60% of needs [2].

Since 2005, GDP shares of agriculture sector remain about 20% but the investment rates experience decreasing trends to the annual level of 5.98% (figures of 2011). FDI rates for agriculture remain also very low (making only 0.61% of the total FDI volume in 2012). The same situation was for non-State-budget sources of investment. There was no effective solutions to mobilize investment sources from enterprises for this sector. Some problems remain yet, namely: incentive measures to encourage them to make investments for agriculture are not found enough attractive, credit supports for agriculture sector and rural areas do not meet needs and access to loans remain difficult for producers. In addition, supports to cover risks and hazards in agricultural productions (including disasters, price falls and others) do not get adequate attention. Note that agricultural developed countries pay particular attentions by Governments to this matter. In USA, for example, the Government provides farmers with 60% of insurance costs of agricultural risks (USD5 billion) and 85% of farmers buy agricultural insurances. Also in China, the Government makes investments support market development which increase from USD300 million by 2007 to USD850 million by 2009 [10]. Short global investments for agriculture sector lead to the low rate of investment for S&T development in agriculture. It is clearly seen through out-of-date research infrastructure which causes big impacts to quality of research projects, particularly of the ones for high techs.

*1.2.2. S&T management mechanism remains heavily administrative, supportive and out-of-date. Many problems still exist, namely: management works remain focused mainly on financial management operations, no particular attentions are paid to quality of research results, research tasks are not linked to development needs of the sector and commercial market needs, no mechanisms exist to fix the liabilities of transfer of technical production advances in State-budget provided research tasks, complex financial procedures are applied for S&T research activities, and economic-technical norms remain out-of-date.*

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<sup>4</sup> According to Report of Vietnam Agriculture Development Master Plan up to 2020 and Visions to 2030, the allocation of State investment budgets for agriculture is about 1.4% of the total GDP which is lower than the average rate of 8-16% of China, India and Thailand, and 8-9% of other South-East Asia countries. Note that the GDP contributions of agriculture sector make 20.9% while the total social investments for agriculture make a share of only 2.85% of total GDP.

The implementation of self-governance mechanism for public research institutes according to Resolution No. 115/ND-CP experienced some fall shorts since Vietnam agriculture remains in small-scale structure of household production. This situation made impossible to offer adequate research tasks, particularly in certain fields such as fruit trees, rice cultivation, etc. Some research results, even if produced, turned out to be impossible for transfer. The Resolution also did not make clear some indications such as salaries, taxations, benefit sharing scheme etc. In addition, the merging process of many research institutes into Vietnam Academy of Agriculture Science (VAAS) (which reduced the number of research institutes from 23 in 2005 to 11 in 2012) without clear indication of coordination mechanisms made appear new administrative formalities. This unclear situation caused also impacts to self-governance mechanism of institute-members, namely more complex formalities in international cooperation, selection of S&T research tasks, research contract bidding formalities etc.

1.2.3. The S&T organizational system and human resources in S&T organizations show certain fall shorts. Despite big number of universities and research institutes in agriculture sector, there was no adequate system to make them meet development needs of the sector. Some research institutes of regional scale were not mobilized effectively for development of mass production of agricultural goods. Despite big number of scientific staffs (more than 10 thousand), their research capacities exhibit certain limitations<sup>5</sup> such as low number of qualified research staff, young researchers, leading experts (caused by low quality training of human resources) and absence of incentive mechanisms to attract, to use and to honor young talents and qualified researchers in agriculture sector. Despite big investments for extending and upgrading of research infrastructure, majority of equipment remain incomplete, out-of-date and non-integrated, then cannot meet needs of research works. Some research institutes were provided with modern research equipment but they do not use them effectively<sup>6</sup>. These factors remain important reasons leading to "brain drains" in agriculture sector, namely shifts of many properly trained and

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<sup>5</sup> Total S&T staff in agriculture sector, including teaching, research and technology transfer activities, are 10,895 persons. The S&T staff working in 11 S&T organizations under management of Ministry of Agriculture and Rural Development (MARD) are 7,934 persons, among them 4,861 persons get their salaries from State budget (making 58.54%).

<sup>6</sup> Actually, 3 national key agricultural laboratories started operation (namely the laboratories of plant cells, animal cells and river/marine dynamics). Investment volume of VND50-55 billion was made for each of these laboratories but the efficiency of use of these laboratories is not high. Limited finances for operation and maintenance of these laboratories cause also other problems.

highly qualified experts to enterprises where they are provided with better working environment.

1.2.4. Actually, we do not have S&T tasks defined for middle and long terms and practical applications of research results get delayed. The definition of research tasks remains still based on subjective considerations rather than on studies of forecast scenarios, social needs and market surveys (naturally these problems cannot be solved solely by agriculture sector factors). Plans of agricultural S&T research still lack not only global strategies for individual fields but also deeply specialized studies for single products. Even if plans are set up, it is difficult to say that research tasks get structured reasonably. In many cases, resources for implementation are divided ineffectively among segmented tasks without defining clearly links between research tasks and practical implementation steps<sup>7</sup>. In fact, big part of research works is focused on studies for seeds and cultivation procedures but not for deep studies of processing techniques and added values of products. Many S&T research tasks and projects, after having passed acceptance formality, cannot be applied in practice because of limited financial sources. Regional research institutes do not exhibit their role in solving global problems and other directly assigned tasks<sup>8</sup>. They lack market studies and production models as backgrounds to develop agricultural policies of regional scale. Agricultural promotional activities remains spread largely which lead to lax links between S&T research, transfer and practical application fields.

1.2.5. Commercialization of agricultural S&T research results face difficult problems caused by low technological level in many production fields, namely: considerable losses in production process, outdate post-harvest equipment and technologies, under-developed and small-scale infrastructure of processing and storing facilities, low quality and safety level of products.

From another side, there exist some objective reasons of this situation. In fact, majority of agricultural research works have to pass tough trials, tests and inspections before being applied. These formalities, as rules, last long and are accompanied with hidden risks of failure. Some of S&T research results cannot be commercially transferred since they are of public service

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<sup>7</sup> For example, in Research Institute of Agricultural Genetics, State budget of VND37 million per year is granted by person which is not enough for monthly salary of VND4 million per researcher and naturally there is no budget for operation costs. *Source: <http://www.tiasang.com.vn>, on 23 January 2014.*

<sup>8</sup> For example, Mekong Delta Research Institute of Rice proposes averagely 40-50 research tasks every year but only minor part of them get approved with the annual budget only of VND7-10 billion allocated. Also, assigned tasks are of short term nature, then problems of practical needs of the region cannot be solved. *Source: see [7].*

nature. Other disadvantages such as natural disasters, bad weather conditions and low attractive policies for agricultural credits do not attract investments from enterprises for agriculture sector.

1.2.6. Low incomes of farmers and small production scale do not lead to high attentions of investments for application of technical advances. Many high efficient research results cannot be applied and transferred because of high costs farmers cannot afford. The violation of Intellectual property right remains large because of lack of effective preventive measures.

1.2.7. Exodus to urban areas raises the trends to get away from agricultural production activities. This leads to reduction of needs for investments and application of S&T advances. Surveys by General Department of Statistics in 2009 show that 16% of urban population (3.8 million people) are migrants from rural areas and this trend has a growth rate of 8.9% per year. The rate of 11% (6.4 million persons) is forecast for 2019<sup>9</sup>.

1.2.8. Vocational training works for rural areas get attentions but they are not conducted effectively. During 3 years of implementation of the vocational training project for rural labors (from 2010 to 2012)<sup>10</sup>, only 1,088,393 labors were trained (making 16.64% of the total number of rural labors). Among them, 78.9% of trained labors get new jobs, 44% remain in agriculture sector and 56% get non-agricultural jobs. This causes also impacts to application of agricultural technical advances.

## **2. Optimal choice for science and technology development in agriculture in Vietnam**

We had set up the Master plan of agriculture production development of Vietnam<sup>11</sup> and Strategies of S&T development of Vietnam, 2011-2020 period<sup>12</sup>. However, we experience some “embarrassments” when we set up concrete measures to implement the Strategies and Master plan for regions and provinces, particularly when we start TPP negotiations. Here, two aspects should get special attentions to turn S&T to direct production forces and to make them a solid background for agricultural development, namely:

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<sup>9</sup> It is the average statistical figure collected during 2004-2009 period. *Source: General Department of Statistics. Migration and urbanization in Vietnam.*

<sup>10</sup> The project was set up with Decision No. 1956/QĐ-TTg dated 27<sup>th</sup> November 2009 by Prime Minister on approval of the project “Vocational training for rural labors, up to 2020”.

<sup>11</sup> Issued according to Decision No. 124/QĐ-TTg dated 02<sup>nd</sup> February 2012 by Prime Minister on approval of Master plan of agricultural production development, up to 2020 and visions to 2030.

<sup>12</sup> Issued according to Decision No. 418/QĐ-TTg dated 11<sup>th</sup> April 2012 by Prime Minister on approval of Strategies of S&T development, 2011 - 2020 period.

*changes of mindset toward agriculture and organization of agricultural production.*

### **2.1. Changes of mindset toward agriculture**

Actually, when evaluating the role of agriculture, we see only the number of 20% of GDP contributions from agriculture sector. Other values such as eco environmental, cultural and social ones were not taken into consideration.

Therefore, investments for agriculture do not correspond to the values it brings back. Low investments without being coupled with incentive measures and mechanisms are factors to block the development of agricultural production and many other activities in this sector such as investments by enterprises, commercialization of products, application of S&T advances and etc.

We do export of some leading products of Vietnam (rice and aquatic products), as raw materials in some cases, without considering the world market needs, structure of export goods and produced values per cultivated land unit. This situation, sometimes, makes us sell products with prices lower than production costs. We can see it clearly through the following table.

**Table 1.** Export of some agricultural products of Vietnam

Items	World import market, 2010 (Unit: USD mill.)	Vietnam export (Unit: USD mill.)				
		2006	2009	2010	2011	2012
Fruits, vegetables	97,900.226	300	420	411.500	515	770
Flower	25,000	10	14.200	60	60	-
Rice	16,818.180	1,489.970	2,600	3,230	3,700	3,700
Coffee	7,548.041	1,911.463	1,800	1,670	2,300	3,740
Rubber	7,488.707	1,400	1,200	2,320	2,700	2,850
Tea	4,369.975	130,833	180	200	182	243
Cashew	1,719.352	653.863	850	1,140	1,400	1,480
Cassava	-	-	-	-	815	1,312.020
Pepper	1,761.3636	271.011	13,328	390	775	802

Source: Nguyen Quoc Vong. (2014) Two weak points of Vietnam agriculture. Magazine Tia Sang. No. 8, 20<sup>th</sup> April 2014.

The structure of export goods in Table 1 shows that Vietnam exports of rice, coffee and tea make considerable part of the world import market (19.2% for rice, 22.1% for coffee, 30.9% for rubber, 66.3% for cashew and 22.1% for pepper). These items require much natural resources and agricultural production materials. Inversely, exports of fruits, vegetables and flowers make minor parts (0.42% for fruits and vegetables, 0.2% for flowers). In world import market structure, fruits, vegetables and flowers make big shares (volume of fruits and vegetables is 6 times higher than the one of rice, volume of flowers is 1.5 times higher than rice). In this context of production and export structure, it is not good that S&T research tasks actually remain focused on “traditional ruts” to promote production of rice, coffee, pepper and cashew. We need to conduct studies to develop new commodities of higher economic values in lines with Vietnam advantages. We need to identify also new market segments which do not yet get attentions of international market. Forecast of market fluctuations and impacts from weathers are also found important.

## ***2.2. Organization of agricultural production***

During long years, Vietnam continues practice of small-scale organization of agricultural production (household). Farming, collective forms of production and production services remain under-developed with limited use of production materials (averagely 0.3 hectare of cultivation land per household). Main agricultural materials, namely animal foods and fertilizers, need to import yet. Distribution service of products remains weak. As results, we do not establish stable material supplying regions for large-scale production where we can do intensive investments, technological applications and higher added values of products. Small-scale production leads to low effectiveness since production processes are not controlled. “Good harvests, bad prices” are repeated practices. Incomes of agricultural production do not get improved and remain much lower than other sectors. After 30 years of “Doi Moi”, the agricultural production process remains unchanged in key rice production regions. Mechanization and automation of production process remain long-distanced practice for majority of farmers. Too tough working conditions and low incomes make rural labors get away from agricultural production. Many of them leave lands for searching better chances for their own life and a better future for their children.

The organization of agricultural production is not well oriented. State supports are not regularly provided and carefully based on market needs.



Farmers face too many worries: which plants to cultivate, which animals to raise, what to invest their limited moneys for, where to store harvests, when and with which price to sell products etc. They have to do all of these themselves.

Another weak point in agricultural production is the problem of “segmented and isolated” shares of State management duties among lines ministries and authority agencies. Everyone controls his “scope of charges”, namely production materials (lands, irrigation water), product control (raw products, processed products) and market development are under charge of industry-trade sector, loans and credits are under charge of finance sector, application of science and technologies are under charge of agriculture and S&T sectors. Then, issued policies are not integrated and cannot provide appropriate supports for farmers (for example, farmers face difficult access to financial support credits for development of production infrastructure such as drying yards and storing facilities). Studies of developed agricultures such as USA, Netherlands and others show that, for example, USA Ministry of Agriculture and Dutch Ministry of Economy and Innovations are authorities to make policies. They do not only policies and regulations for development orientations, production organization and product standards but also run agencies to provide researches of commercial promotions for every sector of products, and, from another side, vocational associations are to provide properly technical consultations and market information. Then farmers need only to do well their cultivation jobs and to produce quality products.

In Vietnam there exist situations where S&T tasks are set up and implemented with State budget supports but the results produced from these tasks are low applicable. It means that the definition of S&T tasks was not correctly done to meet market demands. In practice, market forecast of material supply sources, material prices, selling prices and agricultural-social surveys cannot be used as backgrounds for policy making authorities. This limits also effectiveness of investments and application of S&T advances in agricultural production.

Therefore, the optimal option for S&T development in agriculture needs to be focused on research *for exploitation of non-agricultural values, market forecast, reasonable structure of plants and animals to produce on basis of Vietnam advantages, and agricultural production organization should be based on value chains and market demands.*

### **3. Creation of driving forces for S&T development in agriculture**

**3.1.** First of all, it is needed to get more global visions to agriculture sector and changes of investment structure for agriculture. Actually, we keep a simple concept that agriculture is a sector to produce substantial values to feed population, without taking other values to consideration<sup>13</sup>. As results, State investment sources for agriculture sector are focused simply on improvement of production processes without paying attention to other aspects such as rural environment, forests and seas. In future, agriculture needs to become a focus of State investment structure because 70% of population live in rural areas and 47.5% of population work in agriculture sector. Together with that, it is needed to increase State investment budget for research and technological transfer in agriculture sector. The top research priority is for problems of organization of agricultural production, market forecast, value chains of strategically important agricultural products, application of bio technologies and high techs for creation and selection of new varieties of good quality, mechanization of agricultural production processes (including food processing and storing technologies, construction of high tech zones in key important regions for better scaling up of production levels. It is needed also to attract FDI and non-State investment sources through credit mechanisms and agricultural insurances. Part of incomes from export of key agricultural products should be used for research of breakthrough measures in this sector.

**3.2.** It is needed to change the actual practice of definition of S&T tasks in agriculture. Research tasks need to be re-oriented to explore more “multi-values of agricultural production” as it is analysed in Section 2. S&T research needs to be focused on evaluation of these advantages which would be backgrounds for agricultural policy making process, investments for these values, creations of jobs and improvement of living and working conditions of farmers. S&T research needs also to be focused on restructuring of agricultural products on basis of market demands [1]. Agricultural policy making process needs to be based on scientific research results.

**3.3.** It is needed to change S&T management mechanism, shifting it from task based management to product order-contract based management. In the new management mechanism, administrative formalities should be reduced

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<sup>13</sup> Actually, in some locations, such as Ba Vi, Gia Lam, Da Lat and Mekong Delta region, eco-tourism service starts develop. Visitors have chances to see fruit cultivation areas and farms, and have a closer vision to rural working environment or practice farmers works. Part of incomes from eco-tourism is re-invested for production development.

and simplified, and management of outputs of S&T tasks should be tougher. S&T financial management should be kept in pace with agricultural production cycles and crop seasons. Definitions of S&T tasks should be extended to middle-term and long-term plans and be based on actual analysis works.

**3.4.** System of S&T organizations in agriculture sector should be improved. They need to meet requirements put down from an agricultural economy to produce commercial products in large scale. Key agricultural regions should have S&T clusters set up from universities and regional research institutes and then develop high tech zones, technological incubators and vocational training centers.

**3.5.** It is needed to conduct commercial promotion of Vietnam agricultural products and their trademarks<sup>14</sup>, to enhance S&T international cooperation and exchanges of regional and international market information for key important agricultural products.

Also the following measures are needed to develop S&T in agriculture: i) Establishing labor market in S&T activities for better management of S&T human resources, using effectively S&T human resources and research infrastructure; ii) Issuing incentive offers for qualified scientists and high tech training priorities in agricultural S&T fields, providing investments and mobilizing university staffs for research and technological transfer in agriculture sector and rural development, iii) Issuing policies of proper land use for agricultural production to meet requirements of large scale production, issuing adequate finance and credit mechanisms to attract non-State investment sources to establish favorable environment for research and application of S&T advances./.

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<sup>14</sup> For example, in field of rice export, India promotes only for Basmati variety, and Thailand allocates a budget of USD5 millions per year to promote Jasmine variety. Therefore they have a rice export price higher than the one of Vietnam. Note that Vietnam has more than 200 commercial varieties of rice and is World second rice exporter but Vietnam has no trademark of export rice.

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