INDUSTRIAL REVOLUTION 4.0 WITH HUMAN RESOURCES DEVELOPMENT OF THAI NGUYEN HIGH-TECH AGRICULTURE

Pham Thi Minh Nguyet[*], Duong Thu Ha
Nong Thi Phuong Thu, Nguyen Thi Thanh Tham
Thai Nguyen College of Economics and Finance

ABSTRACT

Development of high-tech agriculture is an inevitable trend of agricultural production in Vietnam in generally and Thai Nguyen province in particularly. Thai Nguyen is the central province of the Northern Midlands and Mountain, Thai Nguyen has abundant natural conditions and natural resources for economic development, especially, the development of agriculture. However, for Thai Nguyen agriculture sector to develop sustainably, in addition to scientific and technological progress, Human resources as capable of applying scientific and technological achievements in agricultural production are an important factor. The article reviews the general situation of human resources in Thai Nguyen. The article proposes some solutions to increase the number and improve the quality of human resources towards developing high-tech agriculture.

Keywords: *Human resources; High-tech agriculture; Human resources in agriculture; Thai Nguyen province; Industrial revolution 4.0.*

CUỘC CÁCH MẠNG CÔNG NGHIỆP 4.0 VỚI PHÁT TRIỂN NHÂN LỰC NÔNG NGHIỆP CÔNG NGHỆ CAO TỈNH THÁI NGUYÊN

Phạm Thị Minh Nguyệt[*], Dương Thu Hà
Nông Thị Phương Thu, Nguyễn Thị Thanh Thắm
Trường Cao đẳng Kinh tế - Tài chính Thái Nguyên

TÓM TẮT

Phát triển ngành nông nghiệp công nghệ cao là xu thế tất yếu của sản xuất nông nghiệp Việt Nam nói chung và của tỉnh Thái Nguyên nói riêng. Thái Nguyên là tỉnh trung tâm của vùng Trung du và Miền núi phía Bắc, có điều kiện tự nhiên và tài nguyên thiên nhiên phong phú để phát triển kinh tế, đặc biệt là phát triển ngành nông nghiệp. Tuy nhiên, để ngành này phát triển bền vững, ngoài tiến bộ khoa học công nghệ thì nguồn nhân lực đủ khả năng ứng dụng thành tựu khoa học công nghệ vào sản xuất nông nghiệp là một yếu tố quan trọng. Bài viết đánh giá chung về thực trạng nguồn nhân lực ở Thái Nguyên và đề xuất một số giải pháp để tăng số lượng và nâng cao chất lượng nguồn nhân lực hướng tới phát triển nông nghiệp công nghệ cao.

Từ khóa: *nhân lực; nông nghiệp công nghệ cao; nhân lực nông nghiệp; tỉnh Thái Nguyên; cuộc cách mạng công nghiệp 4.0.*

1. Introduction

The Fourth Industrial Revolution is changing profoundly economic and social life, including agriculture. Accessing and applying high-tech scientific achievements requires Vietnam to vigorously renew the human resource training programs in the direction of the social need, moreover, innovating content and creating methods, enhancing comprehensiveness and association.

Development of high-tech agriculture is an inevitable trend of agricultural production in Vietnam in generally and Thai Nguyen agricultural sector in particularly. Thai Nguyen is the center of the Northern Midlands and Mountains region of Vietnam, which has abundant natural conditions and natural resources for economic development, especially as agricultural development. However, for developing sustainably, in addition to scientific and technological progress, human resources that are capable of applying scientific and technological achievements into agricultural production have become an important factor.

With the pervasiveness of industrial revolution 4.0, high-tech agricultural human resources in high-tech agricultural becomes a productive force with deep expertise in applied research and transfer skills; management professional; capacity to receive and mastering technology for application and production development. Training and improving the quality of human resources in agriculture are important for agricultural development as well as for the development of the entire economy. In response to the needs of the new economic trend, with the importance of labor resources, important production forces of society, the authors carried out analysis methodology that is the secondary data collected method. The study used Thai Nguyen Statistical Yearbook from 2013 to 2018, the other related reports and summaries of Thai Nguyen Provincial Committee, specialized state's departments in Thai Nguyen, reports of Vietnam General Statistics Office and so on, assessing the actual situation of high-tech agricultural human resources in Thai Nguyen. Thenceforth, the authors proposed a number of solutions to improve the quantity and quality of human resources towards high-tech agricultural development before industrial revolution 4.0.

2. High-tech agricultural human resources in industrial revolution 4.0

2.1. Industrial revolution 4.0

According to Mr. Klaus Schwab, Chairman of the World Economic Forum, Industrial revolution 4.0 is a term that includes a variety of modern automation technologies, data exchange and manufacturing along with physical systems in cyberspace, Internet of things (IoT) and internet of services (IoS). Industrial revolution 4.0 is based on digital technology platform and integrates all intelligent technologies to optimize processes and production methods; emphasizing the technologies that are and will have the biggest impact are virtual technology, biotechnology, new material technology, automation technology, robots... Industrial revolution 4.0 based on internet connect usage, everything to transform the entire real world into a digital world. This revolution has a strong impact on the world and all economic sectors with the unprecedented breakthrough technology, including breakthrough in the agricultural sector. Vietnam is deeply integrated into the world economy; Vietnam economy is developing with a high proportion of agriculture, will be deeply affected by this global revolution.
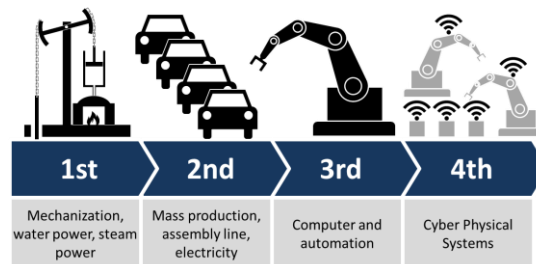
Figure 1. *History of industrial revolution 4.0 High-tech agriculture*

According to the Department of Science and Technology - Ministry of Agriculture and Rural Development, high-tech agriculture is an application of new technologies in agriculture production. Such technologies include automation, mechanization of agricultural production, information technology, new material technology, biotechnology, livestock breeds, new crops with high productivity and high quality, sustainable development on the basis of organic farming. Moreover, existing approaches in agricultural supply chains try to take benefit of recent technologies related to the digitalization era, such as precision farming, which makes use of positioning technologies combined with the application of extra sensors and the collected data increasing the yield [1].

High-tech agriculture has the following basic characteristics: Firstly, large investment, large payback, knowledge-intensive applications (such as the application of biotechnology need to apply knowledge: mathematics, agronomy, botany, microbiology, genetics, molecular biology...). Second, the market of high-tech agriculture focuses mainly on a few large companies due to the large capital required to apply modern scientific advances. Third, the model of building new agricultural enterprises, mainly focuses on areas such as creating new breeds through genetic engineering, genetic engineering, using new techniques in breeding, automated breeding process and strictly controlled...

The mission of high-tech agriculture is materials creation; Using machinery and equipment in agriculture; Selecting, creating and propagating plants and animals for high productivity and quality; High effective cultivation and breeding; Prevention and eradication of diseases in plants and animals; Preserving and processing agricultural products; Developing high-tech services for agriculture; Developing agricultural with applying technology. Thus, the ultimate goal of the development of high-tech agriculture is to resolve the conflict between low agricultural productivity, low quality products, high labor cost, low economic efficiency, and pressure of using scientific and technological achievements to ensure stable agricultural growth with high productivity, high quantity, efficiency and quality. The best of coordination implementation between people and resources, making the advantages of sources achieve the greatest efficiency, harmony and unification of social, economic and ecological environmental benefits.

2.2. Human resources in high-tech agriculture

Human resources for agriculture include the labor force in agriculture in use and labor force for agriculture. The process of creating a healthy physical and mental labor force, achieving a high level of education, vocational training, lifestyle and behavior that accords with the development requirements of the agricultural and high technological industry. Human resources in the high-tech agricultural sector require labor to be trained in agriculture, with a high level of knowledge and skills, applied and transfer research, professional skills and management skills, the ability to receive and master the technology to apply and develop into practical production with the development requirements of high-tech agriculture. The State needs attract talented and skilled collaborators who bring to the table a problem-solving mentality. To achieve the goal a target, governments should look for the best talent to contribute to the program. The best talent will not come easily and competition is strong. Differentiating in your attraction plan is key: Provide high quality job opportunities; Communicate your intentions to show global experts see it is a unique global opportunity that will have a global impact [2].

3. Actual situation of high-tech agricultural human resources in Thai Nguyen province

In 2010, the Government approved the project of developing high-tech applied agriculture

by 2020. The project has the goal of building comprehensive development agriculture in the direction of modernization, producing large and production with high quality, efficiency and competitiveness, achieving a growth rate of over 3.5% per year, ensuring national food security both immediate, medium- term and in the long-term.

After having the High Technology Law, the Prime Minister issued Decision No. 1895 / QD-TTg dated 17th December 2012 approving the program of high technology application in agriculture [3]. In April 2015, the Prime Minister issued Decision No. 575/QD-TTg approving the master plan of high-tech agricultural zones and zones by 2020. The decision is clear that "the coffee high-tech production regions are concentrated in the Central Highlands, Northwest and North Central regions. High-tech tea production areas are concentrated in Thai Nguyen and Lam Dong. Areas of high-tech dragon fruit production are concentrated in Binh Thuan" [4].

3.1. Achievements in high-tech agriculture in Thai Nguyen province

Thai Nguyen agriculture sector after more than 10 years of implementing the Program of Action in the whole Party Committee on agriculture, farmers and rural areas, has basically had large change, average income of people rural areas reached 33.84 million VND/person/ year, increased 4 times compared to 2008, the rate of trained workers reached 62.78%. The value of agricultural products per one ha of cultivated land reached 91.4 million VND, the rate of rural people using clean water reached 89%. Total added value of agriculture, forestry and fisheries in 2017 reached VND 7,231 billion (an increase of VND 2,899 billion compared to 2008); The value of agricultural production in 2017 was VND 12,515 billion (an increase of VND 5,656 billion compared to 2008).

In the field of cultivation, in recent years, many farmers in the province have actively applied many scientific and technological advances to use high-tech into production. Initially, the province has established a number of safe vegetable and fruit production areas. The investment in building cold houses to preserve flowers in large areas of flower-growing areas of the province such as Huong Thuong (Dong Hy) and Tuc Duyen (Thai Nguyen). With cold houses, flower farmers no longer have difficulties related to the weather or are worry about early blooming flowers, quickly decaying, losing value... Phu Gia Dai Tu's high-tech mushroom production and medicinal mushroom models have produced Export products. The model is giving high economic efficiency to grow pepper banana by growing in a culture medium method at Gia Sang technical and agricultural seedling transfer station (Department of Agriculture and Rural Development)... Especially, for tea - spearhead specialty of the province, the areas in the province have been attended to raising tea plantation area to nearly 22,000 ha, creating many tea regions for organic production.

In the livestock sector: The province has built a number of main breeding areas with high economic efficiency (areas of chickens raising areas in Phu Binh, Dinh Hoa and Vo Nhai; pig raising areas in Phu Binh, Pho Yen...). With chicken raising areas, there are 200/356 high-tech application farms such as high-yield, cold-coop breeding, automating care systems, about 20% of the total number of chickens in the province. In pig raising areas, 40/250 farms apply high-tech such as high yielding varieties, cold cages, automating feed and water operation, antiseptic and environmental treatment according to advanced breeding technology process, making 11.2% of the total pig quantity in the province... These applications help reduce labor cost, increase production efficiency for farmers, so that number of pigs grow to more than 700 thousands (up more than 300 thousands compared to 5 years ago), poultry quantity is up to 10 millions, increasing 4 millions for 5 years ago.

In 2018, the province identified a large, deep and wide vision in developing and considering major directions, including the content of diversifying the economy with three pillars: Developing high-tech industry with electronic industry, related supporting industries; tourism - service, in which, the development of education, training and medical services has gradually become an important sector of the local economy; high-tech agricultural development. Thai Nguyen province is in parallel with the issuance of projects and plans to support production development associated with agricultural restructuring and new rural construction (such as: Agricultural restructuring scheme, Scheme Agricultural application of high technology, the scheme of developing tea plants and tea product brands, the development of high-tech agriculture is a great program of Thai Nguyen. In the province, the project of high-tech agricultural development has been developed and implemented; The program of agricultural restructuring towards improving added value and sustainable development is being considered as the main driving force for promoting agricultural growth in the area, improving incomes and improving people's lives countryside. Along with the expansion of the above models, many financial resources have been invested in high-tech applications, forming and developing link chains or using block-chain, creating quality agricultural products, productivity and value, high, environmentally friendly, contributing to ensuring social safety.

However, many high-tech application development projects still exist. Agricultural production in the province is still mainly small and fragmented production based on household size, mainly raw materials, low rate of industrial processing. In order to develop sustainably in high-tech application agriculture, it really achieved good results, it needs to raise awareness, financial capacity, technology, policies and organizational mechanism, close coordination between the state and the faculties, the scientists, investors and farmers.

3.2. Actual situation of human resources in Thai Nguyen province

General characteristics of human resources in Thai Nguyen province: Regarding the number of labor force, by the end of 2017, the province's labor force from the age of 15 to over Which reached 769 thousand people, increasing of 5,000 people to 2016 (male 49.7% and female 50.3%), urban labor force accounts for 30.3%, rural area 69.7%. Workers from the aged 15 and over working in economic sectors in 2017 reached 758 thousand people, up 5.8 thousand people to 2016. In which, agriculture, forestry and fishery sector 332.1 thousands of people, for 43.8%; industry and construction 234.6 thousand people, for 30.9%; service sector 191.3 thousand people, for 25.3%. Thus, Thai Nguyen agricultural workers still account for a higher proportion than other sectors.

Regarding the quality of labor force in Thai Nguyen province, compared to the rate of trained laborers in the whole country in 2017, about 53%, the proportion of trained laborers with degrees and certificates in Thai Nguyen only reached 30.7% (although it was higher than 29.4% in 2016), in which trained workers in urban areas reached 57.7%, rural areas reached 19.2%.

Regarding the employment status of Thai Nguyen's human resources, the number and proportion of laborers in the agriculture, forestry and fishery sectors in Thai Nguyen are always higher than those of industry, construction and services over the years.

Table 1. *The number and proportion of employees working annually following to Thai Nguyen economic sector*

Year	Total (people)	Agriculture and forestry – fishery products		Industry and construction		Service	
		Amount *(people)*	Proportion *(%)*	Amount *(people)*	Proportion *(%)*	Amount *(people)*	Proportion *(%)*
2015	746,898	377,139	50.49%	205,254	27.48%	164,505	22.03%
2016	752,337	354,364	47.1%	219,622	29.19%	178,351	23.71%
2017	758,082	332,116	43.81%	234,586	30.94%	191,380	25.25%

Source: Thai Nguyen Statistical Yearbook 2017[5]

The unemployment rate of labor force in working age in 2017 is 1.68%, of which, labor in urban areas are 2.16%, in rural areas are 1.46%. The underemployment rate of the labor force in the working age is 0.47% (0.21% in urban areas and 0.58% in rural areas).

Regarding training of human resources, by 2020, Thai Nguyen will have about 70% of trained laborers will be trained; becoming a high quality human resource training center for the Northern midland and mountainous provinces... Thai Nguyen has nine universities, nineteen colleges, professional and vocational schools, and thirty-three vocational training centers. Every year, vocational training for about 16,000 to 18,000 people. In the coming years, the province implements measures to develop human resources; especially focusing on the renovation of state management methods on training, human resource development, capital mobilization, training to improve qualifications, knowledge and skills for employees.

Regarding training, Thai Nguyen currently has nine universities with about 2,499 lecturers, 14 professional colleges and vocational colleges with over 1,648 lecturers, 10 intermediate schools with over 661 teachers. The number of teachers increased in both quantity and qualifications.

Table 2. *Level of lecturers of Thai Nguyen University, College and Intermediate school*

Year	University lecturers		College lecturers		Intermediate teacher	
	Post - graduate	Bachelor's degree	Post – graduate	Bachelor's degree	Post – graduate	Bachelor's degree
2015	2.139	449	905	818	112	344
2016	2.244	312	961	705	112	322
2017	2.290	209	979	600	164	339

Source: Thai Nguyen Statistical Yearbook 2017[5]

In the field of majority training, the number of science and technology organizations in the field of agricultural increased significantly over the years, accounting for the highest proportion in the field of scientific research in 2017, this shows that the focus on research investment in the field of agricultural science is increasingly being done high attention.

Table 3. *Number of science and technology organizations in the field of science in Thai Nguyen province*

No.	Science	2015	2016	2017
1	Natural Sciences	1	3	2
2	Technology Science	7	3	11
3	Agronomy	5	3	16
4	Medical science	4	2	3
5	Social science	8	3	6
6	Humanities	1	0	4

Source: Thai Nguyen Statistical Yearbook 2017[6]

However, high-tech agricultural of Thai Nguyen has limit of the whole country. According to the Vietnam human resource development plan for the period 2011-2020, which has been approved by the Prime Minister, the proportion of human resources trained in agriculture, forestry and fishery has increased from 15.5% in 2010 up to about 50% by 2020. However, it is forecasted that by 2020, human resources in this sector will lack about 3.2 millions trained laborers.

In order to develop high-tech agriculture in industrial revolution 4.0, Thai Nguyen province must have a synchronous solution system and comprehensive linkage between the State - Scientist - Enterprise - Farmer.

4. Solution to develop high-tech agricultural human resources in Thai Nguyen province with industrial revolution 4.0

4.1. Growth trends of high-tech agricultural industry and requirements for the developing high-tech agriculture human resources in Thai Nguyen province

According to the plan to 2020, Thai Nguyen province will complete the construction of infrastructure of high-tech agricultural applications with scale of 320 ha which located in Tien Phong and Tan Huong (Pho Yen district); to build agricultural areas where high-tech applications are applied to crops and livestock which are majorities of the agriculture; there are at least 2 enterprises (businesses) to develop high-tech agricultural applications; to reach to the proportion of high-tech agricultural production value into 20% or more of the total value of agricultural production in the locality; to build and perfect the system of technical processes for agricultural, forestry and aquatic, production for plants and animals suitable to the conditions of the province with using high-tech application... [4] These are considered hard-targets for a actual province situation with a low starting point in developing agricultural high-tech applications such as Thai Nguyen. Thai Nguyen has just been at

the starting point, but the province has identified high-tech agricultural investment as an inevitable direction in the province's socio-economic development strategy. Specifically, in 2018, Thai Nguyen attracted 65 projects, especially focusing on 19 projects in the agricultural sector, mainly high-tech agricultural projects.

The requirement for the development of high-tech agriculture human resources in Thai Nguyen province before agriculture 4.0 requires the labor force with high skills and proficiency in the application of scientific and technological advances... for economic results. However, the fact shows that the qualification of labor in rural areas of Thai Nguyen is low, the system of vocational training is outdated and does not meet the requirements. Facing this situation, the renewal of training methods and human resource development for agriculture 4.0 is an urgent requirement for functional levels and branches, needing practical solutions for development of human agricultural force.

4.2. Solution on controlling quantity and quality and improvement of high-tech agricultural human resources

Firstly, there must be good at controlling in terms of the number of human resources, limiting the population growth rate of the province. According to Thai Nguyen statistics, the population of Thai Nguyen province in 2016 is 1,227,400 people, the natural population growth rate is 0.99%. In particularly, the main reason for Thai Nguyen population growth due to high migration into Thai Nguyen (two directions: rural - Thai Nguyen and other urban areas - Thai Nguyen); Thai Nguyen crude birth rate in 2017 is 15.14 ‰ (decreasing 0.17 ‰ compared to 2016), the reduction is not sustainable, especially, that is higher than the other province because of childbearing in rural. Thereby, all creating many problems that need solved such as labor and employment: unemployment rate of labor resources in the working age in 2017 is 1.68%,

of which rural areas are 1.46%. Therefore, ensuring a reasonable population size, limiting the birth of a third child, continue to maintain and promote the implementation of policies on population planning.

Secondly, improving the quality of human resources, it is necessary to improve the physical and mental level of human resources. Propagating and raising awareness for employees, opening propaganda classes for managers, thereby enabling them to go deeper and closer to the workforce of rural agricultural workers (especially ethnic minorities) to active, disciplined life skills in the new environment as well as knowledge of new techniques that will be applied in cultivation under the impact of the 4.0 digital technology context. Improving the income of workers on the basis of stable jobs, ensuring social justice to create conditions for children of poor families to access educational health services.

Thirdly, creating jobs for the labor force in the working age to reduce the unemployment rate in both urban and rural areas, accelerating labor restructuring to progress and improve the efficiency of human resource in use. Implementing regional economic restructuring towards the formation and development of industries and economic sectors to form a new form of economic structure and labor structure, including three closely linked and supportive sections, creating a multi-tiered grid system and create jobs for human resources.

4.3. Solutions to improve the efficiency of using high-tech agricultural human resources

In order for human resources to serve high-tech development with quality and efficiency, it is necessary to build a close link between four houses "Farmers - State - Scientists - Enterprises" this is the development trend of modern and sustainable agriculture. In particular, enterprises applying industry 4.0 support effectively farmers applying high technology, actively linking with agricultural experts in developed countries to provide

solutions, equipment and specific implementation formulas. Domestic high-tech agricultural experts will apply all in practice. The local governments of the provinces need to promote the policy of supporting enterprises, creating a coordination mechanism, getting close links between the state and enterprises, training institutions and farmers, promoting potentials power.

4.4. Solution for training human resources in Thai Nguyen province

Vietnam is lacking of qualified and intensive teachers on new rural areas and agriculture, specially, high-tech agriculture. There are much of theory in training programs, the content does not cover all the knowledge, skills and skills about new rural areas, lack of deep knowledge about international integration, climate change, production linkages, value chain development, business, market orientation, entrepreneurship knowledge, high technology, information technology application...

Firstly, the State must be decisive role in the development of high-tech agriculture. With the tradition of an agricultural production economy, there are about 70% of the population participating in agricultural production in the whole country, in Thai Nguyen the labor force in agriculture accounts for nearly 50%. Thus, in the process of applying high technology to agricultural production, farmers and peasants are mostly in doing. The State should organize training courses to raise farmers' awareness about the importance of high-tech agricultural development, as well as training of life skills, discipline and matching village life with industrial style to increase the dynamics of rural agricultural human resources but not lose the good national identity and culture.

At the same time, the state also needs to enact policies to support businesses, creating opportunities for enterprises to train farmers to produce according to the order requirements of enterprises. Support capital in the application and transfer of high technology in agricultural production to both

farmers and businesses for a number of main projects (such as the application of high technology in tea production and products from tea) ... The state needs enforce policies which support talented people, good experts in the field of high-tech to develop agriculture in Thai Nguyen.

Secondly, improving the professional and technical qualifications of human resources. The rate of unskilled workers in Thai Nguyen which accounts for a high proportion of 69.3% (although it has decreased compared to 70.6% in 2016), of which, untrained workers in urban areas are 42.3%, rural areas account for a very high rate of 80.8%. Therefore, the province needs to build and develop a human resource training system in association with importance products, high competitiveness and great demand. There are prospects for future development of Thai Nguyen, such as planting and processing tea products, growing safe vegetables, flowers and ornamental plants, medicinal plants...

Thirdly, it is necessary to coordinate links between enterprises and schools in training high-tech human resources. Currently, in order to have human resources for developing high-tech agriculture, Thai Nguyen province needs to be bold in the program to send workers to overseas training or training at domestic educational institutions, training links both learning and doing according to the needs of businesses. The school facilitates students to practice in the enterprises to have more experiences, skills for applying the acquired knowledge in the school in working at the enterprise. The school with high qualified scientific researchers needs to cooperate with enterprises to implement projects on agricultural applications in agriculture such as green agriculture, smart agriculture ... including the participation of trainees let them directly study as well as gain more practical experience. The co-operation among universities, businesses and research

institutes is an inevitable reality when training must follow to the demand or according to the orders of the business.

5. Conclusion

The fourth industrial revolution is changing the global economy, having a direct impact on Vietnam (both positive and negative). If Vietnam takes good opportunities and overcomes challenges, Vietnam will be able to narrow the development gap with more advanced countries. It's sooner to realize its goal of becoming a modern developed country.

This article contributes to agricultural development in Thai Nguyen province in accordance with the trend of industrial revolution, improving the socio-economic life of the local people, aiming at agriculture with breeding and farming automation and high standards processes. With the participation of the political system, businesses and peasants, good high-tech agricultural will become a reality, contributing to ensuring food security and national food in generally and agricultural development in Thai Nguyen province in particularly.

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