

# Intellectual Economy as a Higher Phase of Development of the Post-Industrial Economy

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**Abstract.** The article considers the intellectual economy as the highest phase of the development of a post-industrial economy. The authors identified the main signs of intellectomics: intelligence - the main factor of production, intellectual capital - the main source of human development and society; improving the institutional support of intellectual activity; a significant proportion of highly qualified specialists in the structure of employees and wide access to high-quality education; the maximum level of development of information and communication technologies. - the intensification of innovation activities at all levels of society; a sharp reduction in labor demand in the economy. Intellectomics is the highest phase in the development of a post-industrial economy, which involves not only ousting manual labor by machine by automating production processes, but also replacing mental labor by machine by introducing artificial intelligence systems. Based on the selected features, the definition of intellectonomy is formulated and an equation is obtained for an integral assessment of its level of development.

## 1. Common questions

The relevance of the topic of our research is due to the process of accelerating growth of requirements for the level of competence of workers at all stages of professional development, as well as the active development and implementation of the concept and technologies of artificial intelligence in all spheres of production and social life. Improvement of household and industrial technical systems has now reached the level when the presence of the human factor reduces the performance of the system or makes it absolutely impossible. That is, we came to the need to completely exclude the human factor from the process of functioning of technical systems, while the intellectual component is also all necessary, which creates a need for artificial intelligence.

The need for the human factor is preserved only at the stages of design and control, but even there a gradual process of substitution is observed. In the final phase of this process of replacement, the person will only have the role of a consumer, which, of course, will lead to a profound transformation of the whole society as a whole and each individual person in particular. However, the nature of these transformations and the degree of their influence is a subject that requires separate additional research.

It should be noted that many well-known scientists were engaged in the post-industrial development of society: J. Schumpeter, E. Toffler, F. Fukuyama, D. Bell, J. Naisbitt and others. They examined the problems of identifying and classifying innovations, the sources of superprofits in a post-industrial economy, changes in the structure of employment, capital replacement, the initiation of

new markets and many others. As a result, many definitions of the new economy appeared: digital economy, network economy, information economy, creative economy, cognitive economy, innovative economy, intellectual economy, and others.

It is obvious that all the above-named names of the new economy can be summarized by the concept “post-industrial economy”, since historically they arise at the post-industrial stage of development of society. At the same time, their more accurate differentiation is much more difficult. It is possible to say unequivocally only that each name of a new economy characterizes some of its signs or stages of development. In addition, often in the scientific literature there is a duplication of concepts. So in the source [6] the concepts of innovative economy, knowledge economy and intellectual economy are identified. The concepts of “knowledge economy” and “cognitive economy” can serve as another example of duplication, since the concept of “cognitive” is derived from the Latin word *cognitio* - cognition.

**2. Definition of the intellectual economy**

Such reflections lead us to the need for a more precise definition of the concept of “intellectual economy” (hereinafter - *intellectomics*). To do this, consider the existing approaches to the definition of this concept (see Table 1)

**Table 1.** Approaches to the definition of "intellectomics" ("knowledge economy").

Author of the approach	the Definition
Suslov V.I. [7]	Intellectomics is an economy based on scientific knowledge and specialized unique capabilities and skills of their carriers as the main source and key factor in the development of tangible and intangible production, ensuring sustainable economic development.
Sabden O. [8]	Intellectomics is an economy based on knowledge of the laws of material nature and society, contributing to the preservation of power and human development, ensuring the production of necessary material goods, protecting the planet’s ecology from the destructive impact of man-made transformations, improving the standard of living and the duration of active human life.
Will Kenton [9]	The knowledge economy is a system of consumption and production that is based on intellectual capital. It typically represents a large component of all economic activity in developed countries.
The World Bank [10]	The knowledge economy can be defined according to four pillars: 1) institutional structures that provide incentives for entrepreneurship and the use of knowledge; 2) availability of skilled labor and a good education system; 3) access to information and communication technology (ICT) infrastructures; 4) a vibrant innovation landscape that includes academia, the private sector, and civil society
Roberto Mangabeira Unger [11]	The knowledge economy is confined but it is no longer restricted to any particular sector of production. It does not even have a privileged association with industry, by contrast to services or agriculture, as mechanized manufacturing and industrial mass production did. It appears in every sector -- in knowledge-intensive services and precision, scientific industry as well as in high-technology industry. Nevertheless, in each sector it appears as a fringe from which the vast majority of the labor force remains excluded.

Summarizing the definitions considered in Table 1, we can single out the following signs of intellectomics:

- intelligence - the main factor of production, intellectual capital - the main source of human development and society;
- improving the institutional support of intellectual activity;
- a significant proportion of highly qualified specialists in the structure of the employed and wide access to high-quality education;
- the maximum level of development of information and communication technologies.
- activation of innovation at all levels of society.
- a sharp reduction in labor demand in the economy.

On the basis of the selected features, we give the author's definition: intellectonomy is an economy in which the leading factor of production is intelligence existing in the form of intellectual capital, developed by improving institutional support of intellectual activity, providing wide access to high-quality education and developing information and communication technologies, leads to a sharp reduction in labor requirements.

### 3. Intellectonomics evaluation

For an integrated assessment of the level of development of intellectonomy, it is necessary to quantify the following signs of intellectomics:

- intelligence - the main factor of production, intellectual capital - the main source of human development and society. Express this feature using the formula (1):

$$LIC = IR/GDP, \quad (1)$$

where LIC - the level of intellectual capital; IC - intellectual capital; GDP - gross domestic product;

- Improvement of institutional support of intellectual activity. Express this feature using the formula (2):

$$LIS = I^{Sex}/I^{Sreq}, \quad (2)$$

where LIS - the level of institutional support; I<sup>Sex</sup> - the existing level of institutional support; I<sup>Sreq</sup> - the required level of institutional support;

- a significant proportion of highly qualified specialists in the structure of the employed and wide access to high-quality education. Express this feature using the formula (3):

$$LEQ = E^{Qh}/E^{Qt}, \quad (3)$$

where LEQ - the qualification level of employees; E<sup>Qh</sup> - the number of employees with the highest qualification; E<sup>Qt</sup> - the total number of people employed in the economy;

- the maximum level of development of information and communication technologies. Express this feature using the formula (4):

$$LIT = I^{Tc}/I^{Tb}, \quad (4)$$

where LIT - the level of development of information and communication technologies; I<sup>Tc</sup> - the current level of development of information and communication technologies; I<sup>Tb</sup> - the level of development of information and communication technologies in the period preceding the beginning of the development of intellectomics;

- Intensification of innovation activities at all levels of society. Express this feature using the formula (5):

$$LIA = I^{Ac}/I^{Ab}, \quad (5)$$

where LIA - the level of activation of innovation activity; I<sup>Ac</sup> is the current level of activity of innovation activity; I<sup>Ab</sup> is the level of activity of innovation activity in the period preceding the beginning of the development of intellectomics;

- a sharp reduction in labor demand in the economy. Express this feature using the formula (6):

$$LLD = L^{Db}/L^{Dc}, \quad (6)$$

where LLD is the level of the need for labor; LD<sub>b</sub> is the need for manpower in the period preceding the beginning of the formation of intellectomics; LD<sub>c</sub> - labor needs in the current period.

Based on formulas (1) - (6), we can estimate the level of development of intellectomics (LDI) using formula (7):

$$LDI = a_0 + a_1LIC + a_2LIS + a_3LEQ + a_4LIT + a_5LIA + a_6LLD, \quad (7)$$

where  $a_0, \dots, a_6$ , are the parameters of the equation, which allow to take into account the specificity of the influence of individual signs on the assessment result and exclude the factor of their mutual influence.

In order to determine the place of intellectonomy in post-industrial development, it is necessary to consider its stages. Based on the study of modern publications on the post-industrial economy [12-14], we have identified three main stages:

a) digital economy - the process of digitizing analog information (the development of digital data formats, scanning, digital cartography, the creation of databases and data banks, etc.);

b) network economy - the creation of local, regional and global information networks (the development of the Internet, the improvement of mobile communications, the creation of GPS, the emergence of social networks, instant messengers, etc.);

c) intellectomics - the acquisition by intellect of the leading role in the economic system (the allocation of intellectual capital in the structure of assets, the intensification of scientific research in the field of artificial intelligence, the development of decision support systems, etc.). (see Table 2)

**Table 2.** Comparative characteristics of the phases of the development of post-industrial economy.

Characteristic	Digital economy	Network economy	Intellectomics
Key value	Data	Traffic	Knowledge
Necessary infrastructure	Electronic computers	Network hardware	Institutional Infrastructure
Priority area of competence	Programming	Network administration	Artificial Intelligence
Impact on the labor market	Labor restructuring	market Labor Market Cuts	The disappearance of the labor market

As we see from the approach proposed above, intellectomics is the highest phase in the development of a post-industrial economy. This phase involves not only ousting manual labor by machine by automating production processes, but also replacing mental labor by machine by introducing artificial intelligence systems. That is, we are talking about the complete ousting of human labor from production, with the exception of the function of designing, controlling and supporting artificial intelligence systems.

**4. Conclusions**

Based on the above, we can conclude that the main stages of the development of a post-industrial economy are: digital, network and intellectual economy. Intellectomics as the highest phase of the post-industrial economy is an economy in which the leading factor of production is intelligence existing in the form of intellectual capital, developed by improving the institutional support of intellectual activity, providing wide access to high-quality education and developing information and communication technologies, which leads to sharp reduce the need for labor.

The main signs of intellectomics: intelligence is the main factor of production, intellectual capital is the main source of human and social development; improving the institutional support of intellectual activity; a significant proportion of highly qualified specialists in the structure of employees and wide access to high-quality education; the maximum level of development of information and

communication technologies. - the intensification of innovation activities at all levels of society; a sharp reduction in labor demand in the economy.

Integral quantitative assessment of intellectonomy can be obtained on the basis of quantifying its characteristics and building a linear model (7), which also includes the parameters of the equation, which allow to take into account the specifics of the influence of individual characteristics on the assessment result and exclude the factor of their mutual influence.

## References

- [1] Schumpeter J A 1939 *Business Cycles A Theoretical, Historical and Statistical Analysis of the Capitalist Process* two vol (New York)
- [2] Toffler A 2004 *The Third Wave* AST (Moscow)
- [3] Fukuyama F 2002 *Our Posthuman Future: Consequences of the Biotechnology Revolution* Farrar, Straus and Giroux
- [4] Bell D 1976 *The cultural contradictions of capitalism* Basic Books (New York)
- [5] Naisbitt J 1999 *High Tech High Touch: Technology and Our Accelerated Search for Meaning* Broadway Books
- [6] Wikipedia <https://bit.ly/2VTmkk1>
- [7] 2008 Tolkovyy slovar' «Innovacionnaya deyatelnost'» Terminy innovacionnogo menedzhmenta i smezhnyh oblastej (ot A do YA) Otv. red. V I Suslov 2-e izd. (Novosibirsk) *Sibirskoe nauchnoe izdatel'stvo*
- [8] Sabden O 2011 *EKONOMIKA: Izbrannye trudy* Almaty: IE KN MON RK T VI: Intellektual'naya ekonomika – tekhnologicheskie vyzovy XXI veka *Izдание vtoroe* 320
- [9] Kenton W Knowledge Economy Investopedia <https://www.investopedia.com/terms/k/knowledge-economy.asp>
- [10] The World Bank <https://www.worldbank.org>
- [11] Unger R The Knowledge Economy <https://www.oecd.org/naec/THE-KNOWLEDGE-ECONOMY.pdf>
- [12] Carnevale A P, Rose S J The Economy Goes to College: The Hidden Promise of Higher Education in the Post-Industrial Service Economy <https://eric.ed.gov/?id=ED558183>
- [13] Klochko E, Rybyantseva M, Oksanich E 2016 Development Of Controlling In Postindustrial Economy: Tools And Techniques *International Journal Of Economics And Financial Issues* vol 6 33-40
- [14] Vogt K The post-industrial society: from utopia to ideology *Work, Employment and Society* British Sociological Association <https://journals.sagepub.com/doi/abs/10.1177/0950017015577911>
- [15] Marsh R M 2014 Modernization Theory, Then and Now In: *Comparative Sociology* vol 13/3 261-283
- [16] Moskvina A et al 2018 Evolution of Modernization and Transition to New Values and Development Goals *International Journal of Engineering Technologies and Management Research* vol 5 5 113-123
- [17] Hirsichhorn L 2013 The financial crisis: Exploring the dynamics of imagination and authority in a post-industrial world, Towards a Socioanalysis of Money Finance and Capitalism: *Beneath the Surface of the Financial Industry* 394
- [18] Chu A, Leung C, Tang E 2012 Intellectual Property Rights, Technical Progress and the Volatility of Economic Growth *Journal of Macroeconomics* **34** 749–756
- [19] Hudson J, Minea A 2013 Innovation, Intellectual Property Rights, and Economic Development: A Unified Empirical Investigation *World Development* **46** 66–78
- [20] Sam F 2018 *Intellectual Property and the New International Economic Order* Cambridge University Press (Cambridge)