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Economics and Society in the Era of Technological Changes and Globalization



# Post-industrial Technological Mode of Production: Theory, Economic and Environmental Features, Discussion Questions

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## ABSTRACT

The article explores the emergence of a new stage of technological development - the post-industrial technological mode of production. Based on content analysis of industrial technologies and technologies of the new wave there is proposed criterion which can differ post-industrial technological mode of production from industrial. It is shown that a new wave of technologies: Renewable energy, nanotechnology, biotechnology, information and communication technologies - Build the core of the post-industrial technological mode of production. Being at the beginning of its formation, it can only be described by some economic and environmental features. Attention is drawn to the success of post-industrial technologies in ecology and their possible adverse effects on the environment and human, the need for their thorough investigation. There are given the facts of the development of post-industrial business technologies, the formation of a new structure of energy and production. It is proved that there is no reason to consider contemporary social problems as problems of post-industrial society, they are peculiar to the modern super industrial society.

**Keywords:** Post-industrial Technological Mode of Production, Economy, Ecology, Social Expectation

**JEL Classifications:** L52, O33, P48

## 1. INTRODUCTION

### 1.1. Introduce the Problem

In recent decades, in the scientific literature among economists and sociologists became popular the term “post-industrial society” largely due to the release of the book of Bell, 1973 “the coming of post-industrial society. A venture in social forecasting” (Bell, 1973). After its publication, the focus of scientists was drawn to the trend of social change in the community and with a less extent to the development of technologies, which alone can give knowledge of how modern society can be transformed from industrial to post-industrial. In the preface to the Russian edition 1999 Daniel Bell wrote: “We need to understand the evolution of technology, and above all, how to machine technology has given way to the intellectual” (Bell, 2004. p. 11).

In his outlook for social change Bell relied on scientific and technical achievements of the mid-twentieth century - A replacement

of mechanical and electromechanical systems with electronic ones, miniaturization - chips, microprocessors, transforming information into digital form, software, computers, fiber-optic communications, lasers, revolution in materials (Bell, 2004. p. 105-108, 122-126). As can be seen from the list above, we are talking about the breakthrough in areas of the information and communication. Post-industrial sector (manufacturing) Bell drove to the processing of information, the sharing of knowledge - information and communication technologies, which are in the middle of the 20<sup>th</sup> century did, though significant, but the first steps. Nowadays, they have already penetrated into many spheres of human activity and in the future their development is seen encompassing. In this respect, the Bell’s forecast is fully justified. However, is it possible to characterize the post-industrial sector by one, albeit a very important, direction of technological advances - information technology? Information technology, no matter how deep or penetrating it is into the production process and how it is involved in them, they do not form a self-generating

products and services of technological basis of production. They “serve” industrial technological mode of production.

### 1.2. The Aim of Research

Currently becoming more widely available new technologies of emerging new wave of technology: Nanotechnology, biotechnology, new energy, new materials and etc. Offered by them tremendous economic opportunities in case of a successful implementation are now little considered by private business and state officials (Perez, 2014. p. 37). How much can be justified the encouraging economic expectations of a new wave of technologies? What are the theoretical assumptions of already known empirical evidences of their effectiveness? The aim of the article is to identify the nature of the new technologies, to establish their place in the logical and historical process of technological development, to justify the emergence of post-industrial technological mode of production, to consider possible ways of its formation, which could be taken into account in the implementation of innovation policy and business.

### 1.3. The Article’s Structure

The first section of the article is devoted to the theory of technological mode of production, identification of industrial and post-industrial technological modes of production, especially the formation of the latter, its contents, and the relationship with the industrial technological mode of production. The second section will examine some of the economic characteristics of the post-industrial technologies, trends in production and technological structure of the economy, the prospects and limitations of the planned development. Further, in the third section the environmental issues of post-industrial technological mode of production are put both in terms of reducing industrial pollution and in preventing the proliferation of harmful effects on human beings and nature. In the fourth final section there are discussed the controversial issues of the formation of post-industrial technological mode of production, including the relationship of the social aspects attributed to him, with the industrial technological mode of production. The article does not pretend to be a thorough coverage of the topic. It is a preliminary concept sketch of the birth of the post-industrial technological mode of production the basis of which is the deployment of the new wave of technology in many countries.

## 2. THEORY

### 2.1. The Essence of the Post-industrial Technological Mode of Production

The new technological wave is characterized by two main features. The first of these is the fundamental difference between its technology from the traditional methods of production and services. The second is that the first experience with the new technology speaks about the availability of products with unique or high consumer properties, giving rise to some optimism for their dissemination. The turning point in the state of technological basis of production, the emergence of the issue of its renewal leads to the need for understanding of the theoretical foundations of the new wave of technology, the nature of the new technologies as a condition for understanding their prospects.

Consideration of technology as a mean of production of man’s relationship to nature in order to obtain consumer products, providing the support people, can be adopted as the methodological approach for the identification of a new wave of technology and its inherent set of technologies. Following this approach, we can say that the new wave of technology: Getting renewable energy, nanotechnology, atomic-molecular technology, biotechnology, realizing a huge number of specific technological methods based on the use of the processes occurring in nature itself, when the products and services produced by the management of natural processes. Covering many aspects of the production activities of people, they can be categorized as post-industrial technologies, and their combination into a new technological era - a post-industrial technological mode of production, other than industrial. Post-industrial technologies are also called soft technologies, the approximation to natural processes, as well as nature-like technologies. Indeed, these technologies are similar to natural processes, but they are targeted at getting products and services which people need. The term “post-industrial technologies,” though not often, but is found in the scientific literature. For example, this term is referred by Nelson and Cooperman (1998. p. 583-596), however, only with respect to information technologies. And the term “post-industrial economy” is treated as a service - informational (Antle 1999. p. 993-1010).

### 2.2. The Characteristics of Post-industrial Technological Mode of Production

Under the technological mode of production is understood the unity of technology and technological tasks. Industrial technological mode of production is based on the discovery of the laws of nature and creation on the basis of their “second transformed nature” - A system of machines (machine industry) for the production and consumption necessary for livelihoods products and services. For industrial technological mode of production the greatest characteristic is the processing resources provided by nature: Wood, hydrocarbon metallic and nonmetallic minerals and et al., and eventually their destruction (consumption) is in the process of production. Industrial type of technology brings a huge amount of runoff, the onset of the critical pollution for human life. Modern society is characterized as a risk society and its transition to ecological modernization is not clear. “Clarification of the precise dynamics of more empirical analyses on how individual countries are coping with the challenges posed by ecological modernization” (Cohen, 1997. p. 115).

Traditional industrial technologies, with more potential for development, gradually approach the limit of productivity growth and it becomes necessary, in this connection, to update them on new technological principles. It is believed that the era of industrial technological mode of production - the use of machines began with the domination of the steam engine in the middle of the XIX century. At the present time, it continues to dominate the world, although there were also applications of new technological methods.

The use of natural processes taking place internally in the production of products and services can be treated as a starting position, expressing the quality of post-industrial production base,

as a criterion of its difference from the industrial production. The great characteristic has become that it is not human impact on the nature of the substance with the help of his mechanical instruments of production, but management of the natural processes in order to obtain the necessary products and services. Thus, we can conclude that the post-industrial production is the production of goods with the use of natural processes: In energy industry - renewable energy generation in industry, in agriculture - nanotechnology based on the high activity of nanoparticles (ranging in size from 1 to 100 nm) of the substance, their ability to join and connect the particles of different substances to form new materials, parts and products; biotechnology.

### 2.3. Post-industrial Technologies

In the preface to the 1976 edition Daniel Bell wrote: "If industrial society is based on machine technology, the post-industrial society is influenced by intellectual technology" (United Kingdom Renewable Energy Review, CLI). If we expand the term "intelligent technology" and include in addition to information technology, renewable energy technologies, nanotechnology and biotechnology, the thesis of Daniel Bell that the post-industrial society is influenced by intellectual technology gets a modern sound. The meaning of the term "intelligent technology" will be enriched with new content. Toffler (2010), describing the technosphere new wave, except information technology, it is already included renewable energy, the production of composite materials, genetic engineering, the principle of additive technologies (Toffler, 2010).

It is generally accepted position that a new technological mode of production arises on the basis of previous achievements, its created conditions and technology, which allows us to go to an entirely new technology. Post-industrial technologies are emerging as a result of scientific progress and the evolution of industrial engineering and technology. Finding in 70-80s of the last century of the method of direct preparation of solid products from the decomposition of vapors of volatile compounds containing metals, in scope and quality of the products obtained: Wear-resistant coatings to products forming machine parts without machining, is a type of non-waste nanotechnology. Scientific and technological search brought closer revolution in mechanical engineering.

Renewable energy was the product of a long period of development technologies of solar energy, water and wind flows used by people. Thanks to the progress in the creation of a system of machines formed the energy industry on the use of renewable energy sources. The invention of probe scanning tunneling and atomic force microscopes allowed to penetrate into the atomic-molecular structure of materials, design new objects with unique consumer properties. Development of scientific and analytical equipment to study the secrets of nature continues. A recent example - The Nobel Prize in Chemistry in 2014 for the creation of a fluorescent microscope with high resolution which allows us to study the structure of biological molecules.

The above characteristics of the industrial and post-industrial technological modes of production are their pivotal characteristics, technological core. Together with them, there are used technologies

from different eras, which are not separated from each other. So, as part of the post-industrial production formed may be segments of industrial technologies involved in the post-industrial processes. On the other hand, the principle of the post-industrial production - the use of natural processes is inherent to some extent to different technological eras. Thus, agriculture, based on a relatively inexhaustible resource - land for thousands of years, since the pre-industrial (agricultural) technological mode of production, is the basic sector of the economy, changing only technologically, and large hydropower, based on the energy of the water flow, along with other sectors, for example, information and communication, determines the character of mature industrial production.

### 2.4. Perspectives of the Post-industrial Technological Mode of Production

Noting the inherent technological era's symbiosis of different types of technologies, it is possible to identify appropriate instruments of production for each of them, symbolizing this technological mode of production and its technological nature. For pre-industrial type of production these are primitive tools of manual labor, industrial - machines, for post-industrial technological mode of production a symbol of the term has not yet formed. In the Russian language for this purpose can be used the term "ustroistvo," combining concepts: Technological system, the device, the device installation. Post-industrial mode of production technology based on open by now methods of using the renewable energy to manipulate nanometer-scale particles of matter, atomic and molecular structure will change, as experts predict, the basic sectors of the economy: Energy, engineering, transport, agriculture and the environment, conditions of human life. With the technology of the post-industrial era are pinned hopes on the distancing term depletion of economically viable hydrocarbon resources, a radical improvement of the environment, care of large enterprises and the number of hazardous industries, the transition to technology, close to the natural processes, the emergence of new growth potential productivity.

According to the forecast Perez (Perez, 2014), it will take about two decades before the boom of technologies of new wave starts, and while in developed countries there is an active financing of scientific and technological research of innovative technological directions. The ways of modernization, which paves the way for the creative economy, are explored. One of its forms may be already becoming post-industrial economy based on technology. Awareness of the need to move to the creative economy is gradually taking root in society. There is a growing range of companies that are included in the processes of development of post-industrial technologies. Some advances in this area and the problems associated with them, will be discussed in the following sections.

## 3. ECONOMIC FEATURES

### 3.1. The Energy of Post-industrial Technological Mode of Production

The article does not aim to analyze the nuances of the economy already in use post-industrial technologies. The task is to show the

current development of the policies of state and business. Each era has its own technology inherent power base, energy sources for the life of the people. Industrial era is powered by hydrocarbon feed - stocks of solar energy deposits in the earth's crust millions of years ago. The coming post-industrial technological mode of production creates its own power base - renewable energy: Wind power generation, water flows, the use of radiation solar, geothermal and biomass energy. Toffler wrote about "the transition from civilization, based on one source of energy to civilization, based on the many and therefore more reliable," noting "a surprising variety of energy sources" (Toffler 2010. p. 542).

In our time, along with the search and increase of hydrocarbon production, there is the development of renewable energy in energy-deficient areas of the European countries and in areas rich in natural flow of energy (such as solar energy in southern Europe, the Middle East, despite the existing the latter hydrocarbon reserves of energy). It should be noted such a feature of renewable energy as its local production and consumption. This property allows it to provide energy to the population in areas with no network power, or lack of its power. Development of renewable energy stimulates demand for its equipment. The new branches of power engineering are created, new technologies are mastered, experience and professional competence are gained. The structure of power engineering is changing, the export of new energy equipment is increasing. In Germany, for example, not so sunny country, almost 40% of solar cells which are produced are exported. It is a leader in the number of the built wind power stations. China exports more than 60% of the solar cells to Europe, Asia, Africa and the USA. New technologies are changing the structure of the industry - energy and power engineering.

Markets of post-industrial technologies have a greater rate of change of market conditions and subject-equipment suppliers than traditional goods markets. Fundamentally new technologies are in intensive development and improvement (Klass, 2003, 365). Among them are two main areas: Improving efficiency and reduction of specific capital investments. Thus, the manufactured solar cells' efficiency is of 12-18%. In the development and pilot application are solar modules with an efficiency of 35-45%. The second factor of market expansion is price competition. A century of experience shows that qualitatively new technological principles, as a rule, first less efficient than the old, but have the potential to reduce the cost per unit of useful effect. There is a strong tendency of reduction of them on renewable energy. These two factors can change the contours of the global market scale and composition of equipment suppliers. The third factor of the global market of new energy equipment is forecasts changes in the structure of world energy, increasing the share of renewables in energy consumption countries. For example, in the EU it should rise from 10.3% (2008) to 20% by 2020, in the UK from 4.1% (2012) to 15% (United Kingdom Renewable Energy Review), in Sweden to 50% over the same period (Energy use in Sweden). In the US, according to the expert, By the end of this century, the dominant commercial energy mix in the USA will include major contributions to energy demand by renewable energy resources, particularly virgin and waste biomass, photovoltaic generation, water splitting for hydrogen production, and solar thermal energy (Klass 2003, 366).

### 3.2. Advantages of Post-industrial Mode of Technologies' Production

New impetus to the development of business can give success of nanotechnology. Although the time of their mass industrial development has not come yet, there are many examples of their effective application. As an illustration of the different areas of their application we note reinforcing nanocoating, nanoconcrete with improved performance characteristics, composite materials, nanocellulose, nanopolymers with unique parameters, high-brightness LEDs and LED modules, steel billet, steel structure in which the grounds at the nanoscale are built offshore ice-resistant oil platforms. In the process chains in the space industry, in the air and autostructure in the production of power turbines additive technologies are introduced. Anticipating the future of their appearance, Toffler surprisingly well described them: Penetrating the molecular level by introducing computer projects and other tools of a highly developed production, we integrate more and more functions into smaller number of parts, replacing the "whole" to many individual components. This can be compared with the appearance of pictures. Instead of having to create the image, causing the brush strokes on the canvas meaningless, photographer 'created' the whole image by pressing the button" (Toffler 2010. p. 300). This is one side of additive technologies, the other is to reduce waste. If the traditional technology of metal cut out object, then use the laser technology of cultivation of powdered metal products for the computer model excludes industrial technology machining (cutting, milling) and welding materials, reducing the amount of waste. It is estimated that the savings in raw materials by using additive technology can reach 75%. The difference of production technologies can be represented in the form of shaped two-ways to create a sculpture. The first way - is that from the monolith of granite or other minerals the figure or composition is harvested with a lot of waste. The second method is that a sculpture is formed by using a molding frame and its components from the feedstock. Distribution of additive technologies stimulates the creation of a new branch of engineering for the production of additive machines. Additive technologies, using the terminology of Dosi (1982), open a new technological paradigm. Generally, post-industrial technologies cause the fan of technological paradigms. One of them is the paradigm of fuel cell technology (Gilbert and Campbell, 2015). The spread of nanotechnology stimulates research about the conditions and circumstances of their development with the recommendations of the state and business. Examples of research results, in particular, on the commercialization of nanotechnology firms (Fiedler and Welpé, 2010), public and private research funding of nanotechnology (Beaudry and Allaoni, 2012), accumulation of competences in nanotechnology and forming a model for future technological diversification (Colombelli et al., 2014), regulation of nanotechnology the development of scientific knowledge, standards, finding the right balance between risk and reward (Hodge et al., 2014), psychology, social perception (Satterfield et al., 2013) indicate the emergence of a new field of study of economics, management, social problems of R and D, associated with nanotechnology as one of the foundations of the post industrial technological mode of production.

### 3.3. Biotechnologies in the Structure of the Post-industrial Technological Mode of Production

Great prospects for economic and social development, improve the quality of life associated with the design and development of a wide range of biotechnology in agriculture, medicine and pharmacology. Biotechnology as a technology of the post-industrial era begins to penetrate into many areas of modern life. Based on the methods of genetic engineering, it becomes one of the key areas of economic development. Scientific advances suggest possible future radical changes in the technology of products for the life of people. "In front of our eyes, noted Toffler, a new science based on the principles of management of the development of micro-organisms, which promises to change the very nature of the industry as we know it" (Toffler, 2002). There have been advances in the study of biological systems (proteins, microorganisms), biomolecular events (DNA and identification of biological processes), other problems, including the creation of a molecular computer, as well as development of pharmaceuticals, pharmaceuticals delivery, surgical methods, biocompatibility, diagnosis, implants, and prosthetics.

Characteristic feature from the point of view of the establishment of post-industrial technologies is an increasing range of published reports R and D biotechnology dedicated to various aspects of their development: The dynamics of network relations in innovation processes (Ibert and Müller, 2015), patenting and venture financing (Haessler et al., 2014), the effect of age on academic collaboration with industry (Aschhoff and Grimpe, 2014), the emergence of new trends in the in biotech cities (Boschma et al., 2014), the influence of public funds to create a local biotech firms (Kolympiris et al., 2014). Biotechnology industry is becoming a new object of study and its recommendations on economics and management.

## 4. ECOLOGICAL FEATURES

Industrial production is accompanied by a huge amount of waste. In 2010, the total amount of waste generated from production and consumption for the year in Russia was for about \$ 4.5 billion tones of which, according to experts, the waste of production is about 90%. The largest contribution to the energy dependence of pollution contributes energy and transport. The average fuel energy per 1 ton of fuel equivalent emits about 150 kg of pollutants. The total mass of dirt from cars in the world is about 340 million tones, for the entire road transport it reaches 400 million tones. Currently, the prototypes of the future safe for the environment vehicles are being created. The solar panels of different types of vehicles (plane, car, etc.) are already in trial operation. Their prospects are not yet clear, nevertheless, research and development are actively being pursued in these areas. To environmentally hazardous, except energy and transport, are also applied mining, processing and production of ferrous and non-ferrous metals. In addition to the emission of gases into the atmosphere and water pollution it generates a lot of unutilized waste. The most harmful are carcinogens of cooking process, domain emissions of gases and dust with agglomeration of ore, converter and other melting units, slag of all metallurgical processes.

Post-industrial technologies significantly reduce industrial waste and pollution, gradually replacing some of the technologies of industrial production. However, it has not yet been fully explored

in their environment - the influence on the environment and humans. Scientists need to give a comprehensive assessment of all achievements in this area and determine what impact they will have on the ecosystem and, above all, on human health. There are a lot of concerns in biotechnology about manipulation of known genes and the creation of new genetic objects, which did not exist in nature, in nanotechnology these are adverse effects of nanopowders on human in the labor force and others. Among biologists there were put the problems of bioethics, responsibility for the consequences of new developments, technologies, prevention of irreversible negative effects, there have been calls that any new development of post-industrial technologies should be carefully evaluated from the point of the safety of their implementation. They should have an environmental component - assessment of their impact on the environment and people.

The attitude of people to the already used post-industrial technologies that cause some concern, the government should consider in its activities. Thus, a relatively long period of operation of nuclear power allows us to study the impact of public opinion on its different political trajectories of European countries (Franchino, 2014). However, the desired amount of information about people's attitude to other post-industrial technologies, except intuitions, is not yet known. Therefore, this restriction imposes a great responsibility of scientists for environmental safety posed by post-industrial technologies. It is impossible not to take into account "fear and insecurity are associated with all the great changes" (Krajnc, 1991). "Green Issue" (environmental protection) is part of the inter-party competition for votes in many countries (Spoon et al., 2014). There is now the need to include it in the process of post-industrial environmental technology as a new field of "green" party competition.

## 5. RESULTS

There is proved the beginning of a new technological era - the post-industrial technological mode of production based on the generalization of the new technological wave, the criterion of its difference from the industrial technological mode of production where products and services are obtained by processing not provided by nature resources, and through the use of natural processes taking place internally, managing them.

Technological and economic features of a new technological method in production were revealed in the fields of energy (renewable energy sources), industrial production (nanotechnologies), agriculture, medicine (biotechnology), and the relationship with the environment: Reduction of industrial waste and the emergence of new post-industrial pollution, the need to pre-empt them.

There were shown the data on the restructuring of the economy in the production of energy and power engineering, nanotechnology, additive technologies, their economic outlook. There were also noted scientific advances in biotechnology while avoiding irreversible negative consequences.

It raised the question about the character of a new technological era similar to the symbol of the "machine" in the industrial technological mode of production.

## 6. DISCUSSION

### 6.1. The Ratio of Industrial and Post-industrial Societies

The link of Bell on the post-industrial society in the United States and Western Europe in the aforementioned monograph (1973) opened the possibility of multiple authors, first of all, to express their development under the auspices of the post-industrial society, to develop their ideas and propose solutions to contemporary problems in the form of a post-industrial society, secondly, to participate in discussions about the distinctive features of post-industrial society, its differences from industrial one. In a number of journal articles topical issues of the day are seen as problems of post-industrial society. In the economic sphere, for example, the topics are discussed: State and economic democracy (Manza, 1992), protection of intellectual property (Pirages, 1996), the strategy of the company (Lowendahl, Revang 1998), the ambivalence of computer technology (Feenberg, 1990), transport planning (Theologitis, 1990), men and women in the labor market (Boyd et al., 1991). In politic sphere of post-industrial society there are questions of transformation of socialist ideas and new forms of working class struggle (Gorz, 1990), the evolution of technology (Tribe, 1992), the paradoxes of post-industrial democracy by the example of the United States (Melucci 1993/1994), regionalism (Paddison, 1991), ethnoregional policy (Newman, 1992) to social problems of post-industrial society: The class structure (Hout et al., 1993), cultural traditions and ways of knowledge transfer (Filent, 1992), social media functions (Sias, 1992), the impact of democracy on the activities of the creative intellectual class (Ambrose, 1995), technological education (Wei, 2004), organization, management in colleges and universities (Cameron and Tschirhart, 1992), students from working-class families (Bettis, 1996), socio-economic status of elderly people (Ginn, 1993), new homelessness (Nodoushani, 1989), childcare (Hied, 2013).

The study of problematic situations of our time in the above list of publications is certainly relevant and useful in the political decision-making by government and business. However, this raises the question of how it is legitimate to refer to the study of these problems in the post-industrial society? How justified is that to consider these issues as problems of post-industrial society? One can agree with the statement of Ferkiss (Ferkiss, 1979) that there are features of post-industrialism in an industrial society that the differences between them are marginal and shadowy, and post-industrial society, which we are talking about, is a more advanced stage of industrial society. This question was even more sharply posed by Nelson and Cooperman (1998) who evaluated the relationship of social change in society with innovations in information technology with the advent of post-industrial society as a utopia.

### 6.2. The Features of Superindustrial Society

Such signs of post-industrial society on the concept of Bell as the central role of theoretical knowledge, the creation of new intellectual technologies, increasing the share of services is increasingly complies with the modern industrial (in the terminology of Krajnc, 1991 superindustrial) society. What is

more, currently the development of industrial production is largely determined by the achievements of fundamental science and its role is becoming more and more leading, central as well as the use of intellectual (information) technology, it is reflected in the development of industrial society: Science, education, growth of carriers of knowledge is a natural process of scientific and technological and social development. The expansion of the service sector is also organically inherent to the industrial society. Employment growth in the sector of service providers, as convincingly shown M. Watanabe, is a testament to the growing social division of labor in industrial society. The growth of labor efficiency, productivity in the real sector of the economy of industrial society is the main factor in the development of services. He said: "In light of our discussion, we can see how the further development of the division of labor within the capitalist sector has led to a growing opportunities for business to focus on industrial services. We also identified how capitalist industrialization, together with institutional changes of society... led to a renewed forms of personal consumption" (Watanabe, 2001. p. 271-281).

If the strokes attributed to post-industrial society can be also characterized by industrial, it is hardly necessary to study modern problem situations associated with the era of post-industrial society.

As for the nomination of Daniel Bell's thesis (Bell 1973. p. 358) of technical elite at the forefront of achieving power, the reality in countries that Bell refers to a post-industrial world does not confirm this thesis. In the study of McDonnell, Valbruzzi (McDonnell and Valbruzzi, 2014) has been shown that fully technocratic government is extremely rare. In the EU there were only six cases three of which occurred in the last decade. In modern industrial society, the role of the technical intelligent class is increasing along with the development of industrial technology. However, as practice shows, the formation of power structures has not professional but other reasons: The correlation of social forces in the society. Professional activities, no matter how it is important for society, cannot be the only factor entering into the power. Therefore, according to Ferkiss (Ferkiss, 1979, 72), "The main, if not the only advantage of the theory of post-industrial society is that it forces us to look closely at the industrial society."

## 7. CONCLUSION

New evidence on the emergence of a set of technologies outside the industrial production methods are considered as the birth of a new, post-industrial technological mode of production. The basis of it is the new wave of technologies: Renewable energy production, the use of nanotechnology, which are classified as post-industrial technologies. They are fundamentally different from industrial production methods according to the method of production of man's relationship to nature. Industrial production in the technological aspect is based on the use of public laws of nature and creation on their base of machines for processing resources provided by nature. Post-industrial technologies are focused on the use of the processes occurring in nature itself, when the products and services which are necessary for the life of the people are produced by manipulation of natural processes.

The emergence of post-industrial technology has become possible by advances in science and invention of tools which penetrate into the secrets of nature, of microscopes with high resolution. Post-industrial technological mode of production came to the structural changes in the economy: The formation of a segment of renewable energy industries for the production of energy for new energy vehicles, additive machines for the manufacture of metal powder, equipment for biotechnological production, manufacture, although in small numbers, high-performance of nano and bioproducts. Post-industrial and industrial technologies are not isolated from each other. Industrial and post-industrial technologies, penetrating into each other, form a symbiosis of technology, create new hybrid areas of technological excellence.

Post-industrial technology either embeds in the industrial production process chains, forming a new type of technology - convergent, improving the quality of products and services, or form a separate segment of production. Industrial technologies have not yet exhausted the potential of growth. They continue to rise to new levels of development. It may be noted achievements in the fields of robotics, automation, technology classical energy and other industrial technologies. Along with the development of industrial technologies, the post-industrial technological mode of production is also emerging.

Post-industrial technologies are still at the beginning of its formation. To a large extent, their development goes in industries requiring special accuracy, reliability, neutral to hostile environments: Aerospace, aviation and defense industries. The industrial boom of the post-industrial technologies are expected with increasing efficiency, reducing costs per unit of effect, eliminating any possibility of new environmental hazards. In these areas, research is being conducted in many laboratories around the world. In rich countries, governments spend billions of dollars on the development of post-industrial technologies, preparing involvement in this area of business, which is gradually adopted there.

The introduction of the post-industrial technologies, the formation of post-industrial technological mode of production is historically justified in case of a new leap in productivity growth and, consequently, an increase in the wealth of society, free time of people, in entering new stage of social development, including the development of science, health, education, culture and art. Maybe the assumption of Bell that in the next 30-50 years we will see what is called a "post-industrial society" with the transformation of mainly social structure will come true (Bell, 1973. p. CLXVI).

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