

Solutions to Promote the Application of Science and Technology of Businesses in Green Agricultural Development in Vietnam

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ABSTRACT

Green agricultural development is an inevitable trend of countries around the world, including Vietnam in order to achieve the goal of sustainable agricultural development. This article aims to assess the current situation and propose solutions to promote the application of science and technology by enterprises to green agricultural development in Vietnam. Research results showed that, in recent years, many businesses have applied farming techniques in greenhouses, net houses, economical irrigation, nutrient management and automatic lighting and production processes according to GAP standards that brings economic, social and environmental efficiency. However, the number of enterprises applying science and technology to agricultural production in general and green agriculture in particular is still limited due to policy barriers, difficult land access, capital scarcity and outdated synchronized infrastructure system. To promote the application of science and technology in agricultural production, the following solutions need to be implemented synchronously: completing the policies of land; agriculture and rural development; credit; well forecasting supply and demand of agricultural products; simplifying administrative procedures in land; completing infrastructure of agriculture and rural.

Keywords: enterprise, green agriculture, science, technology.

INTRODUCTION

Since the 21st century, global problems such as climate change, shortage of natural resources, and environmental pollution have become more and more serious (Zhang et al., 2019). **In particular, the COVID19 pandemic has caused many social, economic, political and environmental challenges** (McNeely, 2021). **It is necessary to have solutions to overcome conflicts between resources, environment and economic development mode** (Liu et al., 2018). Until now, scientists have made great efforts to find solutions to create a sustainable future for future generations, while protecting the ecological environment. In particular, green technology is an effective solution that can help industries treat wastes in an alternative and sustainable way, while using a lot of advanced biological materials to create low-cost products, safe and environmentally friendly (Bradu et al., 2022). Green technology is a fairly broad category, fields such as energy, atmospheric science, agriculture, materials science and hydrology are all covered in green technology (Fu et al., 2021).

According to Zhang et al., (2022), scientific and technological innovation in agricultural production is an important factor and a driving force for the development of high-quality green agriculture, and at the same time contributes to reducing environmental pollution, improving the efficiency of agricultural production and promoting sustainable ecosystem building. In Vietnam, agriculture has always been at the forefront of

Doi Moi, making an important contribution to the achievement of poverty reduction and food security (Otsuka, 2013; Wegren & Elvestad, 2018). Moreover, Vietnam has a great role in ensuring the world's food security because it is a major exporter of rice, seafood and coffee (Anh et al., 2023). Currently, agriculture plays a relatively important role in socio-economic development (Tu et al., 2021) with nearly half of the country's labor force working in this field (Anh et al., 2022). In the context of a strong outbreak of the Covid-19 epidemic, agriculture is considered a bright spot and a pillar of the economy, with a growth rate of 2.88%. Agriculture not only contributes to ensuring food security, but the export turnover of agriculture, forestry and fishery products in 2022 reached 24.73 billion USD, up 3.9% compared to 2021 (General Statistics Office, 2022). However, agricultural production has an impact on the ecological environment, so the Government is also interested in developing green agriculture with the promotion of the application of science and technology to improve productivity, quality and reduce waste. Harmful effects on the ecological environment. However, so far, the application of science and technology by enterprises to green agriculture development has been limited, not promoting the comprehensive development of agricultural production to meet the requirements of sustainable development. This article aims to assess the current situation and propose solutions to promote the application of science and technology by enterprises to green agriculture development in Vietnam.

NATURE OF GREEN AGRICULTURE AND SOME POLICIES RELATED TO GREEN AGRICULTURAL PRODUCTS IN VIETNAM

The essence of green agriculture

Up to now, there are different concepts of green agriculture. According to the Organization for Economic Cooperation and Development (2010), green agriculture is a way to develop the agricultural industry in the direction of maximizing opportunities to exploit clean resources, ensuring a sustainable agricultural growth model more associated with environmental protection. Green agriculture or with the orientation of organic agriculture, circular agriculture ensures 4 principles: health, ecology, fairness, and prudence to build a civilized agriculture that adapts to climate change (Organisation for Economic Co-operation and Development., 2010). Green agriculture is a complex concept that integrates the concepts of organic agriculture, circular agriculture, low carbon agriculture and ecological agriculture (Wang et al., 2014a, 2014b).

According to Wang et al. (2021), green agriculture based on "green environment", "green technology" and "green products", is transformed to a new agricultural development mode based on traditional agriculture (Wang et al., 2021). Green agriculture pays full attention to the relationship between man, nature and it is more concerned with the harmonious development of man and nature (Ghadiyali & Kayasth, 2012). Green agriculture must follow environmental laws, rational use of agricultural resources and rely on green technology to realize green transformation of agricultural economic activities (Behera, 2012).

The green agricultural model will reduce the situation of chemical packaging falling into the environment, excess wastes existing in the soil and water, create clean agricultural products to ensure safety for human health, help the ecosystem to be balanced, and maintain biodiversity. In Viet Nam, the current popular green agricultural models include organic farming, hydroponic farming, large sample field model, agricultural model combining cultivation and aquaculture and tourism model associated with green agriculture. In short, green agriculture is a productive agriculture that applies synchronous processes, rational using of technology, saving input materials for production, efficient using of natural resources, suitable for the ecological environment and no greenhouse gas emissions. Green agriculture brings many benefits to life, ensuring sustainable agricultural development such as significantly reduce the impact of harmful chemicals; limit environmental pollution, help protect the environment and human health.

Some policies related to green agricultural products in Vietnam

Greening production, greening lifestyles and sustainable consumption are two of the four themes of Vietnam's green growth action plan for the period 2014-2020 approved in Decision No. 403/QD-TTg. On March 20, 2014 of the Prime Minister. According to the plan, ministries, branches, localities, People's Committees of provinces and cities and relevant agencies assigned to lead the implementation of activities under the green growth action plan, is responsible for providing solutions to implement according to the plan for the period 2014 – 2020. Actions should be implemented synchronously and in accordance with the contents of awareness raising; institutional improvement; changes in the economic structure of industries, localities and enterprises; innovation in technology(Prime Minister of Vietnam, 2014).

According to Decision 403/QD-TTg, for the agricultural sector, the Ministry of Agriculture and Rural Development must assume and coordinate in the implementation of the following activities: researching and popularizing nutrient-rich feed in livestock to increase absorption capacity, reduce greenhouse gas emissions, increase quality of livestock products and improve economic efficiency; renewing technologies in fishing, aquaculture and seafood processing; improving energy use efficiency and reducing pollution in craft villages and non-agricultural production activities in rural areas; reviewing and proposing adjustments to the development planning in forestry and fishery according to sustainable development opinion; developing a policy framework and green growth action plan of the agriculture, forestry, fishery and rural development for the period 2014-2020; using efficient and sustainable resources; completing and developing irrigation infrastructure. The above activities are carried out in conjunction with technological innovation, institutional improvement and structural change (Prime Minister of Viet Nam, 2014).

Decree No. 109/2018/ND-CP of the Government dated August 29, 2018 on policies on organic agriculture has specified principles, standards and inputs for organic agricultural production. This Decree also regulates production, certification, labeling, logos, traceability, trading, state inspection of organic agricultural products in the fields of cultivation, animal husbandry, forestry, aquaculture and policies to encourage the development of organic agricultural production. In addition, the Decree also mentions the priority of scientific and agricultural extension funds to carry out research projects and agricultural extension projects, especially on pest-resistant varieties, organic fertilizers, plant protection drugs, herbal veterinary medicine; supporting policies of agricultural cooperatives; policies of linking production with product consumption; vocational training policies for rural workers; credit policies for agricultural and rural development; lending policies to encourage the development of high-tech, clean agriculture (Government of Vietnam, 2018).

In 2020, the organic agriculture development project for the period 2020-2030 approved in Decision No. 885/QD-TTg dated June 23, 2020 of the Prime Minister has set out specific goals and tasks for the development of organic agriculture to ensure the supply of better products for human health and society (Prime Minister of Vietnam, 2020).

On October 1, 2021, the Prime Minister issued Decision No. 1658/QD-TTg on the National Strategy on Green Growth for the 2021 – 2030 period, with a vision to 2050. The decision set the goal: “Green growth contributes to promoting economic restructuring in association with growth model innovation in order to achieve economic prosperity, environmental sustainability and social justice; towards a green, carbon-neutral economy and contribute to the goal of limiting global temperature rise”. This decision has also given specific orientations for agricultural development towards modernity, sustainable organic and clean agriculture, while improving the quality, added value and competitiveness of agricultural production. The Ministry of Agriculture and Rural Development is responsible for formulating and implementing the tasks of agricultural development in efficient, sustainable, low-emissions commodity in the direction of circular and economy that adapting to climate change; promoting the market in the direction of linking along the product value chain and improving the competing capability for green, safe and organic agricultural products, meeting international and domestic standards. Promoting and supporting the implementation of

regulations on intellectual property for green agricultural products; developing and implementing programs and projects on the protection and restoration of ecosystems, biodiversity in agriculture, forestry, and fisheries; recovering and increasing the carbon accumulation in natural reservoirs; surveying, inventorying and monitoring the change of the forest resource monitoring system; perfecting the policy and effectively implementing the policy of payment for forest environment services; promoting socialization in forest protection and development through the application of incentive mechanisms and policies on land, credit, insurance, taxes, and market mechanisms associated with certificates of sustainable forest management according to international standards; promoting the construction of new rural in a green and sustainable direction; reviewing and completing the targets and criteria on rural environment; building eco-villages, climate-adaptive smart villages(Prime Minister of Vietnam, 2021).

The Strategy for Sustainable Agriculture and Rural Development for the period of 2021 – 2030, with a vision to 2050, has set a goal to 2030 “Developing green, environmentally friendly agriculture, adapting to climate change, reducing rural environmental pollution, striving to reduce greenhouse gas emissions by 10% compared to 2020. The forest cover rate remains stable at 42%, the forest area has a certificate of sustainable forest management gain over 1 million hectares” and vision to 2050 “Striving for Vietnam to become one of the leading agricultural countries in the world with agricultural product processing industry in modernity, effectiveness and environmental friendliness. The countryside no longer has poor households and becomes “a place worth living, civilized, green, clean and beautiful with living conditions and incomes of rural residents close to and closely connected in harmony with the city”. To accomplish the above-mentioned objectives, the Strategy has also proposed a solution to “Promote the piloting and scaling up of new agricultural production models such as: ecological agriculture, green agriculture, organic agriculture, circular agriculture, smart agriculture, high-tech agriculture, agro-industry combination, agriculture combined with services (experience tourism, environmental protection services, training services and technology transfer provision, agro-business services...)(Prime Minister of Vietnam, 2022).

Resolution 19-NQ/TW dated June 16, 2022 of the 13th Central Committee of the Party on agriculture, farmers and rural areas for the period to 2030, with a vision to 2045 set out the requirement to promote the agricultural structure according to the trend of ecological agriculture to be consistent with the spirit and goals of the Resolution of the 13th Party Congress. Exploiting and promoting the advantages of tropical agriculture, potentials and advantages of each region and locality; promoting the accumulation and concentration of land; developing agriculture in the direction of modernity, concentrated and large-scale commodity farming, food safety basing on the basis of advanced science and technology application, digital transformation, mechanization, and automation; closely associating agriculture with industry, services, production with preservation, processing and consumption of agricultural products; encouraging the development of green, organic, circular agriculture and the one-commune-one-product (OCOP) program; reducing greenhouse gas emissions...; continuing to invest, renovate, upgrade and build the infrastructure of agricultural production(Party Central Committee of Vietnam, 2022).

CURRENT STATUS OF ENTERPRISE’S APPLICATION OF SCIENCE AND TECHNOLOGY IN GREEN AGRICULTURAL PRODUCTION

Over the years, our Party and State have constantly supplemented, perfected guidelines and policies for science and technology development, making science and technology truly “the leading national policy” in the process of socio-economic development of the country. In particular, guidelines and policies to accelerate research, transfer and application of scientific and technological achievements to agricultural production are of special interest. At the XIII Congress (in 2021), in the context of the new situation, our Party affirmed the policy: “Strongly develop science – technology and innovation to create breakthroughs in productivity, quality, efficiency and competitiveness in the context of the Fourth Industrial Revolution” (Communist Party of Vietnam, 2021b). In agriculture, the Congress pointed out: “Promote agricultural

restructuring... develop large-scale concentrated commodity agriculture towards modernity, specialized cultivation areas for high-quality commodities. Strongly develop high-tech applied agriculture, organic agriculture, ecological agriculture and meeting popular standards on food safety..." (Communist Party of Vietnam, 2021a). The viewpoints, undertakings of the Party and the policies, laws of the State are both oriented and create a favorable legal environment to promote research and application of science and technology in agricultural production in our country.

Towards a green and modern agriculture, the business team is always identified as the core, in which the application of science and technology is a prerequisite to build a link chain in production and consumption of products, contributing to agricultural sustainable development. Over the years, many enterprises have actively applied technical advances to production, many models have been deployed and replicated, bringing practical effects such as the application of economical irrigation technology, application of intensive farming technology, safe production according to Viet GAP, application of net house technology, membrane house to protect products, application of biotechnology, microbiology, application of machinery technology, mechanized equipment, automation in production... In animal husbandry, the cleaning of the barn also applies the most advanced technologies, automatic processing or the use of biological padding to protect the environment... In addition, modern technological equipment and processes have also been applied in research, production and vaccination against diseases for livestock in order to improve productivity and commercial quality, and at the same time reduce costs and labor. According to statistics, the number of enterprises applying high-tech agricultural models increased sharply with 49 enterprises. Many enterprises have advanced level on a par with the region and the world, such as: TH Group (dairy), Dabaco (livestock), Nafoods (planting, fruit processing); South Central (shrimp); Vingroup (vegetables); Ba Huan, Loc Troi... (Phai et al., 2022); Vinamilk with a system of 12 international standard farms spread across the country and 1 dairy farm complex in Laos manages approximately 150,000 dairy cows, helping to supply the market with over 1 million liters of raw fresh milk/day. According to statistics of the Ministry of Agriculture and Rural Development, the area of organic farming has increased from 53,350 hectares in 2016 to about 237,693 hectares in 2019 with about 46/63 provinces and cities applying organic farming. The number of organic production enterprises is 97, of which 60 enterprises participate in the export market of agricultural products with a turnover of about 335 million USD/year. Vietnam's organic agricultural products are consumed domestically and have been exported to 180 countries around the world such as the US, the European Union (EU), China, Japan, Germany, the UK, Korea, Russia, Singapore, France, Belgium, Netherlands and Italy... (Phuoc & Huong, 2021). The application of high technology in agricultural production towards a green, safe, efficient and sustainable agriculture has also been effectively implemented by local businesses such as Hanoi, Lam Dong, etc., specifically as follows:

In Hanoi, there are 160 high-tech agricultural production models (cultivation: 105 models; husbandry: 39 models; aquaculture: 15 models; 1 model combining cultivation and husbandry), concentrated in districts such as: Me Linh, Gia Lam, Thuong Tin, Dong Anh, Thanh Oai, Dan Phuong... High-tech agricultural models account for 35% of the total agricultural production value of Hanoi City. In farming, businesses apply net houses, economical irrigation, temperature and light control systems, etc. In animal husbandry, artificial insemination methods are applied (applied to 100% of dairy cows and 80% of beef cows). In the field of fisheries, applying "river in a pond" technology, enriching oxygen with water fans, using biological products in water environment treatment, using Bio floc technology... One of the high-tech agricultural models of the capital must be mentioned is Kinoko Thanh Cao Import-Export Co., Ltd in Doc Tin commune, My Duc district. Currently, the company has 3,000 m² of mushroom cultivation using Japanese technology and packaging production process, every day the company produces 3 tons of mushrooms of all kinds. Or as Cuoi Quy Organic Vegetable Production and Consumption Cooperative (Dan Phuong district) has 5 hectares of high-tech vegetables grown in net houses, automatic irrigation. Thanks to the application of high-tech farming methods, the whole production process of organic vegetables does not use drugs and chemical fertilizers, so it not only limits the adverse effects of the weather, but also brings high productivity,

ensure stable product quality, favored by the market and bringing the average farming value of nearly 6.7 billion VND/ha. In addition, Organic Green Clean Food Co., Ltd in Thuong Tin district has associated with more than 300 pig, chicken and duck farms... and slaughtered cattle and poultry on advanced technological lines to ensure food safety. The company also opened 134 clean food selling points to ensure the supply of processed foods for the market in Hanoi, other provinces and cities (Huyen, 2023).

In Lam Dong province, the application of modern high technology in agricultural production has been promoted in recent years. The province has planned 18 high-tech production areas with a total area of nearly 4,000 hectares with key crops such as tea, coffee, vegetables and flowers. By the end of 2020, the province has 62,000 hectares of high-tech production land (accounting for more than 20% of the cultivated area), many models with revenue of more than 3 billion VND/hectares/year. The province has 13 enterprises recognized as “high-tech agricultural enterprises”, 90 cooperatives, farms applying IoT technology, organic farming; 175 chain links, with the participation of 201 businesses, cooperatives and nearly 17 thousand farmer households. In production, the province has over 50% of the vegetable and flower cultivation area applied with high technology, 25% of the tea area is applied with high-quality varieties and 11% of the coffee area has been converted to new varieties. productivity, high quality. The main applied technologies include cultivation techniques in greenhouses, greenhouses, economical irrigation, nutrient management and automatic lighting; applying production process according to GAP standards... Besides, smart technology is also applied to about 50 hectares of hydroponic vegetables, 195 hectares of plants that apply automatic sensor technology for temperature, humidity, etc. average income is more than 440 million VND/hectares/year. Currently, each district and city of the province continues to deploy at least 01 smart technology application models (Dung, 2023).

In the Central Highlands provinces, the model of coffee farming is combined with crops such as durian, pepper, cashew or black cassava, or planting more wild peanuts to cover the soil, protect the topsoil, help prevent erosion and leaching in sloping land is quite common with sustainable effects. Coffee is a shade-loving plant, so intercropping durian trees in the garden not only gives extra income from durian harvesting but also has the effect of shading and blanketing the wind, keeping the coffee tree moist, helping coffee grow and develop better.

The application of science and technology to green agricultural production has brought certain effects, improving productivity and product quality is an inevitable trend to adapt to climate change and develop sustainably. However, the application of science and technology to green agricultural production today in our country still faces some difficulties and limitations, specifically as follows:

Firstly, policies related to green agriculture have not encouraged enterprises to apply science and technology to production. Over the years, the Party and State have many guidelines and policies to attract businesses to invest in green agriculture such as Resolution No. 26-NQ/TW of the 10th Party Central Committee on agriculture, Farmers and rural areas have pointed out: “Rapidly develop research, transfer, application of science and technology, human resource training, create breakthroughs for agricultural modernization and rural industrialization...”. Resolution No. 19-NQ/TW on agriculture, farmers and rural areas by 2030 with a vision to 2045. Environmental protection tax, resource protection tax, corporate income tax, Decree 57/2018/ND-CP dated April 17, 2018 on mechanisms and policies to encourage enterprises to invest in agriculture and rural areas; Decree 57/2018/ND-CP dated April 17, 2018 on mechanisms and policies to encourage enterprises to invest in agriculture and rural areas; Resolution 53/NQ-CP dated July 17, 2019 on solutions to encourage and promote enterprises to invest in agriculture effectively, safely and sustainably, etc. However, according to Vu Khue (2023), currently, the country has about 50,000 enterprises investing in agriculture, a very modest number compared to the total number of over 900,000 enterprises operating in our country (Khue, 2023). In particular, the number of enterprises applying high technology to agricultural production is still small with 49 enterprises being granted valid certificates (as of June 2021).

Secondly, the limited land fund for agricultural production of enterprises makes it difficult for the application of mechanization, the application of high technology as well as the closed and concentrated production forms of green agriculture. In fact, the access to land for agricultural development in general and green agriculture in particular for businesses still has certain barriers such as the form of leasing land use rights is not popular, people say. Even when leaving the field, they still have the thought to keep the field to prevent risks and uncertainties; Administrative procedures for land use right transfer, land use purpose change is still not clear... Besides, if you want to plant and raise livestock with high technology, you must invest in building net houses, greenhouses, modern barns include shelters for caregivers, however, the procedure for applying for a permit to build works for high-tech crop production and animal husbandry on agricultural land currently faces many difficulties.

Thirdly, businesses investing in green agricultural production lack capital. The application of science and technology, especially the application of high technology to green agricultural production, often requires a large capital source. In fact, it costs 4-5 times more to develop an average livestock farm under a high-tech model than to build a traditional farm. Although, at present, our country has many credit policies for agricultural development specified in Decree No. 55/2015/ND-CP of the Government dated June 9, 2015 on credit policies for development. in agriculture and rural areas, in which credit policies to encourage high-tech agricultural production are provided in the form of loans without collateral, up to 70%-80% of the value of agricultural projects. high technology by flexible lending form; incentives on land rent, reduction of administrative procedures...; Resolution No. 30/NQ-CP of the Government on March 7, 2017, spending at least 100,000 billion VND to implement a lending program with interest rates lower than the market interest rates from 0.5% -1.5% In addition, there are many investment funds for science and technology activities in Vietnam such as the National Science and Technology Innovation Fund, the Support Fund. start-up..., however, access to capital of enterprises still faces many difficulties. In fact, agricultural production has a high risk due to the effects of weather, climate and market factors, so banks are very hesitant to lend in the agricultural sector...

Fourthly, infrastructure, especially fisheries infrastructure, has not met the requirements of restructuring agricultural production and applying science and technology to production, processing and preservation of agricultural products. In addition, the lack of connectivity and information infrastructure in agriculture and rural areas is also the reason for enterprises to approach and apply science to agricultural activities face many difficulties.

SOME SOLUTIONS TO PROMOTE THE APPLICATION SCIENCE AND TECHNOLOGY OF BUSINESSES IN GREEN AGRICULTURE DEVELOPMENT IN VIETNAM

- In order to increase the number of enterprises applying science and technology in green agricultural production, it is necessary to improve the land policy first. Specifically, it is necessary to stipulate that households and individuals who are allocated land without collection of land use levy when not using the land for a certain period of time or leaving the land uncultivated or using land with low efficiency must give priority to the agricultural production enterprises lease or receive land transfer to expand green agricultural production. The land rental unit price must be compatible with the profitability from the leased land. In addition, enterprises renting land also need to be exempt from income tax from land use for a period consistent with the general capital recovery period for green agricultural production.
- In order for farmers willing to transfer land use rights through land lease or land use right transfer, the State, businesses, including green agricultural production enterprises need to have policies to attract laborers agricultural activities into the non-agricultural sector and ensure a stable income for them. In particular,

enterprises that receive land use rights from farmers must purchase risk insurance against job loss for farmers after transferring land use rights and participating in the non-agricultural sector. The level of risk insurance is calculated according to the value of the transferred land use right.

– In order to help businesses have enough capital to receive land use rights transfer and invest in scientific and technological advances in green agricultural production, it is necessary to continue researching to reduce interest rates and increase loan terms. Besides, it is also necessary to have policies to attract domestic and foreign investment capital sources to expand the scale of green agricultural production. At the same time, it is necessary to perform well forecasting of supply and demand of agricultural products to orient agricultural production to best meet market demand.

– It is necessary to continue simplifying administrative procedures in land use purpose conversion, granting land use right certificates, registering land changes, as well as construction procedures, applying for permission to import and export agricultural products and other related to green agricultural production. Pushing the network of digital applications when implementing investment procedures, financial obligations, taxes, fees and charges. Furthermore, in order to have a green, modern agriculture, applying mechanization and advanced techniques, corresponding infrastructure is required. For example, when you want to encourage rice farmers to apply the “alternate wetting and drying irrigation” method, you must first help them have an in-field irrigation system that allows them to do so. Or digital agriculture requires electricity, digital infrastructure, and an efficient logistics system.

CONCLUSION

The Green Revolution, understood as a revolution in the agricultural sector, began in the 1950s and 1960s in many countries around the world. Green agriculture was a period of technology transfer that led to a significant increase in agricultural output between the 1940s and 1960s. In Vietnam, agricultural production in the 70s – 80s was also influenced by the Green Revolution. In the agricultural and rural development strategy to 2030, Vietnam’s agricultural sector will move towards green agriculture and ecological agriculture by synchronously applying processes and technologies; rationally and economically using inputs for agricultural production; effectively using natural resources without affecting the environment and human health. Currently, the application of science and technology to green production has been applied by large enterprises, but the number is not significant due to policy barriers, difficult land access, capital scarcity and outdated synchronized infrastructure system. To promote the application of science and technology in agricultural production, the following solutions need to be implemented synchronously: completing the policies of land; agriculture and rural development; credit; well forecasting supply and demand of agricultural products; simplifying administrative procedures in land; completing infrastructure of agriculture and rural.

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