

poverty of a large part of the population are growing, which is directly linked to the growing dependence on the strategy of the functioning of transnational structures, and therefore the issue remains open concerning the stability of state-management systems in the world.

### **2.3. Technological transformation of the economy of Ukraine in conditions of modern global processes**

The evolution of human society was held in three stages, which are called traditional society, industrial society and postindustrial society (table 2.5).

Traditional (pre-industrial) or agricultural society is characterized by hunting-spirallike way of farming, when men were mainly engaged in hunting and women gathering. Over time, the transition from hunting-zurlnick to agricultural and pastoral agriculture, in consequence of which the collection has changed to the cultivation of plants, and hunting and raising animals. This type of society existed before the industrial revolution of the late XVIII – early XIX century.

*Table 2.5*

**Types of human society**

The type of society	The Nature of the production activities	Main production resource	Technology	The Basis of society formation
Traditional (pre-industrial)	mining	raw materials	time-consuming	interaction with nature
Industrial	production	energy	capitalintensive	interaction with the transformed nature
Post-industrial (the knowledge society)	processing	information	knowledge-based	interaction between people

The scientific discoveries of the early nineteenth century. gave rise to a gradual transition from manual labor to machine. With the invention of the conveyor belt and steam engine society has become industrial. Industrial society is

characterized by the use of steam power and the use of machinery, the formation of large industrial enterprises and industries. The industry is based on the scientific organization of labor.

As a result of global changes in industrial society caused by the dynamic information technology bubble was formed-elt informational or post-industrial society.

According to Professor of sociology, Harvard University D. bell, the postindustrial society is a "society whose economy is the priority switched from primary production of goods to production of services, research, organization of the education system and improve the quality of life; in which the class of technicians has become the basic specific group and, most importantly, where innovation ... increasingly began to depend on achievements of theoretical knowledge" (1967) [1, p. 173].

By definition of SB. Brzezinski (1971) "the post-industrial society becomes technotronic society, culture, psychology, social life and the economy which are formed under the influence of electronics, especially computers and communications. The production process is not the main decisive factor of change affecting the morals, social order and values of society" [5].

A feature of post-industrial society D. bell is "the formulation of a society based on the production of services and information" [1].

Signs of transition to a new type of society began (a):

a gradual transition from the traditional fossil energy sources to unconventional;

replace mass production with production of goods and services, clearly focused on the consumer;

replacement nuclear family "many plates";

shift in the organization of corporations to forms less bureaucratic, more specialized and focused on solving specific problems;

demosite means of communication, facilitated the development of cable television, satellite communications, etc. [16].

The development of the Internet and information technologies resulted in "information explosion" in modern society. To date, the annual increase knowledge in the range of 4-6%, and the current specialist almost a third of the total volume of your time should be spent on the upgrade of professional knowledge, and thus, it gets to 50% of the knowledge after graduation. Updated annually about 5% of theoretical and 20% of professional knowledge [14].

If the most important economic feature of the post-industrial society is the leading role of the production services, the technological basis for such transformation is a qualitatively new role of science and theoretical knowledge that has developed in advanced industrial countries in the postwar period [1].

The main fundamental features of post-industrial society D. bell are:

- the Central role of theoretical knowledge;
- the creation of new intellectual technology;
- the growth of a class of carriers of knowledge.

Therefore, post-industrial society is often identificireba with the "knowledge society" (knowledge society).

Simultaneously with the evolutionary development of human societies have varied methods of processing, manufacture, change of state or properties, forms of raw materials in the production process. It is associated with the development of technology is the main driving force of scientific progress. With this new technology occurs not alone but in combination with other, complementary technologies.

A set of technologies and industries of the same level, which are combined in a stable integrity, which itself is reproduced, form a technological way. The concept of "way" means establishing a certain order of something [9].

For the first time the concept of "technological way", as a scientific economic category proposed by S. Glazyev. In his opinion, the technological

structure is a complex of technological processes, which represent a totality which is reproduced, and cover a variety of industries and enterprises of production [3].

Technological way is a group of technological sets connected to each other the same type of technological chains and forming a reproducing integrity [2].

Technological structure is characterized by a single technical level of its constituent industries associated vertical and horizontal flows are qualitatively similar resources based on shared resources of skilled labor, common scientific and technical potential of certain technologies [10].

In the framework of the technological system is vicious microfinance cycle, including extraction and obtaining of raw materials, all stages of their processing and production of end products that meet the appropriate type of public consumption.

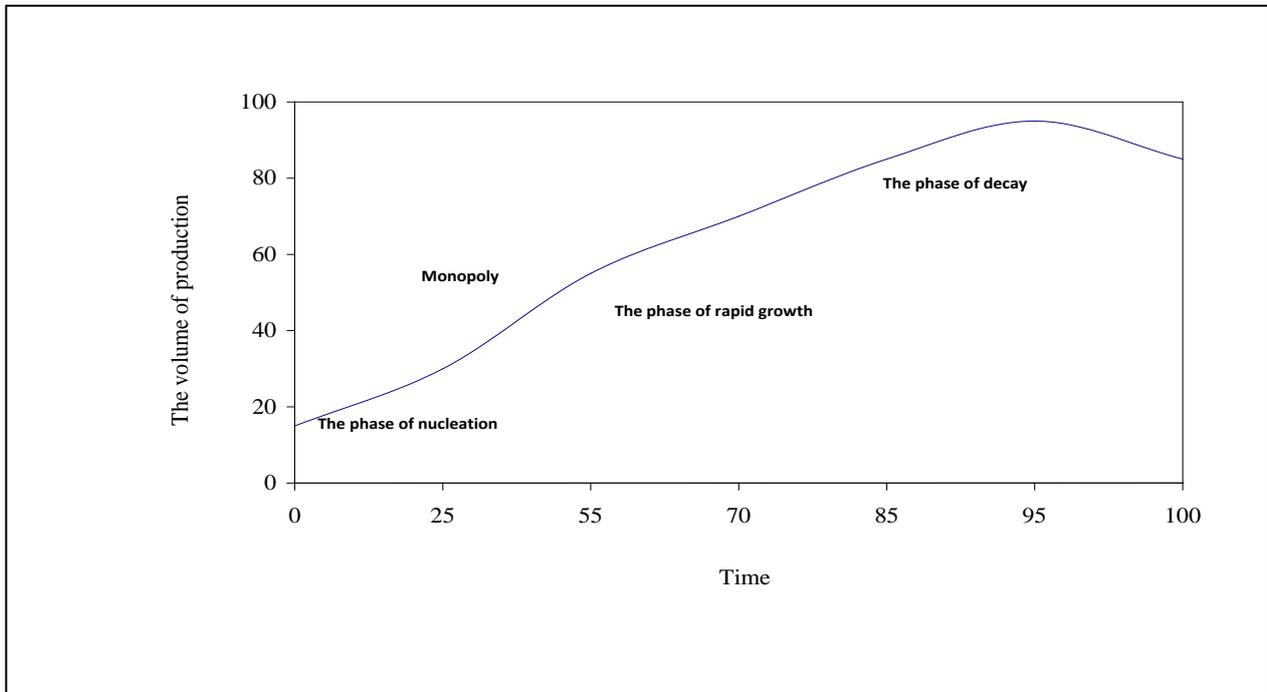
Each technological system is self-reproducing integrity. It has a complex internal structure, which is based on - technological system. Technological structure is also a key factor and the organizational and economic mechanism of regulation.

The core of the technological structure are fundamentally new (radical) technologies, which are created under the influence of earlier unknown laws and laws, inventions, discoveries that fundamentally change the content of the various activities in the society [15].

Each technological generation has a life cycle that is a period of time from inception to decline. According to many authors of scientific and technical progress, the cycle lasts about 100 years.

According to Krasnokutskaya N. In. life cycle of the technological structure includes four phases of development: the emergence and formation of new technological mode in the depths of the previous one; the dominance of the technological structure, maturity and decay (death) of an aging technology structure (Fig. 2.13.). The life cycle of a technological order Popel S. divided into the following phases: nucleation, monopoly, growth and extinction [15].

The first phase. The emergence and formation of new technological mode in the depths of the previous one. The existing productive capacity of the economy gives impetus for the further development of technological structure.



*Fig. 2.13. The life cycle of a technological order according to N. Krasnokutskiy*

The second phase. Economic restructuring based on new production technology, which leads to the domination and monopoly of technological mode. The rate of maturation of a particular technological structure depends on the favourable technological and socio-economic environment. If there is though a slight but steady regardless of price the demand for a new method, process, product, the development of elements of a new technological system is accelerating.

The third phase. The phase of rapid growth. Invented a new technology of production goes to the mass use that gives impetus to the accelerated development of new technological order.

The fourth phase. Technological way is moving from the stage of ripeness to gradual decay and death. At this stage begins the search for the replacement of old technologies for new, more efficient way.

The impact of technological structure determines the level of social development, culture, defence, the legal status of each subject, the crime rate and other parameters of the development of society over time under the influence of business cycles, the change of technological structures in social production, that drew the attention of N. Dmitry Kondratiev. He is still in 20-e years of the twentieth century, studying fluctuations in the economy, came to the conclusion that economic changes are preceded by significant scientific and technological inventions and technological innovations. Long-term economic growth with technological development linked economists like Marx, S. Schumpeter, N. Kalecik and many others, but for a long time, the role of technological structures had been ignored in economic science.

According to the theory of long waves of N. Kondratieff economic and social development of countries in the world, there are waves. "Long-wave" consists of two phases: ascending and descending, which falls in the period of crisis and depression. Between short and long waves are closely linked, since the first as if strung by the second. The real nature of the economic cycle depends on what phase of long cycle falls short of this: if you the rising – revival, and if a downward – crisis depression worse.

Before the beginning of the upward phase has seen a revival in the field of technical inventions, their widespread use, that provides a long economic boom. At the stage of economic recovery usually changing economic conditions, supply and demand for manufactured goods. Feature of a depression wave is that it is accompanied by high activity of innovation, full upgrade of buildings, equipment, long-term use, the creation of new jobs and new production facilities. During the recession of the long waves of technological change the development model.

After a period of stagnation, the exit phase of the crisis and depression and to further the achievement of economic recovery can only happen thanks to the massive replacement of the active part of the instruments of labor, those businesses that survived the crisis. Through the use of new technology and relatively low prices of the period of stagnation is achieved by reducing unit costs and increasing the profitability of production, thus expanding economic activity.

These cycles have spiral progressive movement in technological potential of the economy. They are the mechanism by which the market environment is implementing the self-regulation of innovation by entrepreneurs in the economic practice. The most important cause of cycles ("long waves") Kondratiev and the duration of the known American economist P. Drucker recognized innovation.

According to the theory of "long waves" N. Kondratyev, scientific and technological revolution is developing in waves, with cycles of approximately 50 years. Scientific-technical revolution leads to change of technological mode. Life cycle of a new technological wave starts during the decay of the previous one. Currently scientists distinguish six technological ways and show signs of the formation of the seventh (tab. 2.6):

The first wave (1785-1835), was formed the first technological generation based on new technologies in the textile industry, the use of water-power.

This technology, related to the textile industry became the core of the first technological wave. The invention of spinning and weaving machinery, have led to the transfer of the textile industry on machine base that gave impetus to the development of this technological system. This, in turn, caused increase of demand for engineering products [7]. There was also improvement in the processing of metals.

A key factor of the first technological system has become a water engine. For the first time, such technological developments have taken place in England. Subsequently, with some delay, similar developments occurred in other European countries: France, Germany, Russia.

Since 1790, these processes began to occur in the United States. The formation of the first technological structure in these countries, except Russia, was carried out for 30-50 years.

Starting in 1820-ies on the basis of the first technological wave began to form a new technological way. The impetus this gave the second wave (1830-1890.), which is associated with the development of rail transport and mechanical production in all sectors on the basis of the steam engine.

Table 2.6

**The periodization of technological structures**

Technological way					
Name	Period	Core	The basic innovation	Advantages	Dominant industries
1	2	3	4	5	6
1st technological way	1785-1835	textile industry, textile mechanical engineering, iron smelting, iron processing, construction of channels	textile machine, water engine	mechanization and concentration of production in factories	textile industry, iron smelting, Metalworking, and construction of the main channels
2nd technological way	1830-1880	steam engine, railway construction, shipbuilding, the coal industry, ferrous metallurgy	steam engine, machines	the growing scale and concentration of production on the basis of the steam engine	mechanical production based on the steam engine, railroads, railway, steamship transport, engineering and machine tool industry, coal industry
3rd technological way	1880-1940	electrical heavy engineering, manufacturing and steel rolling, power lines, inorganic chemistry	motor, steel	Increasing in the production flexibility through the use of electric motors, standardization of production, urbanization	radio, Telegraph, electrical and heavy engineering, manufacturing and rolled steel, lamp appliances, shipbuilding, inorganic chemistry

4th technological way	1940-1990	automobile and tractor construction, nonferrous metallurgy, production of durable goods, synthetics, organic chemistry, extraction and processing of oil	the internal combustion engine, petrochemistry	mass and serial production	automotive, tractor, aircraft, synthetic materials, nonferrous metallurgy, organic chemistry
5th technological way	1990-2020	electronic and computer fiber-optic industry, software, telecommunications, robot construction, information services, extraction and processing of gas	trace elements	industrialization of production and consumption, increase production flexibility, deurbanization on the basis of information technologies	electronic engineering, computers, software, telecommunications, fiber optic equipment, information services
6th technological way	2000-2020	bio - and nanotechnology, Photonics, optoelectronics, aerospace, alternative energy sources	Nanotechnology	overcoming environmental constraints through the use of non-conventional energy sources	robotics, biotechnology, artificial intelligence, global information networks and integrated high-speed transport systems, space technology, nuclear industry, the use of hydrogen as an energy carrier, genetic engineering
7th technological way	XXI century	fusion technology, psi technologies, biotechnologies associated with morality and responsibility	cognitive technology (human bioenergetics)	the emergence of the categories of "GParted", "gpinfo" and "Tarzana"	the mastery of the physical vacuum, a new model and life forms on the planet, bacon utern systems and Biomedicine

That is the steam engine became a key factor in the development of the second technological way. The basis of this period were coal and transport infrastructure.

In the years 1845-1850 second technological mode becomes dominant in the economy of developed countries. The rapid development of machine production, including automated production has become the core of the second technological way.

During this period, dramatically increased the intensity of international trade. The growth of large industry was constrained by the underdevelopment of transport. Therefore, an important feature of this structure was the rapid development of railway construction and transport mashinobuduvannya. The concentration of population in cities and intensive construction in the transport sector required the strengthening of technical base of construction and encouraged mechanization [7].

Mechanization of social production on the basis of the steam engine was gradually reached maximum capacity. Public demand for products of the second technological way saturated. Thus, the economic growth of the 1850-1860-ies was followed by stagnation. Was over-production of some industrial goods. Under these conditions, and began to form the third technological way.

Impetus to the development of the third technological order gave the third wave (1880-1940.) that was based on the use in the industrial production of electric energy, development of heavy engineering and electrical industry through the use of rolled steel, new discoveries in the field of chemistry. Was implemented radio, Telegraph, automobiles, airplanes, began to be used non-ferrous metals, aluminum, plastics and etc. becomes Dominant consumption AC deployed in the construction of power plants [7].

Although the most important energy carrier of the third technological order was coal, but also on the energy market starts using oil.

A significant development in this period reached the chemical industry. For the third technological structure was invented the ammonia process of obtaining a soda, the production of sulfuric acid by the contact method established electrochemical technology.

Formed the large enterprises, the cartels, the trusts. There is a concentration of banking and financial capital. Smaller companies began to be absorbed in the large and in the market to create monopolies and oligopolies.

The characteristic features of the monopoly are:

market presence of only one manufacturer that sells its products to many operating independently from each other.

the lack of substitute products the products of the monopolist;

blocking market entry to new companies.

Oligopoly – a situation in which several companies dominate the market. The characteristic features of oligopoly are:

goods are not differentiated (undifferentiated oligopoly) or differentiated (differentiated oligopoly);

every company is exposed to marketing activities of competitors;

are high barriers of market entry for new businesses.

The oligopolistic markets are formed: steel, aluminum (undifferentiated oligopoly); computers, cars (differentiated oligopoly)).

A key factor in the development of the third technological mode was the motor. Global leadership moving from England to the United States.

The fourth wave (1940-1990 gg) has formed the fourth technological order, based on further energy development with the use petroleum and petroleum products, organic chemical products, gas, communications, new synthetic materials. Oil has become a leading energy source, unlike the previous structure, which was the basis of coal. Petroleum products are used as the primary fuel for almost all types of transport – diesel locomotives, automobiles, aircraft, helicopters, missiles. Oil has also become the most important raw materials for the chemical industry.

The transition of the population to new type of consumption, characterized by mass consumption of consumer durables, synthetic products [7].

This way of life began a new direction of technological development. The era of mass production of cars, tractors, airplanes, various types of weapons, consumer goods on the basis of conveyor technology.

Was invented and became widespread computers and software for them. With maturity the fourth technological order is created the global telecommunication system on the basis of telephone and radio communications [7].

I started using the atom first in military and then for peaceful purposes.

The core of the fourth technological order was the automobile industry and the development of the first samples of the tracked vehicle and special equipment.

Appeared multinational and international firms that carry out direct investments. Prevails in the market oligopoly competition.

A key factor in the development of the fourth technological order was the internal combustion engine.

The fourth technological order has reached maturity until the 1980s, in developed countries. The transition to the fifth technological order gave the fifth wave (1985-2035 years) that builds on the achievements in the field of microelectronics, Informatics, biotechnology, genetic engineering, new energy, materials, space exploration, satellite communication etc. There is a transition from isolated enterprises to the development of a network of transnational corporations, the United of the Internet, carrying out close cooperation in technology, quality control, production, planning, innovation and investment, procurement on the principle of "just in time". During this period in the industry are actively used achievements in the field of microelectronics in the management of physical processes on economy level.

- The fifth technological structure formed electronic engineering, computer engineering, software, aerospace, telecommunications, fiber optic, robotic construction, information services, production and consumption of gas.

A key factor in the development of the fifth technological structure steel gas technology and microelectronic components.

On the fifth technological way are countries such as Japan, USA, Germany, Sweden, the EEC, Canada, North Korea, Australia.

Since 2000 in leading countries made the transition to the sixth technological mode, which gave impetus to a new stage in the development of medicine and biotechnology. Modern technologies are changing the structure of matter to atomic and nanoscale. At the nanoscale there is an opportunity to change the molecular structure of substances purposefully to give it the fundamentally new properties to penetrate into the cellular structure of living organisms, altering them [18]. The development of computer technology has led to increased information processing. In the result of a combination of discoveries in science and the rapid development of technology created a quantum computer, artificial intelligence, virtual money (bdon) and other discoveries. Such discoveries have provided access to a new level in enterprise management systems, society, government, economy.

When entering into the sixth technological way, all parties familiar life and dynamics of society are changing dramatically [18]. A society moves from post-industrial to the knowledge society.

The core of the sixth technological structure steel, bio - and nanotechnology: nanoelectronics, molecular and nanophotonics, nanomaterials and nanostructured coatings, optical nanomaterials, nanoheterogeneous systems, nanobiotechnology, nanosystems engineering, nanoablation; space technology.

The leading industries of the sixth technological order are the electronic, nuclear and electrical industry, ICT sector, machine tools, shipbuilding, automotive industry and instrument-making industry, pharmaceutical industry, solar power, space-rocket industry, aircraft industry, cellular medicine, seed farming, construction, chemical and metallurgical complex [18].

Key factors in the development of the sixth technological order are: unconventional (alternative) sources of energy: hydrogen energy, wind energy, sun;

cell technologies and methods of genetic engineering (fine chemistry), implementation of which requires the mandatory use of electronic raster and atomic-force microscopes;

the development of nuclear power with advanced security, and in the future of fusion energy;

the widespread introduction of materials with predetermined properties, primarily composite;

the formation of a pervasive global information and communication networks;

radical changes in the methods and means of environmental activities that reduce the anthropogenic impact on the biosphere of the Earth [11].

According to forecasts of Scientific Foundation, in 2015 the annual turnover of the nanotechnology market will reach 1-1.5 trillion. dollars [9].

According to the leading scientists of the sixth technological way has already reached the second phase of the life cycle. But its further development is not yet well conceived and the prevalence of new technologies. While maintaining the current pace of technological progress in 2040 it will reach maturity [6].

Creation of technologies of "cold fusion", the development of which has long been under way, will radically change the energy potential of earth's civilization and lead to the industry's switchover to the seventh technological way.

The fundamental difference between the seventh technological order from all other orders will be a combination of production processes and human consciousness. Human consciousness will become a powerful resource as science. To date, the production of any product requires no direct involvement of human consciousness, and needs only his muscular strength: for example, press the button and start the conveyor in motion and then observe the production process. But in the near future, the start of the production process will realize the consciousness of the person. On the basis of human consciousness has developed so-called cognitive technology [13].

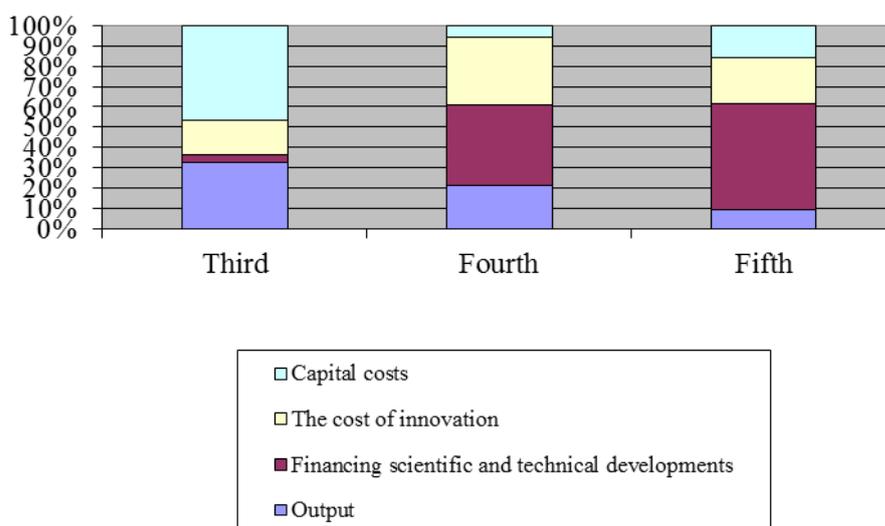
A key factor in the development of the 7th technological order will become the human consciousness and artificial intelligence system.

In connection with acceleration of scientific and technological progress in the future, the projected reduction in the duration of waves (modes).

Sequential change of technological structures gives impetus to the economic development of the countries. So, in economically developed countries there is a heavy redistribution of resources from the fourth to the fifth technological order. In Ukraine, the fifth technological structure exists mainly in the defense industries. The transfer of defense technologies to the civilian sector is extremely slow due to a number of objective and subjective reasons [2].

Over the last decade developed countries to postindustrial economy is increasingly estranged from other States, which include Ukraine.

In the economy of Ukraine due to the potential large territory, favorable weather conditions, cheap natural resources and labor, at the same time traced the existence of the third, fourth and fifth (in defense industries) technological structures with a predominance of the third and fourth.

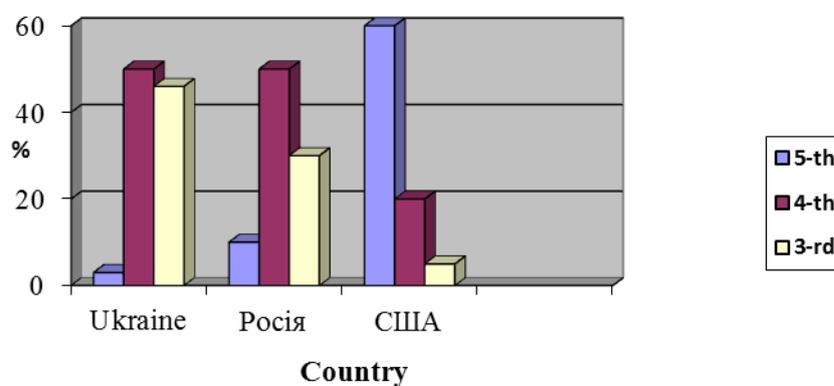


**Fig. 2.14. The structure of technological orders in Ukraine (compiled by E. G. Kirdina)**

According to the analytical materials for the parliamentary hearings "Strategy of innovative development of Ukraine for 2010-2020", in Ukraine in

enterprises III technological mode accounts for 46% of the total IV – 50% V – 3%, and innovation changes the technological structure of the economy, preserving it [8, p. 54, 16].

The U.S. share of the fifth technological structure is 60%, fourth – 20% and only about 5% are sixth technological order. For comparison, in Russia the share of technologies of the fifth way is about 10% (in the military-industrial complex and aerospace industries), the fourth – more than 50%, the third about 30%, and the sixth has not yet formed [20].



**Fig. 2.15. Comparison of technological structures of the countries**

Recent research of the industry of Ukraine indicate the country's technological degradation and the threat of deepening technological regress [17]. Today, the industry of Ukraine is heavily degraded, some experts speak even about the need for re-industrialization of the country and the reconstruction of national industry" [18,p. 15].

The analysis of the dynamics and structure of the scientific-technological and innovation activity in Ukraine allows to draw the following conclusions:

1. In the industrial complex of Ukraine and deepening the trend of dominance of industries with low knowledge intensity [4, p. 305].
2. Domestic enterprises at present and in the near future is not able to mass deploy high-performance, scientific-technological, industrial and innovative activities [21, p. 337].

3. Ukraine as a result of market transformation of inversion type, combined with the globalization processes, has not rebuilt its domestic market, have not created the corresponding consumer and manufacturing demand and supply, did not satisfy the basic needs of the population, and once in the defining part adapted on the basis of market mechanisms in certain segments of the world market as a raw materials appendage. Its structure, in its main points is not determined by the internal needs of economic development and external demand commodity nature [17].

4. The narrowness of the domestic market of Ukraine does not create adequate incentives for investment in domestic enterprises both from domestic and from foreign investors.

5. Unfavorable investment climate in Ukraine, which, through the incompleteness of institutional transformations, excessive government intervention in economic activity, corruption, low level of development of market infrastructure discourages domestic companies from the main flows of capital.

6. Irrational structure of export to international markets. Ukraine exports to international markets those goods and services (food, ore, metals, primarily black, transport services) that is mostly raw materials and are characterized by their declining share of global sales of goods and services.

7. The lack of a competitive, financially-powerful domestic multinational corporations.

8. Do not use the strategy of global marketing and investments, forms and methods of implementation of major international investment projects.

9. The presence of barriers to entry of domestic exporters to international markets.

10. Not the inclusion of domestic subjects of foreign economic activity to international information networks.

The above problems hinder the development of the economy and insufficient funding of domestic research and innovation does not allow to create new technologies, which will enable a rapid transition to a higher technological way.

However, the current state of the global economy is characterized by the transition industry developed country leaders are already to the sixth technological mode, while the domestic economy was generally on the third and fourth order.

In order to be part of the technological leaders, Ukraine must focus its efforts on the creation of a fundamentally new directions, which are characteristic of the knowledge economy (i.e. the fifth and sixth technological structures), funding them through the development of unique technologies of the third and fourth orders. Scientific and scientific-technical potential of Ukraine in a number of basic industries, adequately corresponds to the level of developed countries and allows to create base for formation and development of the technologies of the fifth and sixth modes [12].

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## **2.4. Migranomics: the chance for Ukraine to become a successful country in the XXI century**

The development of the world economy has always been accompanied by migration processes. Approximately until 1990, migrants were evenly distributed between developed and developing countries.

However, with the liberalization of economic regimes, the decline in the birth rate, the aging of the population, and the intensification of globalization, migration accelerates and moves mainly to the developed countries.

In 2016, an average of 57 high-income countries (according to the World Bank methodology), immigrants accounted for 26% of the population, and in the top 10 countries of the world - 36%. In other groups of countries, the share of immigrants to the population is much lower (fig. 2.16).