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FORMATION OF SECTORIAL MODEL OF UKRAINIAN ECONOMY AT THE POST-WAR PERIOD

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Purpose of the article is the empirical research of the development of sectorial models of national economies at globalization and to provide some recommendations for transformation of sectorial model of Ukraine at the post-war period. The hypothesis is that Ukraine has a chose to form a new sectorial model of national economy with powerful Secondary (S_2) and Quinary (S_5) sectors that will push country to become global competitively in the terms of the post-industrial society development at the post-war period.

Design/methodology/approach. The methods of scientific research were applied to research the economic models and the structural changes of countries: theoretical generalization (to systematize scientific research of sectorial model and to formulate the conclusions), empirical method and methods of statistical analysis (to determine the structure of sectorial model of national economies of the world; to compare the level of the national economies' development in the world and Ukraine and the their national economies' structure via specific sectors; to simulate the sectorial model of the national economy of Ukraine).

Findings. The development of Ukraine towards post-industrial society can be achieved by forming a modern sectorial model at postwar period. The model involves economic complexity, such as reducing the proportion of Primary (S_1) and Tertiary (S_3) sectors, and increasing proportion of the Secondary (S_2) and Quinary (S_5) sectors, which are concentrated on high-tech economic activities of material and non-material production. Development of Ukraine at the level of the countries with innovative economies involves the formation and development of sectorial model, which would be able to occupy strategic places in the global economy.

Originality/value. The research highlights the elements of the methodological system of choosing and forming the sectorial model for national economy's development at the conditions of post-war period, based on macro-forecasting of the country's development was carried out in accordance with strategic economic tasks.

Practical implications. The obtained results impact to develop the recommendations for the formation and implementation of modern sectorial model of Ukrainian economy at the conditions of post-war period.

Key words: sectorial model; economic growth; national economy; agriculture; industry; comparative studies of countries; Ukraine.

Paper type: research paper.

Formulation of the problem

During the years of 2002–2021 Ukraine went through a challenging period of structural and socio-economic changes. We saw uprising of civil society, revolution of dignity, clash of government and nation, elections, annexation of Crimea, conflict in the Eastern Ukraine, and Russian war with Ukraine now. All these events seriously affected economic complexity, economic growth and development of the national economy.

The modern state (till 2021) of Ukrainian economy can be characterized with follows trends:

– economic development of the national economy of Ukraine is mainly driven by the traditional economical activities of industrial society - mining and processing industries;

– worsening political and economic situation in the years of 2013–2021 led to recession in the main economic activities: mining and processing industries, supply of electricity, gas, steam and conditioned air, water supply, sewerage, waste management, and construction;

– the share of an economic activity in the structure of economy does not correlate to its importance (impact) for Ukrainian economic development. The biggest shares in the economic structure belong to the economic activities (such as real estate transactions, leasing, engineering and business services; trade, repair of automobiles, household goods and personal effects; agriculture, hunting and forestry) that are not crucial for the growth and development of the country;

– asymmetric distribution of productive forces in economic structure: processing industry, wholesale and retail trade, repair of motor vehicles and motorbikes create one third of gross value added, whereas other economic activities produce two thirds of gross value added.

Thus, Ukraine will focus on formatting a new sectorial model of national economy that will address issues of transforming its industrial society to post-industrial society according to the goals of sustainable development at postwar period. Structural transformation of sectorial model of Ukrainian economy should take place in order to push country to become global competitively in the terms of sustainable development at postwar period.

Analysis of recent research and publications

To formulate a sectorial model of national economy, I rely on works of C. Clark (1942), J. Fourastié (1949), D. Rodrik (2014) [1], L.F. Gabriel (2016) [2], D. Bell (1999) [3], J. Schumpeter (1982), and A. Maslow (1943). Thus, the model can predict not only economic complexity (structural changes and technological advances), but also the social needs of a society.

However, questions of the transformation of development models of national economies under the conditions of different types of societies remain badly researched.

Formulation of hypothesis and goal setting

The goal of the article is the empirical research of the development of sectorial models of national economies at globalization and to provide some recommendations for transformation of sectorial model of Ukraine at the post-war period. Based on the latest research and publications related to this topic, it is possible to formulate the hypothesis that in the terms of the post-industrial society development at the post-war period, Ukraine has a chose to form a new sectorial model of national economy with powerful Secondary (S_2) and Quinary (S_5) sectors that will push country to become global competitively.

Research methods

To research the economic models and the structural changes of countries, the methods of scientific research were applied, in particular, theoretical generalization – to systematize scientific research of sectorial model and to formulate the conclusions; empirical method and methods of statistical analysis – to determine the structure of sectorial model of national economies of the world; to compare the level of the national economies' development in the world and Ukraine and the their national economies' structure via specific sectors; to simulate the sectorial model of the national economy of Ukraine.

Presenting main material

In the historical process of social development, there were formed classical and modern development models of national economy. Models of national economies reveal similarities of theoretical and empirical content, which remain unchanged for a long time and are beyond the influence of seasonal factors.

Among the variety of development models of national economies, the most urgent, under conditions of emergence of postindustrial society, is a sectorial model that reflects the historical process of transformation of society according to technological criteria and reflects process of natural, radical, progressive, structural and technological changes in a national economy of country, which provide a transition to a qualitatively new level of development of society. During the 20th century, theoretical principles of sectorial model of national economy have undergone significant changes and evolved from two-sectorial model (A. Lewis) to three-sectorial (C. Clark, J. Fourastié, D. Rodrik [1], L. F. Gabriel [2], Ye. Xiaosu [4]) and five-sectorial (D. Bell [3], J. Schumpeter, A. Chukhno) models.

Sectorial development model of national economy (sectorial theory, theory of structural transformations) was the base for industrial society. The theories of structural changes pay most attention to the economic structure, structural changes and development patterns (A. Lewis, D. Rodrik, Ye. Xiaosu).

They are directed towards the mechanism by means of which undeveloped economies transform their own economic structures from traditional agriculture (pre-industrial society) towards industry (industrial society) and diverse services (post-industrial society). Sectorial model is developed by D. Rodrik [1] and considers a small open economy with three sectors, namely:

1) the traditional (subsistence sector), which does not employ capital in such a way that the productivity of labor in this sector is null or negligible;

2) the industrial (manufacturing) sector in which labor productivity is positively affected by the spillovers effects from the technological frontier, thus exhibiting "unconditional convergence"; which means that the further away industrial domestic firms are from the technological frontier, the higher the subsequent rate of growth in labor productivity;

3) the services sector in which the potential productivity of labor is a function of the social and institutional capabilities of the economy, which is supposed to be a geometric average between variables that reflect the accumulation of human capital and the institutional development of the economy.

In the economic literature, structural changes are considered to be influencing the relative share, significance and location of certain wholes and parts in the economy and to also be an important driver of economic development [5]. Although they are mainly universal, the relations, speed and directions of structural changes depend on the specificities of an economy [6]. Efficient structural changes are important for the growth of productivity, as well as for an efficient allocation of resources and taking advantage of technology and innovations [7, 8]. Today, apart from innovations and new technologies as the main drivers of structural changes, knowledge, investments, externalities, skills, use of resources, offer and demand, international trade, relationships and agglomerations, institutional frameworks, globalization are also highlighted [9, 10].

Upon studying theoretical principles and taking into account the results of empirical research, proposed to interpret "sectorial model of the national economy development" as an empirical model that allows to explore the structural changes at the national economy in accordance with social needs and technological approach, that is based on the leading role of the productive forces at society development, and to establish relations between the structural elements and to forecast future periods [10]. It should be emphasized that the sectorial model of national economy development at terms of postindustrial society makes it possible not only to assess structural changes by the technological criteria but also to take into account the social needs and determine human's place in the economic system and his importance at the development of society.

To analyze sectorial models of national economy development, the types of economic activities were divided into five sectors with regard to their technological intensity and in accordance to international classification:

– Primary Sector (S_1) includes agriculture, forestry and fisheries, mining industry;

– Secondary Sector (S_2) includes manufacture, supply of electricity, gas, steam and conditioned air, water supply, sewerage and waste management, construction;

– Tertiary Sector (S_3) includes transport, warehousing, postal and courier services, wholesale and retail trade, repair of motor vehicles and motorbikes, arrangement of temporary housing and catering;

– Quaternary Sector (S_4) includes financial and insurance services, real estate services, administrative and support services, public administration and defense, compulsory social insurance, information industry and telecommunications;

– Quinary Sector (S_5) includes intellectual and creative activities, such as education, professional, scientific and technical activities, healthcare and social assistance, arts, sports, entertainment and recreation.

Thus, the basis of the national economy of postindustrial society consists of economic activities that produce goods with high proportion of intellectual contribution and actively introduce innovations, therefore new class of employees, who actively use their intellectual abilities, emerges. In such national economy, information and innovation are resources that contribute to trends and dynamics of the development of industries, which define information as main limiting factor in production of an efficient economic system.

According to the results of own research, it was found that countries with postindustrial (information) society have quinary structure of the national economy, which has a high priority for Quinary (S_5) and Secondary (S_2) sectors in the form of high-tech material and immaterial production. In the same time, countries with postindustrial society have decrease in Primary (S_1) and Tertiary (S_3) sectors and expansion of the Quaternary (S_4) sector (Fig. 1).

Pre-industrial society   Industrial society   Post-industrial society
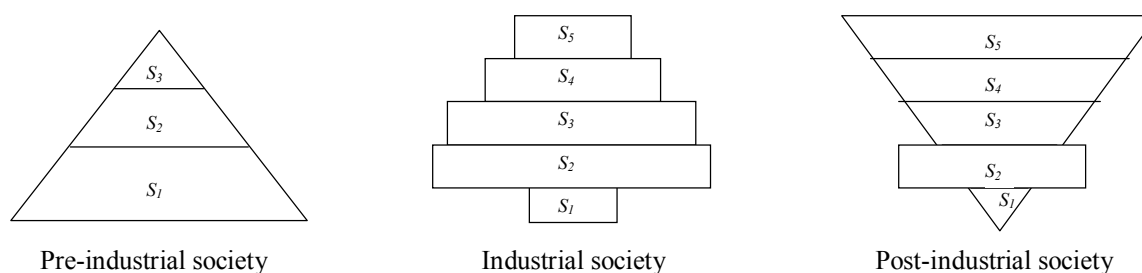
Fig. 1. Structure of sectorial model of national economy's development by type of society

Designation: S_1 – Primary sector; S_2 – Secondary sector; S_3 – Tertiary sector; S_4 – Quarternary sector; S_5 – Quinary sector.
Note: compiled by the author based on own research.

According to my researches (O. Pyroh [11–13]), I formed such conclusions of economic complexity:
– countries with pre-industrial society have three-sector economies with dominant primary sector (S_1);
– countries with industrial and post-industrial societies have five-sector model of the national economies, where one sector is dominant, which is specific to stage of development of that country;
– in industrial society Secondary (S_2) and Tertiary sectors (S_3) become dominant, and Primary (S_1) sector declines, whereas the Quinary (S_5) sector starts forming. Quinary (S_5) and Secondary (S_2) sectors in the form of high-tech material and non-material production are typical for post-industrial society, as well as a decreasing Primary (S_1) and Tertiary (S_3) sectors, and the expanding the Quaternary (S_4) sector;
– it was found that during the 2002–2013 period the share of processing industrial activities in the national economy of Ukraine was consistent with indicator of optimal economic structure (20 %), but qualitative characteristics did not correspond to the features of post-industrial society.

In several leading countries (USA, European countries), the most important economic activities for growth and development are those related to the following types of technologies: aerospace, nuclear, optical, information, communication, electronic, transportation, new materials and materials with improved properties, biotechnology, technologies in the life sciences (biochemistry, immunology, genetics, physiology, ecology), nanotechnology.

Having analyzed the structure of the sectorial model of the national economy of Ukraine for 2001–2020 (Fig. 2), we can assess the structural changes:

– the sectorial model of Ukraine in the period 2001–2007 most corresponds to the industrial stage in terms of the ratio of sectors, especially the sectoral model in 2007 (Fig. 2), while in the period 2008–2020 those structural changes that took place in the sectorial model, do not correspond to either the industrial or post-industrial stage;

– negative structural changes in the sectorial model in accordance with the requirements of a post-industrial society [12] are the reduction by almost 2 times of the Secondary sector (S_2), the basic type of economic activity of which is the manufacture, and the dominance of the Tertiary sector (S_3), the basic type of economic activity of which is wholesale and retail trade; repair of motor vehicles and motorcycles.

– positive structural changes in the sectorial model in accordance with the requirements of the post-industrial society [12] are the increase of the specific weight by 2 times of the Quarternary sector (S_4) and the gradual growth of the Quinary sector (S_5), which corresponds to the trends of the formation of the post-industrial society;
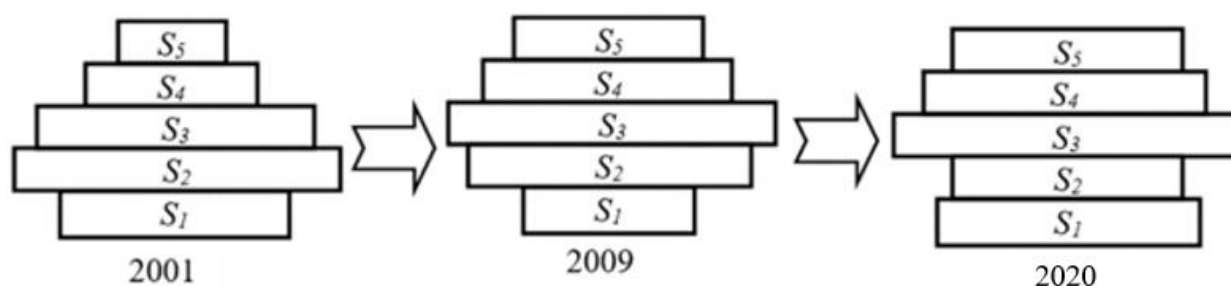

Fig. 2. Graphic view of the sectorial model of the national economy of Ukraine during 2001–2020

Designation: S_1 – Primary sector; S_2 – Secondary sector; S_3 – Tertiary sector; S_4 – Quarternary sector; S_5 – Quinary sector.

Note: compiled by the author based on own research and statistic data [14]
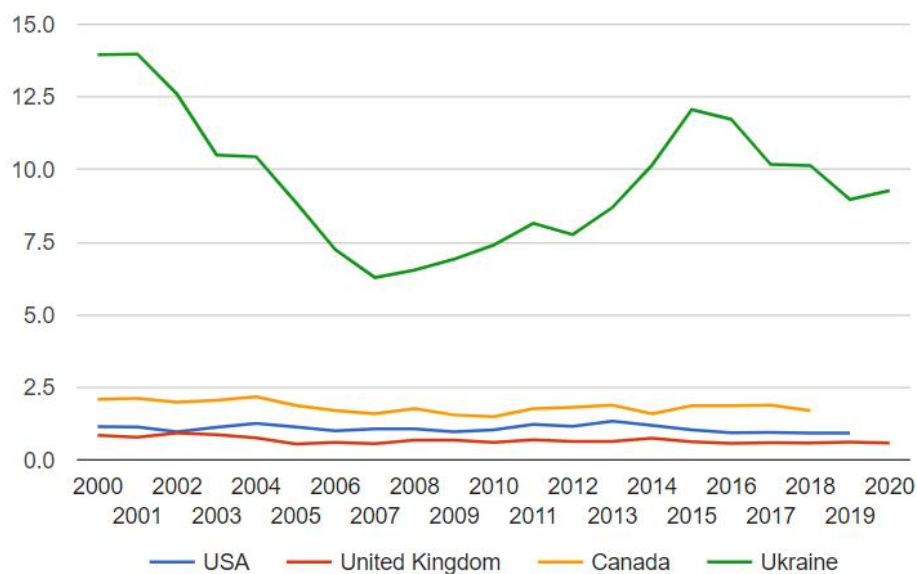

Fig. 3. Share of Primary sector (S_1) at the national economies during 2000–2020

Note: compiled by the author based on the World bank data [15].

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– trends in the development of Primary sector (S_1) cannot be assessed unequivocally (Fig. 3): 2001–2007 – we can assess the reduction in specific weight positively, which meets the requirements of a post-industrial society; while the increase in specific weight during 2008–2020 can be assessed as negative, as it does not meet the requirements of a post-industrial society, but if we take into account the negative impact of external factors – the global financial and economic crisis (2008–2009) and Russian war in Ukraine since 2014, then the increase in the specific weight of Primary sector (S_1) can be assessed as the positive trend that ensures food security for Ukraine in conditions of instability.

The development of the national economy of Ukraine depends on the efficiency and optimality of its structure by sectors, which is defined as the order of forming a system of relations between macroeconomic subjects based on the maximum satisfaction of society's needs, provided that the production and distribution efficiency of the use of the country's limited economic resources is achieved. Therefore, modeling of the sectorial model of the national economy of Ukraine was carried out, respectively, for the industrial and post-industrial stages [11]. Graphically, the modeling results are presented in the form of the "optimal" sectorial model of the national economy of Ukraine, respectively, for each stage on Fig. 4.
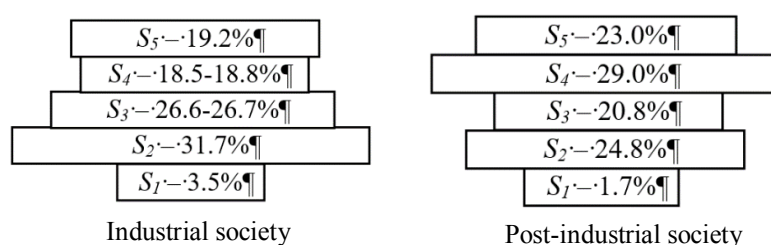
S_5 – 19.2%	S_5 – 23.0%
S_4 – 18.5-18.8%	S_4 – 29.0%
S_3 – 26.6-26.7%	S_3 – 20.8%
S_2 – 31.7%	S_2 – 24.8%
S_1 – 3.5%	S_1 – 1.7%
Industrial society	Post-industrial society

Fig. 4. Graphic view of the "optimal" sectorial model
of the national economy of Ukraine

Designation: S_1 – Primary sector; S_2 – Secondary sector; S_3 – Tertiary sector; S_4 – Quarternary sector; S_5 – Quinary sector
Note: compiled by the author based on own research and statistic data [14].

If we compare the sectorial model of the national economy of Ukraine in 2020 with the "optimal' sectorial model for the industrial and post-industrial stages, we can form the such recommendations:

1) the real model partially corresponds to the "optimal' model for the industrial stage: the specific weight of the Tertiary (S_3), Quaternary (S_4) and Quinary (S_5) sectors corresponds to the forecast indicators, but the Primary (S_1) and Secondary (S_2) sectors do not. However, in order to balance the sectorial model of the national economy of Ukraine, it is necessary to provide public (state) and private (corporative) support to the Secondary sector (S_2), namely to types of manufacture with high- and medium-tech productions;

2) in order to transfer the real sectorial model of the national economy of Ukraine to the level of the "optimal' model for the post-industrial stage, it is necessary to form a state structural policy that will provide for the structural transformation of the national economy of Ukraine: a partial, gradual reduction in the specific weight of the Primary sector (S_1), an increase in the specific weight of high- and medium-tech production of the Secondary sector (S_2), Quaternary (S_4) and Quinary (S_5) sectors, significant reduction of the Tertiary sector (S_3).

We believe that the departure of the sectorial model of the national economy of Ukraine since 2009 from the industrial sectorial model of development occurred under the negative influence of external factors – the global financial and economic crisis (2008–2009) and Russian war in Ukraine since 2014.

The current stage of development of the national economy of Ukraine requires using the advantages of resource potential based on high-tech types of economic activity and innovative development [12]. To my mind, the transformation of sectorial model of the national economy of Ukraine should become from the Ukrainian economic integration into EU value added chains as one of the country's priority tools for

economic development in the post-war period. Before the start of the full-scale invasion of Russia on the territory of Ukraine (until February 2022), business entities of various types of economic activity were integrated into the EU value added chains:

– IT industry, 70 % of whose exports are software development services – outsourcing [16, 17];

– manufacture, in particular, instrument manufacturing and automobile manufacturing. M. Hartog [18, p. 42] emphasized that the Western regions of Ukraine had a higher level of integration into EU value chains due to its geographical proximity to the EU than the Central and Eastern regions, where powerful industrial enterprises operated. The Western regions, such as Lviv, Ternopil, Rivne, Zakarpattia, should become the basic industrial hub of Ukraine in the post-war integration (Fig. 5). Business entities from the Eastern regions of Ukraine, which lost the opportunity to carry out production activities due to Russian invasion, are already transferring their production facilities to these regions;
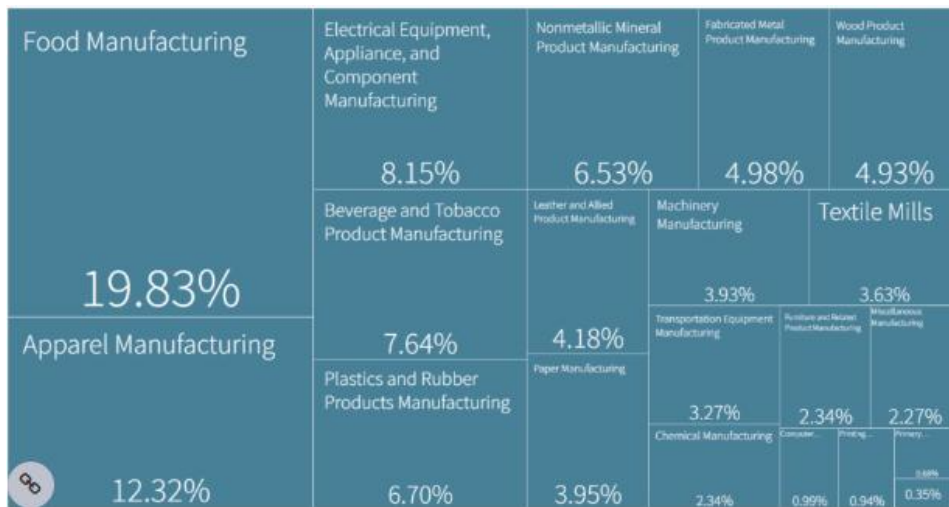

Fig. 5. Economic complexity of Lviv region

Note: compiled by the Metriverse [19]

– agriculture, which during 2008–2020 were the basic spheres of economic activity of Primary sector (S_1), are gaining new importance for the national economy of Ukraine in the context of rapid growth in production and export volumes. Precisely, as a result of the military conflict in the East of Ukraine and the temporary occupation of the Autonomous Republic of Crimea (2014–2020), there was a sharp drop in industrial production [20], which led to structural changes and a significant increase in the importance of agriculture in the structure of the sectorial model of the national economy and exports.

Conclusions

Thus, the development of Ukraine towards post-industrial society can be achieved by forming a modern sectorial model at postwar period. The model involves economic complexity, such as reducing the proportion of Primary (S_1) and Tertiary (S_3) sectors, and increasing proportion of the Secondary (S_2) and Quinary (S_5) sectors (O. Pyroh [11, 12]), which are concentrated on high-tech economic activities of material and non-material production. Development of Ukraine at the level of the countries with innovative economies (USA, Canada, countries of Europe) involves the formation and development of sectorial model, which would be able to occupy strategic places in the global economy.

Prospects for future research

In order to overcome described obstacles, Ukraine needs new sectorial model, which will address issues of distribution of productive factors, introduce new administrative and business practices, as well as create conditions for sustainable (socio-economic-ecological) growth and innovations at postwar period. My

preliminary research (O. Pyroh [11, 12]) indicates that leading agents of macro-level (developed countries: USA, Canada, European countries) and meso-level (regions, economic activities) of global economy systematically improve their models of economic development by economic complexity (structural and technological aspects) of economic systems while efficiently utilizing all factors of production of post-industrial society. These continuous improvements allow leading countries to maintain their positions as well as innovate and creative. The sectorial models include a transformation of the role and place of state in managing economic development, the transition from intermediate to high-technology industries.

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**ФОРМУВАННЯ СЕКТОРНОЇ МОДЕЛІ ЕКОНОМІКИ УКРАЇНИ
У ПОСТВОЄННИЙ ПЕРІОД**

У статті досліджено трансформацію секторної моделі економіки України у 2001–2020 рр. та формування нової структури секторної моделі у поствоєнний період. Секторна модель розвитку національного господарства комплексно відображає організацію економічної системи за технологічною інтенсивністю й суспільними потребами в умовах постіндустріального суспільства, враховує структурно-технологічні зміни національного господарства.

У ході дослідження сформовано гіпотезу: **Україна постала перед завданням із формування нової секторної моделі національної економіки з потужними вторинним (S_2) і п'ятериковим (S_5) секторами, які посилять конкурентоспроможність країни на глобальному рівні у поствоєнний період.**

Здійснено оцінювання структурних змін секторної моделі економіки України відповідно до новітніх вимог постіндустріального суспільства в умовах нестабільності (2001–2020 рр.). Розвитку національної економіки України відповідно до вимог постіндустріального суспільства можливо досягти, сформувавши у післявоєнний період сучасну секторну модель, яка передбачає зменшення частки первинного (S_1) і третинного (S_3) секторів зі зростанням часток вторинного (S_2) і п'ятерикового (S_5) секторів, у яких зосереджено високотехнологічне виробництво.

Ключові слова: секторна модель; економічне зростання; національна економіка; сільське господарство; промисловість; порівняльний аналіз країн; Україна.