Knowledge economy changes in the perception of investment nature in agriculture

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Abstract. The specific nature of the so called knowledge economy, the innovation economy, determines a number of new trends that in a very recent past might have seemed fantastic. The article is devoted to the discussion of the nature of investment in the modern economy, including the agricultural sector, one of the main factors of production in which, along with traditional factors, is knowledge. Today it is common to face a situation where their use multiplies the end result of entrepreneurial activity much more efficiently than the use of such traditional factors of production as land, labor and capital. Among the most popular and promising trends in agriculture in the United States and Europe, experts recently point out the introduction of high-tech innovative technologies that require the active attraction of investments related to intellectual and human capital. The authors consider such investments as a special type, significantly different from their classical Keynesian interpretation, which is characteristic for describing investments in industrial economy.

1. Introduction
It is known that the economy as a form (field) of social activity went through a number of stages in its development. At an early stage of human civilization, physical labor was the basis of pre-industrial or agrarian proto-economics, the origin of which was the result of the Neolithic revolution. The basis of the next – the industrial stage of development were natural resources and machine production. The knowledge-based economy gradually comes to replace the industrial economy.

At the time, D Bell describing the signs of the coming era of “post-industrialism” gave a set of features of the post-industrial society:
1. Moving away from the production of goods to the services economy.
2. The dominance of professional and technical class in the employment structure, as well as the increasing role of scientists and engineers.
3. The central role of theoretical knowledge as a source of innovation and policy formulation.
4. The special role of technology and technology assessments.
5. The creating of new “intellectual technology” [1].

It is worth noting that Bell, as well as his followers, acting as apologists for a variety of ideological directions – from conservative W. Rostow and moderate liberal K. Tominaga to the clearly socialist orientation of A Touraine and Czech Marxist R Richta [2], describing the direction of “post”, in the early seventies of the last century predicted that in the General system of socio – economic relations in the coming decades, fundamental changes, the quality and scale of which, due to objective reasons, could not be assessed objectively. In what format the post-industrial reality will be built into the modern world is not clear and today, at the same time, let us make the following assumption. Today, it
is becoming increasingly clear the fact that a number of signs indicated by Bell, namely: “moving away from the production of goods to the services economy”, “the special role of technology and technology assessments” and “the creating of new “intellectual technology” describes a concrete expression of post-industrial reality - a new economy, functioning through the digital ecosystem, or the so-called innovative the knowledge-based economy. According to D. Bell, the post-industrial society is characterized not by the labor theory of value, but by the theory of value based on knowledge. The enabler of innovation becomes the systematization of knowledge. The peculiarity of the latter is that even when it is sold, it remains the same with its manufacturer [3].

Knowledge economy as a natural manifestation of the post-industrial paradigm is based on the full use of the potential contained in the progress of theoretical knowledge. This statement, which follows from the characteristic of post-industrial economy formulated by D Bell – “the central place of theoretical knowledge as a source of innovations and policy formulation” – today there is no doubt.

Recall that the term “knowledge-based economy” or “knowledge economy” was proposed in 1962 by the American economist Fritz Machlup, who designated them only as a sector of the economy oriented toward the production of knowledge [4]. In the modern world, this term is interpreted broadly and is used to determine the type of economy in which knowledge plays a crucial role, while their creation and use becomes a constant source of growth, determining the competitiveness of individual companies, industries, as well as countries in general.

In modern economic literature, the definition proposed by experts of the World Bank is most often used, according to which knowledge economy should be understood as “an economy that creates, spreads and uses knowledge to accelerate its own growth and increase competitiveness” [5]. A similar definition is given by the OECD: the knowledge economy is “an economy that is directly based on the production, distribution and use of knowledge and information”.

Today, scientific knowledge coexists with other types of “everyday” knowledge, which consists in the necessity of everyday use of a large array of information by every person: “banks and databases, standards, statistical indicators, traffic schedules, huge information files on the Internet, etc.” [6]. For a modern person, knowledge becomes a factor in the production of “utilities” even in everyday life, not to mention the fact that in the economic environment, knowledge is not simply generated, but is a factor of production, along with traditionally distinguished factors.

In this regard, B.Z. Milner notes that “as shown by numerous studies, the main prerequisites for the formation of the “knowledge economy” should be considered the transformation of knowledge into the most important factor of production along with labor, natural and material resources [7]. In turn, V. Inozemtsev also points to the fact that “the new economy is now confidently becoming not so much the “information economy”, that is, an information-based economy, but a “knowledge economy”, that is, an economy based on knowledge. The most important resource of modern society is not information as a relatively objective entity, but knowledge, information acquired by man and not existing outside of his consciousness” [8].

2. Materials and methods
This is particularly relevant in connection with the emergence of the concept of sustainable development, which undermined the fundamental basis of the traditional economy – unlimited economic growth. Recall that sustainable development is seen as a process of change in which the exploitation of natural resources, the direction of investment, the orientation of scientific and technological progress, personal development and institutional change are consistent with each other, strengthen the current and future potential to meet human needs. Given that the concept of sustainable development refers primarily to patterns of use of natural resources, including those involved in agriculture, the implementation of this concept in the modern world is only possible with the use of advanced modern technology to meet human needs while preserving the environment so that these needs can be met not only for the present but also for future generations. Today, humanity has almost exhausted the possibility of a significant increase in arable land, so to increase the needs of the growing population of the planet (7.3 billion people by the end of 2018 and the projected increase in
the population by 2050 another 3 billion), agriculture needs an early transition to technologies that allow qualitatively and quantitatively increase the yield of fields, while reducing the environmental burden on the environment.

UN experts note that as agriculture becomes more technological, the structure of agricultural capital, and hence investment in it, is changing. For example, in high-income countries, machinery and equipment account for more than 40 per cent of total fixed assets in agriculture, in sharp contrast to less than 3 per cent in low-income countries. In today's world, production systems in agriculture are highly knowledge-intensive, requiring active investment related to intellectual and human capital, which will further contribute to the economy of increasingly scarce natural resources. As noted in the report of Food and Agriculture Organization of the United Nations “The State of Food and Agriculture: Investing in Agriculture for a Better Future”, today investments should be directed specifically to those assets that are linked to decisions about the transition to sustainable productivity growth, namely to improving the qualitative characteristics of natural and human capital, as well as help to improve these qualitative characteristics, for example, in agricultural research and development [9], which are very actively developing recently.

Thus, according to Fertilizer Daily, among the 10 most popular and promising trends taking place in agriculture in the United States and Europe, experts point out:

1. Technology “second green revolution”, due to which the productivity of fast-growing genetically modified crops is increased by 50%.
2. Artificial intelligence, the use of which in the field will allow farmers to significantly increase productivity while reducing the cost of fertilizers and plant protection products, since the “smart” machine will be able to determine very precisely when, where and in what quantities you need to plant and treat crops with chemicals.
3. Microbiomes and biopesticides that can increase the resistance of crops to drought, disease and pests, thereby reducing the cost of fertilizer and pesticides.
4. RNA interference, which allows to effectively suppress the expression of genes, allowing, thereby, to “program” the plant for increased protection against drought and insects for a certain period of time.
5. The use of blockchain technology, which allows to obtain "transparent" access to information on the production, transportation and storage of products.
6. Urban hydroponic farms, providing very effective conditions for growing plants with reduced risk of disease and much more economical water consumption.
7. Edible packaging, which will prolong the shelf life of certain foods up to five times, and also in the near future will significantly reduce the amount of waste produced in the food industry.
8. Launch of modern geostationary operational satellites GOES-R, which allows to obtain much more information about weather conditions and makes it easier for farmers to monitor their fields.
9. Cultivated meat or "tube meat".
10. Robotics [10].

It is obvious that the practical implementation of the described trends in agriculture is possible only through the constant generation of new knowledge by a person who is considered in the knowledge economy as a goal and criterion of social progress, and not just as a means for economic growth. Becoming among other, the most important factors of production, knowledge needs investment, and often to a much greater degree than material factors of production. In today's world, investment and innovation is one of the main drivers of productivity, inclusive economic growth and job creation [11] in modern economy.

3. Result and Discussions
And here it is possible to come to the most important thesis, which can be dwelt on in more detail: in the modern post-industrial world, the idea of the usual nature of investment is changing. It is known that the concept of investment in traditional factors of production is based on the Keynesian understanding of this economic category, as that part of income for the period, which was not used for
consumption [10]. It is obvious that this approach contrasts consumption and investment, and the latter represent a conscious rejection of current consumption in favor of the expected future benefits. In the Wake of Keynes, traditional industrial production has always believed that investment is a part of the national product diverted from consumption and directed to the expansion of production. In an innovative economy, a person creates an ever-expanding cloud of services around him, while the border between consumption and investment is erased, because by acquiring, for example, a modern powerful computer and a new software product, the consumer on the one hand achieves better skills and improves the quality of his education, on the other hand, gets the opportunity to monetize the knowledge gained, for example, through the sale of new research and development in various fields generated by him. In today's world, there is a situation when savings that are not used for gross capital formation are huge amounts. Thus, in 2014, the volume of private savings worldwide amounted to 136 trillion EURO. in 2016, the volume of direct investment alone amounted to 1.52 trillion USD.

This situation suggests that there is a new type of investment that stimulates economic development by maximizing personal consumption, which is different from our usual perception of investment as the antithesis of consumption. Today, in a number of developed countries there is indeed a paradoxical situation in which consumption at the level of macroeconomics is growing, while investment does not fall. At the same time, statistics of developing countries show that at the start of the 21st century, the industrial economic model has no sources of financing for its own development, except for the reduction of current consumption, which reduces the possibility of accumulating intellectual capital. In the fact that humanity not only develops information as an inexhaustible resource for the development of production, but also turns the main types of consumption associated with the development of the individual into a means of renewing and increasing this resource, thus the guarantee of endless progress of post-industrial society can be seen. Its rapid economic growth can last for decades in conditions of not only low, but also negative rate of accumulation in its traditional sense [11].

As noted earlier, the most important element of economic growth in the knowledge economy is human capital, and its accumulation, in turn, can be in fact more "investment" than the building of material factors of productive capacity. In such a situation, the diversion of funds from investments in material factors of production and their direction to consumption, that is, ultimately, to the development of the individual, is not an obstacle to the sustainable and progressive development of both the economy as a whole and its individual sectors, including agriculture. In an innovative economy, the main types of consumption associated with the development of the individual are increasingly becoming a means of continuous generation of knowledge that requires investment, and this process, in turn, opens up limitless opportunities for development.

This is fully relevant for agriculture, where, in addition to traditional factors of production, great attention is now being paid to types of agricultural capital that are not necessarily tangible. Investments are directed to agricultural research and development, which generate intellectual capital, which makes a decisive contribution to the improvement of agricultural productivity in the long term. In addition, special attention is paid to investment in education, which increases the productivity of those who receive it, and generates long-term returns through human development.

And here it is necessary to stop on one more important, in our opinion, circumstance. The fact is that unlike the process of technology generation within the industrial paradigm, the creation of technologies in the knowledge economy does not demonstrate a direct relationship between investment in these technologies and the end result. And this point is extremely important for understanding what is happening in the technological sphere, including in agriculture, which seeks, as noted earlier, to use all the most advanced technologies for sustainable development.

If in the 20th century for a breakthrough in a particular industry can be earmarked for this purpose, huge investments to attract additional labor and with high probability to get a positive result, as happened for example with the "Manhattan project", today more and more the role of small research groups and even individuals, which gave birth to key technologies of today.

Moreover, modern and high-tech agriculture today mainly does not use any special, limited only by the scope of application in this industry technology, but consumes and implements technologies
already tested in other areas: blockchain technology, genetic engineering, modern achievements in robotics, big data, artificial intelligence, etc. All these things have been developed for a long time and today new technologies are fine-tuning or improving existing achievements, as well as their adaptation to a specific sector of the economy, and this process in itself does not require the implementation of megaprojects, and is quite successfully carried out through small investment costs or individual creative thinking individuals or small creative teams.

4. Conclusion

Thus, it is possible to assume that in the knowledge economy, one of the most important sources of economic development is reinvested intellectual capital, and the self-growth of such capital does not reduce the personal consumption of citizens, but actually involves it. The maximization of personal consumption associated with the development of the individual allows for successful economic development, possible not only with a low rate of accumulation, but with its negative value. In our opinion, all this should be fully attributed to agriculture, which introduces the most modern and advanced technologies in the developed world.

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