

Original Paper

Science and Technology Development in Vietnam: Current Situation and Solutions

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Received: April 15, 2021

Accepted: May 7, 2021

Online Published: May 10, 2021

doi:10.22158/sss.v2n2p52

URL: <http://dx.doi.org/10.22158/sss.v2n2p52>

Abstract

Science and technology play an important role in transforming growth models, improving productivity, quality, efficiency and competitiveness of the economy. This is a matter of vital significance to the existence and development of the country, and is an urgent requirement of the current industrialization, modernization and national integration in Vietnam. During 35 years of industrialization, modernization and international integration (1986 – 2021), science and technology in Vietnam have made important progress in all aspects, making a practical contribution to economic development - society, improve the quality of people's life and consolidate national defense and security. However, science and technology in Vietnam today still has many shortcomings such as: The level of science and technology of social production remains low and backward compared to other countries in the region; low labor productivity; domestic businesses are still less interested in investing in research and development; investment in science and technology activities is low, structure is not suitable, efficiency is low; the contingent of science and technology staff lacks quantity, is weak in quality, and the structure is not suitable. These shortcomings have been affecting the demand for reform of an economic growth model to meet the requirements of rapid and sustainable development. In the coming time, to overcome the above problems, Vietnam needs to deploy a synchronous system of solutions.

Keywords

Science, Technology, Social- economic development, Vietnam

1. Introduction

In the early years of the twenty-first century, humanity witnessed and enjoyed many achievements due to the brilliant development of science and technology, especially the achievements of the industrial

revolution 4.0 have changed all areas of social life. Science and technology have become the direct production force, a major driving force behind the socio-economic development of many countries around the world and more importantly, it opening up a new economy, a new civilization for all humanity: intellectual economy and intellectual civilization. Therefore, in today's era, any country that perceives the role of science and technology to the socio-economy, knows to focus on adequate investment in science and technology development, that country will have conditions to quickly spurt in socio-economic development, soon join the ranks of countries with highly developed economies in the world. Science and technology are the key to transforming economic growth models from breadth to depth. Over the years, science and technology of Vietnam have shown this role quite well, but there are still many problems that need to be overcome. The paper analyzes the current situation and proposes a number of solutions to promote the role of science and technology in our country's economic growth model in the coming time.

The research questions in this study will be:

Question 1: What is the current state of the Science and technology development in Vietnam?

Question 2: What should be done to develop science and technology in Vietnam in the coming time?

2. Literature Review

"Tendances actually de la recherche Scientifique" has analyzed and evaluated the scientific organization, the scientific research organization, the analyzed works contain the economic potential of science and the impact of science on the aspects of social life (Pierre, 1961). Alvin Toffler's conception of the role of science is the factor to diverge human history into different periods according to successive waves of civilization created by scientific and technological achievements. Alvin Toffler asserted that knowledge is the power, the power of the future, the thing that is never-ending, uses never-ending and is the most democratic power (Alvin, 1991).

Besides, it is possible to mention here that are some recent forecasts that have been forecasted by the future related to the impact of science and technology. Author of Konrad Seitz through the "The race in the twenty-first century", he affirmed the role of science and technology as the power of countries to advance in the twentieth century (Konrad, 2004). Author Claude Allgre affirmed that the advances of science in the twenty-first century would be even greater than in the past, with science related to life, the Earth, people, the brain; Science changes everyday life, upsets people's understanding and beliefs (Claude, 2013).

Science and technology contributing to increased labor productivity, transforming economic growth models, people in many countries become rich, well-off, healthy, and live longer, but all of them have side effects, negative (Peter, 2018).

Science and technology is to exercise the function of perception and transformation of the world. The last part of the work focuses on analyzing the role as the foundation and driving force of science and technology for the industrialization and modernization in Vietnam as a decisive role for equipping

modern equipment for production, having an important role in training and promoting human resources, perfecting mechanism, organizing production management, contributing important to realizing sustainable development goals (Pham, 2003).

3. Method

The article is made on the basis of the Marxist worldview and methodology, the views of scientists, organizations in the world and Vietnam on the science and technology development. A systems approach is used to analyze the role of science and technology in the growth model. The advantages and results gained in promoting the role of science and technology in growth models in Vietnam are evaluated and described with the help of objective data from statistical sources and is officially announced. At the same time, the article also uses a combination of specific research methods such as historical, logical, comparison, analysis, synthesis, inductive and interpretation, data synthesis... to serve in research and article presentation.

4. Result

Achievements on the science and technology development in Vietnam

Over the past years, Vietnam has implemented many guidelines and policies to promote the development of science and technology, so it has made a significant progress in the ranking of the global innovation index. According to the World Intellectual Property Organization in 2019, Vietnam's global innovation index ranking continued to improve to 42/129 economy, up 3 places compared to 2018, 17 levels compared to 2016 and 34 levels compared to 2012. This result puts Vietnam ranked first in the group of low middle-income countries, ranking 3rd in ASEAN (after Singapore and Malaysia). In particular, there are two indexes related to inputs and outputs of science and technology that have made great leaps, namely: the total expenditure on research and development (R&D) increased by 5 places and the Index of Production products based on knowledge and technology increased 8 places compared to 2018 (Quynh, 2019).

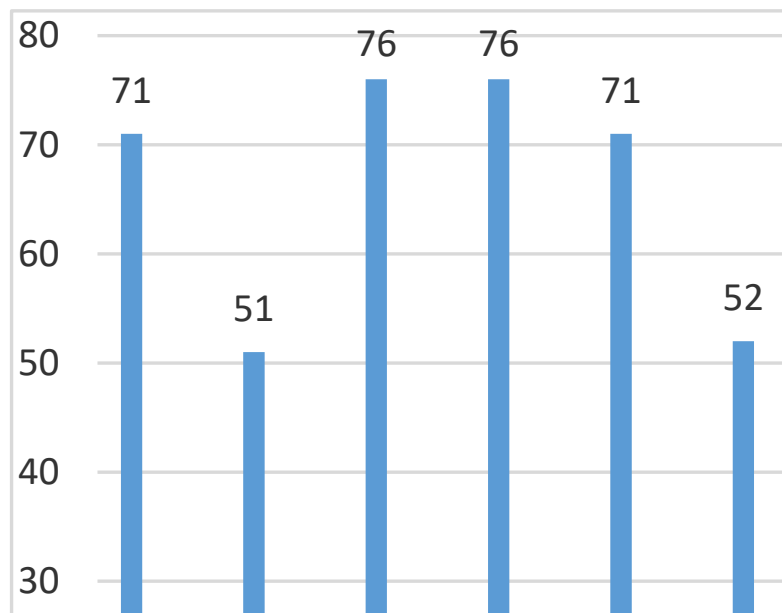


Figure 1. Vietnam on Global Innovation Index, 2010-2019

The survey results of the Ministry of Science and Technology in 2018 showed that about 30% of enterprises have technology innovation activities and about 4,000 creative startups are operating (Viet, 2019). Particularly in the industry and trade, the proportion of enterprises participating in technology innovation is increasingly high. In 2017, 49.8% of the technology was renewed compared to the internal of the enterprise, 47.8% compared to the market and 2.4% compared to the world. In the field of technological innovation, more than 80% of large enterprises participate in product or process innovation, nearly 50% expand the field of production - business; for small and medium enterprises, and the corresponding figures are about 50% and 17-18%. That proves that businesses are increasingly interested in R&D activities. A report by the World Bank in 2017 shows that Vietnamese businesses spend about 1.6% of their annual revenue on R&D. Many corporations/enterprises have set up an S&T development fund to promote science and technology activities (Tran, 2019). The number of international publications in Vietnam in the past 5 years has increased rapidly (about 2.5 times), from 4,484 articles in 2015 to 11,061 articles in 2019, with an increase rate of 25.5% per year. The number of international articles published annually by Scopus has also increased from 1,764 articles in 2009 to 8,243 articles in 2018. The strong development of science and technology in Vietnam over the past years has had a positive impact on the innovation of economic growth model, as shown through:

Firstly, science and technology have contributed to improving the efficiency of using other resources. Improve the efficiency of labor use. In the 2006-2010 period, the labor productivity growth rate of Vietnam is 3.45% / year; to the period 2011-2015 increasing to 4.35% / year and the period 2016-2019 to reach 5.75% / year. Generally, in the 10 years 2007-2016, labor productivity in terms of purchasing power equivalent in 2011 (PPP 2011) of Vietnam increased by an average of 4.2%/year, 1.5% higher than Singapore's average growth rate year; Malaysia 1.9%/year; Thailand 2.5%/ year; Indonesia 3.5%/

year; Philippines 2.8%/year (Nguyen, 2018). Improve efficiency of capital use. In the period 2006-2010, ICOR of the economy was 6.96 times, in the period 2011-2015 it decreased to 6.25 times and in the period 2016-2019 it was 6.17 times (Vietnam Economic Times, 2020, p. 102). Improve the efficiency of natural resource exploitation. In the 2010-2018 period, the coal industry, thanks to the promotion of research and investment in technological innovation, has increased the average output by 9.4% / year. In particular, the rate of mechanical exploitation increased dramatically, from 3.3% in 2010 to 13.1% in 2018. Especially, through the State-level Science & Technology Project: “Research and manufacture equipment and technology for construction of wells and vertical well loading shafts for Nui Beo coal mines”, for the first time, Vietnam has approached and mastered the world’s advanced technology, helping to increase proactivity, reduce consultancy and design costs by about 30% compared to foreign hiring costs; contribute to localization of 2/3 of the value, reduce 17-20% of equipment import costs. Industry, science and technology developed, gradually becoming a direct production force, leading to a huge change in the production process. The trend of globalization, along with the transfer and international integration in science and technology, has promoted the strong development of our economy. Simple and handicraft labor tools have been replaced by modern lines of machinery. Human labor is liberated, manual labor is gradually replaced by intellectual work, and simple labor is gradually replaced by increasing specialization. The above changes make labor productivity increase dramatically, the volume of products produced is more and more and of high quality. Thanks to that, our country’s economic structure is undergoing a strong shift. The contribution of the industries, construction and services tends to increase more strongly than that of agriculture. From a purely agricultural country, Vietnam has built many factories and factories with advanced technological lines; many high-tech export processing zones. This, the Government of Vietnam said: “Technology of industrial production has had a change in level towards modernization. The proportion of manufacturing and processing industries in industrial production value increases, while that of the mining industry decreases. Communist Party of Vietnam, 2016, 83 has grown well” (Communist Party of Vietnam, 2016: 83). The agricultural sector, with the goal of industrialization and modernization of agriculture and rural areas, Vietnam has actively advocated the application of modern scientific and technological achievements to agricultural production. Currently, science and technology have contributed over 30% of added value in the field of agricultural production and 38% of added value in the production of seeds and animals. Therefore, the productivity of some livestock and crops is high compared to other countries in the region and in the world: rice ranks first in ASEAN; pangasius and pepper topped the world; coffee and rubber ranked second in the world. The application of science and technology to agricultural production also creates conditions for farmers to access new achievements in science and technology, contributing to gradually improving the quality of rural human resources in general and the whole country in particular. Our country has formed key agricultural regions, specializing in farming, with agricultural products for export such as rice (Vietnam ranked 2nd in Asia and 3rd in the world in terms of rice export), seafood, vegetables, roots, fruits... The role of science and technology in the

development of modern agriculture in our country has been recognized by our Party: “Industrialization and modernization of agriculture and rural areas have made changes, agriculture develops more comprehensively in the direction of exploiting the advantages of tropical agriculture; the application of science - technology and the level of mechanization has been raised” (Communist Party of Vietnam, 2016, p. 83).

Secondly, science and technology have promoted the transformation of economic growth model towards increasing TFP based growth, decreasing based on increasing capital and labor. From 2011 up to now, the TFP growth rate of Vietnam is much higher than that of previous years. On the contrary, the growth rate of capital and labor decreased. Specifically: the TFP growth rate in the period 2011-2018 was 2.06%, nearly four times higher than that of the 2006-2010 period, 0.54%; the growth rate of capital decreased sharply from 13.3% in the 2006-2010 period to 7.97% in the 2011-2018 period and the labor growth rate decreased from 2.77% in the 2006-2010 period to 1.27% in the 2011-2018 period.

The rapid growth of TFP in the period 2011-2018 prompted the growth model transformation of Vietnam in this period, gradually reducing the dependence on capital and labor. In the 2001-2010 period, Vietnam’s contribution of capital and labor growth to GDP growth was 73.6%; in the period 2011-2015 it will be reduced to 69.8%; the period 2016-2019 continued to decrease to 59.7%. The contribution of the TFP increase factor to GDP growth is increasing. If in the period 2001-2010, this proportion was only 26.4%, in the period 2011-2015 it increased to 33.6% and in the period 2016-2019 it was 44.5%, is quite far from the set target of 30-35%.

These achievements have contributed practically to the industrialization, modernization of the country and international integration, promoting productivity, quality and growth of the economy, maintaining national defense and security, improving the quality of people’s life, creating a new position and force for the country.

Limitations on the science and technology development in Vietnam

Firstly, the level of science and technology of social production has been raised, but in general it is still low, even out of date, and slowly being reformed. Currently, most Vietnamese enterprises, especially private enterprises, are using technology 2-3 generations behind the world average, of which 76% of equipment, machinery and technology lines imported from abroad in the years 1960-1970; 75% of the equipment is fully depreciated; 50% of equipment is refurbished (Nguyen, 2018). Knowledge Economic Index (KEI) of Vietnam is 3.51, of which the innovation index is 2.72, much lower than Singapore (8.44), Malaysia (6.07), and Thailand (5.52). According to the World Intellectual Property Organization (WIPO), by 2018, the rate of Vietnamese patents and applications has improved significantly (ranked 51), higher than the Philippines (ranked 55), Bangladesh (102nd place), but still much lower than Singapore (25th), Indonesia (35th), Malaysia (38th), Thailand (40). This shows that the role of science and technology, especially high technology, has not played a key role in improving investment efficiency.

The application of science and technology to agricultural production has not been conducted synchronously. Machinery and equipment put into production are still outdated compared to the world, leading to environmental pollution consequences. The speed of mechanization in agricultural production is not high, not synchronous and development is not comprehensive. Compared with other countries in the region, the level of motivational equipment of Vietnam's agriculture is low, averaging 1.3 horsepower (CV)/hectare of cultivation, while some regional countries such as Thailand achieve 4 CV/ha, Korea 4.2 CV/ha, China 6.06 CV/ha (the main farming stages in these countries are mechanized over 90%).

Secondly, labor productivity in Vietnam is low. Comparing Vietnam's labor productivity with other countries in Southeast Asia, compared with the least developed countries in Southeast Asia (CLMV - a block of four countries Vietnam, Laos, Cambodia and Myanmar), with ASEAN + 6, ASEAN all see lagging. According to the Asian Productivity Organization (see Figure 2), Vietnam's labor productivity is even lower than that of Laos, Myanmar and even lower than CLMV. In 2018, Vietnam's labor productivity was only equal to 96% Myanmar, 88.7% Laos, 54.5% Philippines, 41% Indonesia, 36% Thailand, 18% Malaysia, 35.4% ASEAN + 6, 43.6 % ASEAN and only equivalent to 7.7% of Singapore.

Analyzing the changing trend of labor productivity in the period 1970 - 2016, if the United States is taken as a standard, Vietnam's labor productivity has increased, but the growth rate is quite slow, at the same time, labor productivity of Singapore, Hong Kong, Malaysia... increased dramatically (the slope of these countries is larger than that of Vietnam), showing the absolute gap in average income between Vietnam and a number of countries in the region are being expanded.

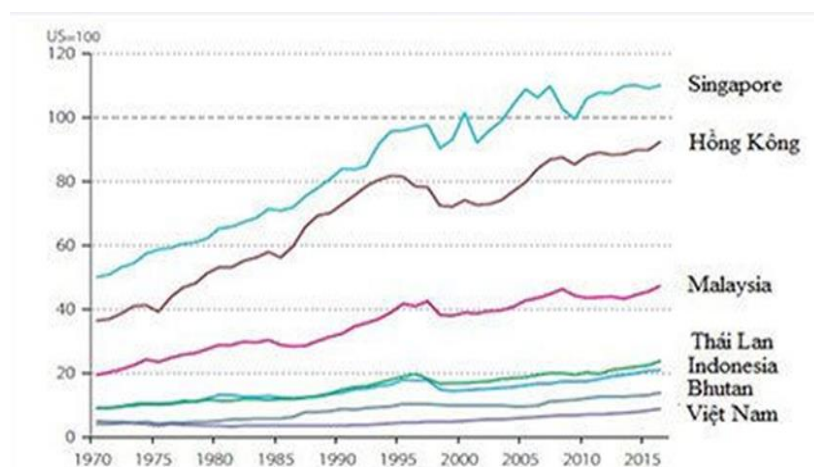


Figure 2. Labor Productivity of Vietnam and other Countries in the Region, 1970-2015

Thirdly, domestic enterprises are still less interested in investing in research and development (R&D). The proportion of enterprises with R&D in all industries is still very low (17% in the electrical equipment manufacturing industry, 9% in food production and processing, and 5.0% in the textile

industry...). The ratio of R&D spending to GDP in Vietnam (including the public and private sectors) is only about 0.44%, much lower than the world average of 2.23% of GDP. The linkage between enterprises and scientific research facilities to implement the process of technology transfer and innovation is still very limited. According to FIRST-NASATI's recent research on enterprise innovation, only nearly 14% of businesses have coordinated with outside units to conduct product innovation research; Technology transfer activities from science and technology organizations to enterprises are very low (just under 1%). This shows that the linkage between enterprises (the demand side in the science and technology market) with institutes, schools, and scientists (the supply side) is still very limited. A survey by the Ministry of Science and Technology in 2018 shows that only about 30% of businesses have innovative activities and about 4,000 creative startups are operating.

At the same time, according to the State-level mission report in 2018 on "Research analyzing labor productivity of Vietnam through survey and assessment of the status of labor productivity of enterprises in some economic sectors" shows that : the rate of enterprises having R&D in the electrical equipment manufacturing industry is 17.0%; chemical production, chemical products: 15.0%; food production and processing by 9.0%; rubber and plastic products manufacturing by 7.0%; leather and related products 6.0% and textile 5.0%. The percentage of personnel engaged in R&D activities corresponding to the above industries is even smaller, respectively: 0.4%; 1.4%; 0.4%; 0.5%; 0.03%; 0.07%. Universities are more inclined to training than research, or if there is research, the applicability is not high. There is a lack of effective linkages between universities, research institutes and the business and public service sectors.

Fourthly, investment in science and technology is low, the structure is not suitable, and the use efficiency is low. The rate of investment in science and technology from the state budget has gradually decreased from 2000 to present. On average, the 2000-2010 period reached 1.85%/year of the total state budget expenditure. In the period 2011-2018, this rate was only 1.4%/year. While the Law requires that 2% of the state budget be spent on science and technology. The ratio of R&D spending to GDP in Vietnam is very low compared to the world average. Vietnam's total expenditure for both public and private sectors for science and technology since 2010 has reached only 0.44% of GDP, much lower than the world average of 2.23% of GDP. (Thailand 0.78%; Singapore 2.2%; Malaysia 1.3%, China 2.1%) (Hai, 2020). The structure of investment capital in science and technology still has many shortcomings. In East Asian countries, the state budget capital for this activity only accounts for 20-30%, while that of the non-state sector is 70-80%; In OECD countries, this structure is close to 20% and above 80%. Meanwhile, the structure of Vietnam in the period 2001-2010 was 70%/30%, the period 2011-2015 was 60%/40% and the period 2016-2019 was 52%/48%. The efficiency in using funding for science and technology activities is not good. Some localities have not used these funds for the right purposes, such as spending on the operation of the non-business units under the Department of Information and Communications; project reciprocal spending; expenses for wastewater treatment; expenses for construction of underground medium-voltage lines, transformer stations...

Fifthly, the contingent of science and technology staff is insufficient in quantity, weak in quality, and the structure is not suitable. The rate of R&D staff per capita in Vietnam is relatively low, and has hardly increased since 2013 ;has barely increased, reaching about 7.02% (only equal to 20% of the EU average, 7.6% South Korea, 29, 8% Malaysia, 58% compared with Thailand). The proportion of people of university age (18-29 years) attending university is 28.3%, among the lowest in the world. Meanwhile, this rate is 43% for Thailand, 48% for Malaysia and even higher in developed countries (Tran, 2019).

Sixthly, there is a lack of mechanisms and policies to favor and stimulate creativity for scientists and scientific establishments, so it has not created a driving force for the creation and application of science and technology. In addition, awareness of all levels, sectors and localities about the role of science, technology and innovation is not comprehensive enough.

The above limitations and shortcomings show that science - technology and innovation have not done well the role of "really a leading national policy"; "Is the key and most important driving force to develop a modern production force, to industrialize and modernize the country". The main reason is: (i) The levels, branches, enterprises, and science and technology organizations are not fully aware of the role and position of science and technology for the country's rapid and sustainable development; (ii) The institutions for the development and application of science - technology and innovation still have many shortcomings and inconsistencies. Lack of mechanisms suitable to the specificity of intellectual activities to create a strong driving force for the development and application of science - technology and innovation; (iii) The country's scientific and technological potential (the contingent of science and technology staff, intellectual property, financial resources, scientific and technological facilities) has been increased but still very humble. These are also important issues to be overcome in order to promote the role of science and technology and innovation in the new period.

Some solutions to develop science and technology in Vietnam in the coming time

Firstly, to build a strong science and technology development strategy as a basis for improving productivity, quality, efficiency and competitiveness of industries, sectors and the whole economy, promote economic restructuring and economic growth model innovation, promote R&D innovative start-ups, application combined with technology development, especially in new fields and fields with potentials and strengths.

Secondly, to develop national science and technology in the direction of enterprise-centered, universities and research institutes as healthy research subjects. They are developing and implementing science and technology programs to support research institutes, universities and enterprises towards creating research results for intellectual property rights protection, which increasing the use of intellectual property tools to develop key industries and fields, products and services with competitive advantages, to create source technologies and core technologies. Continue to implement the process of transforming S&T public institutions into enterprise models.

Thirdly, to renew and perfect mechanisms and policies to effectively mobilize, allocate and use

investment capital for science and technology activities. Continuing to improve the policy of State budget investment in science and technology activities in the direction of avoiding overlapping and overlapping allocation, avoiding scattered investment and ensuring efficient use; enhancing the roles and responsibilities of organizations in the management and use of state budget funds for science and technology, avoiding misuse, waste and loss; strengthen the inspection and supervision of scientific and technological research results; to soon build a system of indicators to evaluate the completion and quality of the assigned tasks of science and technology units; to encourage enterprises to establish and scale-up science and technology development funds, promote and encourage the private sector and enterprises to invest heavily in science and technology.

Fourthly, to strongly develop educated an intellectual workforce, improve people's knowledge and train talents. To concentrate on investment in education development. Accelerating training of scientific and technical staff and skilled workers, managers, people in business, etc. Education and training, science and technology should be considered the top national policy, a breakthrough to meet the demand for high-quality human resources for the knowledge economy. Create opportunities to improve skills, work learning opportunities and lifelong learning for employees. Encourage enterprises to participate more in national human resource development, especially state-owned enterprises and multinational corporations. To adopt policies to attract overseas Vietnamese and foreign experts to participate in scientific and technological activities in Vietnam.

Fifthly, promote international cooperation and integration, promote joint research cooperation to take advantage of resources and knowledge of advanced countries and step by step raise the level of domestic research capacity and level to be able to participate in equal cooperation and mutual benefit in the long term. We are strongly supporting regional and international scientific exchanges and academic exchanges. Develop and improve the operational efficiency of the network of Vietnamese science and technology representatives in foreign countries, especially in key areas. Attracting and exploiting the strengths of the contingent of talented Vietnamese scientists abroad.

5. Discussion

In today's era, when humanity is entering the knowledge economy, science and technology become direct production forces. Science and technology with nature not only improve human knowledge, help people perceive and grasp the nature and laws of the world, but also help people transform knowledge into technical means, ways to improve the world, effectively serving the socio-economic development of each country in general, to economic growth model in particular.

In the process of international integration, science and technology in Vietnam play an important role in strongly developing production forces, reforming growth models, improving the quality of people's lives and consolidating national defense and security. However, the reality of scientific and technological development, Vietnam's innovation still has many limitations and shortcomings, has not really become the most important driving force in the development process, such as: science and

technology of social production remains low; the application of science - technology - technology to agricultural production has not been conducted synchronously; the proportion of businesses with R&D in all industries is still very low; low investment in science and technology activities, inadequate structure, low efficiency... have been and are having a negative impact on the reform of growth models in Vietnam today, requiring Vietnam It is necessary to synchronously implement the above solutions to promote the role of science and technology in growth model innovation in Vietnam, contributing to rapidly increasing productivity, quality, efficiency and competitiveness of the economy. economy, rapid and sustainable development of the country; increase the factor contribution to aggregate productivity and growth.

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