CHAPTER 6

Conceptual Fundamentals and Indicators of Knowledge Economy

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Abstract

The main research results are the clarification and systematization of the categorical apparatus of the concept of the knowledge economy. The proposed conceptual apparatus for the knowledge economy was the step for creating a single multifunctional system of statistical measurement of the knowledge economy for its full-scale monitoring, justification, and evaluation. The authors revealed distinctive features of the knowledge economy from the traditional economy. General indicators of knowledge economy include the index of knowledge, index of the knowledge economy, index of human capital, index of education, and indicators of scientific economics, health, innovation, IT technologies, and globalization. The model of economic development of knowledge is proposed.

Keywords

knowledge economy – knowledge-based economy – human capital – intellectual capital – education

1 Introduction

Knowledge becomes the foundation for all forms of production. In the knowledge economy, knowledge becomes the basis of competition.

B. Asheim (2009), *S. A. Alekseeva* (2010), G. S. Becker (2012), *P. A. David* (2003), *E. Dedkova* (2020), *T. Eggertsson* (2013), *Z. Griliches* (1979), *A. L. Gaponenko* (2022), *N. V. Govorova* (2006), *I. Korostelkina* (2020), *V. N. Kostyuk* (2004), *A. I. Kapterev* (2005), *V. L. Makarov* (2003), *N. A. Tovma* (2020a), and others worked out the problems of economic development of knowledge.

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The analysis showed that there is no clear definition of the concept of the knowledge economy and its basic characteristics. Practically no research has been conducted on the distinction between the traditional economy and the knowledge economy. Indicators of the economics of knowledge are not fully disclosed. The mechanism for the development of economic knowledge is not developed.

2 Methodology

Regardless of their importance at all times, scientific knowledge, new technologies, and innovations are becoming critical factors in the economy and prosperity in today's conditions. The key resource in the pre-industrial economy was land. The capital was the key resource during the industrial economy. Nowadays, in the conditions of the knowledge economy, the key role is played by information and knowledge. Table 6.1 presents distinguishing features of the knowledge economy from the traditional economy.

In the new economy, wealth is determined by possessing human capital, although capital invested in material resources does not disappear. A significant part of knowledge is a public good. The knowledge economy has some distinctive effects that differ from all predominant types of economics – the law of increasing returns, network effects, exponential nature of growth, and positive feedback. An increase in the number of market participants and the use of production resources does not reduce the return on them after crossing the extremum.

3 Results

3.1 *Specific Interpretation of the Concept of Economy in the Results of the Literature Analysis*

The term "knowledge economy" (or knowledge-based economy) was introduced in 1962 by Fritz Mahlup (*Asheim*, 2009). A. I. Kapteev states that the practical activity of the company should include such staff units as a director of knowledge management, vice president of management of intellectual capital, manager of intellectual assets, and the director of training; group management activities should be held (*Kapterev*, 2005). According to P. A. David and D. Faure, many researchers prove that the creation of new knowledge has a real impact on the economic growth and productivity of labor (*David and Faure*, 2003). Various economists interpret the term knowledge economy differently

TABLE 6.1 Distinguished features of the economy of knowledge from the traditional economy

Distinctive features	Traditional (industrial) economy	Knowledge (postindustrial) economy
Result	A person is subject to the tasks of economic development.	The economy is subject to the challenges of human development.
Dominant sector in the economy	Production sector (production of products)	Non-productive sector (creation and provision of services)
Key factors	Capital and labor	Knowledge and information
Dominant stage of using knowledge	Subjective knowledge belonging to separate subjects	Objective (codified) knowledge embodied in technology and processes
Provision of resources	Restriction – the economy is limited (basic resources are depleted, limited)	Infinity – the economy of excess; knowledge is the main resource
Territorial restrictions	Transport costs. The location and geographical remoteness of a physical object have value.	Insignificant. Localization of a physical object is almost not important, as long as the connection with it is provided remotely.

SOURCE: DEVELOPED BY THE AUTHORS

(*Becker*, 2012). We agree with the opinion of T. Eggertsonn that the knowledge economy can be aimed at ensuring competitiveness with sustainable and economic rates of economic development (*Eggertsson*, 2013).

3.2 *Proposed Indicators of Knowledge Economy*

N. V. Govorova highlights that the knowledge economy is subdivided into three groups:

1. Indexes and ratings that characterize the potential of the country's economy for the transition to the knowledge economy: global rating of human capital development, index of human development, and ICT development index.

TABLE 6.2 Knowledge Index for 2021 by countries

Rating	Country	Significance
1	Sweden	9.38
2	Finland	9.22
3	Denmark	9.00
66	Russian Federation	6.96
73	Kazakhstan	5.40

SOURCE: COMPILED BY THE AUTHORS BASED ON (*GAPONENKO*, 2022)

2. Index of the knowledge economy.
3. Indices and ratings that characterize the use of knowledge economy: the rating of innovative economy, the global index of innovation, and top 100 companies of global sustainability (*Govorova*, 2006).

Different indicators affect the development of the knowledge economy. As noted by Alekseeva S. A., the determinants of economic development are knowledge: the increase of "knowledge-capacity" of various species of economic activity and the strengthening of globalization (*Alekseeva*, 2010). The main indicators of the knowledge economy are the index of knowledge, the index of the knowledge economy, the index of human capital, the level of education, indicators of scientific economics, the index of health, the index of innovation, and the globalization index.

The main indicators of the knowledge economy are as follows:

AQ_1

3.2.1 Knowledge Index (Table 6.2)

Kazakhstan ranks 73rd on the knowledge index.

3.2.2 Index of Economic Knowledge (Table 6.3)

Nowadays, only the USA and the EU have achieved a knowledge economy (*Alekseeva*, 2010).

3.2.3 Human Capital

Such factors as human capital also influence the development of the knowledge economy. It is impossible to develop the knowledge economy without

TABLE 6.3 Economics Index for 2021 by countries

Rating	Country	Significance
1	Sweden	9.43
2	Finland	9.33
3	Denmark	9.16
66	Russian Federation	5.78
73	Kazakhstan	5.04

SOURCE: COMPILED BY THE AUTHORS BASED ON (*GAPONENKO*, 2022)

TABLE 6.4 Index of human development by countries for 2021

Rating	Country	Location index of human development
1	Norway	1
2	Ireland	2
3	Switzerland	3
16	Kazakhstan	51
17	Russian Federation	52

SOURCE: COMPILED BY THE AUTHORS BASED ON (*GAPONENKO*, 2022)

the development of human capital and new technologies. The human development index by country is presented in Table 6.4.

Norway is the leader in statistics, followed by Ireland and Switzerland. Kazakhstan surpasses the Russian Federation in this indicator by one point.

3.2.4 Education Index

The education index is calculated as an index of the adult literacy index and an index of the total share of students receiving education. Country rankings by the level of education are presented in Table 6.5.

TABLE 6.5 Country rankings according to education index for 2021

Rating	Countries	Index
1	Germany	0.943
2	Norway	0.930
3	Great Britain	0.928
35	Kazakhstan	0.830
39	Russian Federation	0.823

SOURCE: COMPILED BY THE AUTHORS BASED ON (*GAPONENKO*, 2022)

TABLE 6.6 Expenditures on R&D (% of GDP) for 2021

Rating	Countries	Expenditures on R&D (% of GDP)
1	South Korea	4.3
2	Israel	4.1
3	Japan	3.6
28	Russian Federation	2.8
81	Kazakhstan	0.1

SOURCE: COMPILED BY THE AUTHORS BASED ON (*GAPONENKO*, 2022)

3.2.5 Scientific Economy

The scientific economy includes the knowledge of humanity, innovation, culture, and society. R&D covers fundamental research, applied research, and experimental development. Let us consider the R&D expenditures (Table 6.6).

The Republic of Kazakhstan lags behind all other countries in terms of a knowledge-intensive economy.

3.2.6 Health

The possibility of creating new knowledge critically depends on the state of health (physical and mental). The country's health rating is presented in Table 6.7.

TABLE 6.7 Country rating by the level of health expenditures in 2021

Rating	Countries	Expenditures on health care in% of GDP
1	Tuvalu	17.1
2	USA	17.1
3	Marshall Island	16.4
121	Russian Federation	5.3
167	Kazakhstan	3.10

SOURCE: COMPILED BY AUTHORS BASED ON (*GAPONENKO*, 2022)

TABLE 6.8 Rating countries by level of innovation for 2021

Rating	Country	Index
1	Switzerland	66.1
2	Sweden	62.5
11	Russia	35.6
12	Kazakhstan	28.6

SOURCE: COMPILED BY THE AUTHORS BASED ON (*GAPONENKO*, 2022)

Apparently, the cost of health care in the Republic of Kazakhstan is 3.10% of GDP, which is significantly lower than in developed countries.

3.2.7 Innovations

In the innovation economy, the primary process of capital replacement is carried out in the direction of physical and natural capital. Innovative activity determines the development of an innovative economy. Table 6.8 shows the ranking of countries by the level of innovation.

The ranking of countries by the level of innovation includes 131 countries. Kazakhstan took 77th place with an index of 28.6, which is more than Kyrgyzstan but less than the EAEU countries such as Russia, Armenia, and Belarus.

TABLE 6.9 Rankings on the level of digitization in 2021 by countries

Rating	Country rating by the level of digitization	Index
1	Great Britain	5,4
2	Sweden	6,7
3	Finland	7,0
45	Russian Federation	39,3
52	Kazakhstan	49,7

SOURCE: COMPILED BY THE AUTHORS BASED ON (*GAPONENKO*, 2022)

3.2.8 Informatization, IT

New economic processes have become possible thanks to the spread of the Internet and the widespread use of personal computers (*Tovma* et al., 2020b). The EU has created an information service for scientific research and development "Cordis." The European Commission attaches great importance to the ICT industry (*Gaponenko*, 2022). Country rankings are presented in Table 6.9.

The knowledge economy functions in a digitalized environment. Z. Idrysheva, N. Tovma, K. Z. Abisheva, M. Murzagulova, and N. Mergenbay claim that the development of infrastructure, the reduction of the cost of processing, storage, and transfer of data will bring humanity to the threshold of a new, large-scale stage of the digital revolution, a characteristic feature of which is the merger of online and offline (*Idrysheva* et al., 2019).

The information society promotes the creative abilities of the employee in the first place. According to N. Tovma, K. Kazbekova, L. Shamina, K. Z. Abisheva, and A. Nurgalieva, employment in the digital sector provides many benefits (e.g., flexible work schedule) (*Tovma* et al., 2020a).

Norway, Sweden, and Switzerland are currently the leaders of digital countries. The top ten include the USA, the UK, Denmark, Finland, Singapore, South Korea, and Hong Kong. V. N. Kostyuk states that platforms are radically changing the business models, increasing their efficiency by eliminating intermediaries and providing optimization (*Kostyuk*, 2004).

This leads to sustainable development. As noted by I. Korostelkina, E. Dedkova, N. Varaksa, and M. Korostelkin, sustainable development is a new

TABLE 6.10 Rankings on the level of globalization in 2021 by countries

Rating	Countries	Index
1	Switzerland	91.19
2	Netherlands	90.71
3	Belgium	90.59
51	Russian Federation	72.45
84	Kazakhstan	64.45

SOURCE: COMPILED BY THE AUTHORS BASED ON (*GAPONENKO*, 2022)

philosophy according to which economic agents act and make any management decisions, considering socio-economic and natural factors of production (*Korostelkina* et al., 2020).

3.2.9 Globalization

Table 6.10 presents country rankings by the level of globalization.

3.2.10 Index of Creative Capital

In 2015, the most creative country was Australia, followed by the USA and New Zealand. The world's top ten creative countries also included Canada, Denmark, Finland, Sweden, Iceland, Singapore, and the Netherlands. The country ranking of creativity is presented in Table 6.11.

3.2.11 Development of a Model of Economic Development of Knowledge

The first model of economic development of knowledge was built by academician *V. L. Makarov* (2003). This model includes the budget, the Academy of Sciences, Higher Education Schools, information vectors, and the sector of scientific development.

Z. Griliches states that the number of patents issued to American companies increased by 20% per annum (*Griliches*, 1979). Thus, the model provides no direct connection between science and innovation with economic growth.

The literature notes that the model of the economy is a model that represents a system of successively interrelated basic institutions – the Institute of

TABLE 6.11 Rating of the level of creativity in 2021 by countries

Rating	Countries	Global Creativity Index
1	Australia	0.97
2	USA	0.95
3	New Zealand	0.94
38	Russian Federation	0.58
162	Kazakhstan	0.12

SOURCE: COMPILED BY THE AUTHORS BASED ON (*GAPONENKO*, 2022)

Knowledge Generation, the Institute of Knowledge Distribution, the Institute of Intellectual Property, and the Institute of Intelligence.

The complex model of interaction should be based on specific principles and rules that ensure its reliable functionality.

The knowledge economy is an inseparable triad of markets: knowledge market, service market, and labor market. These markets closely interact with each other (Figure 6.1).

Together with the knowledge in the economy, a new type of worker, the "Knowledge Worker," appears. This is a person who consciously uses the knowledge in their work. Knowledge workers perform repetitive operations and realize their understanding through the assigned tasks. It can be manifested in the form of critical analysis of data or innovative actions.

4 Conclusion

The knowledge economy replaces the postindustrial economy. In the knowledge economy, knowledge becomes an economic resource. "Production of knowledge" became an independent, large, and leading branch of the economy, which feeds all other branches. Knowledge of wealth is determined by the ownership of human capital. Nevertheless, capital invested in material resources does not disappear. Management of economic knowledge has specific features; for example, knowledge can uncontrollably multiply and spread. After all, the exchange always leads to the generalization of knowledge of each individual.

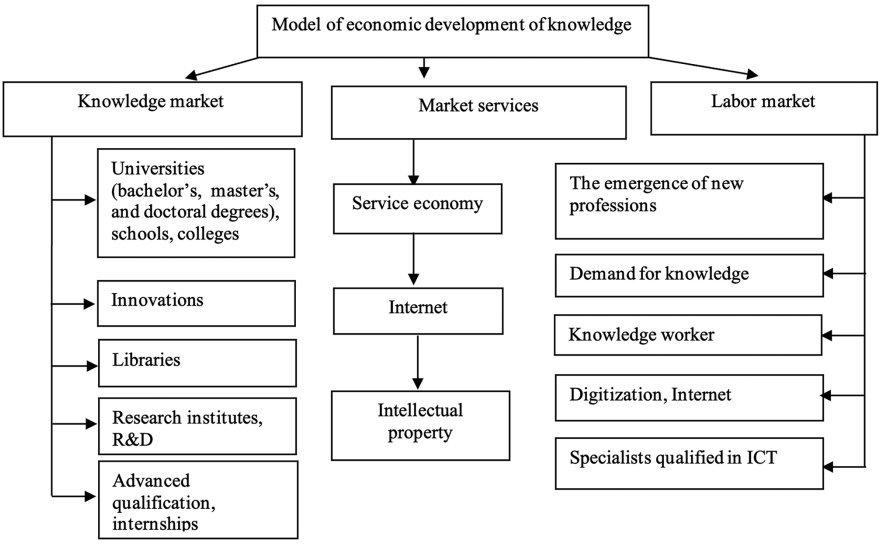

FIGURE 6.1 Model of economic development of knowledge in the Republic of Kazakhstan

The main resource of economic knowledge is scientific knowledge. The maximum achieved at a certain stage of social development and the approach to an adequate display of action in the most substantive laws is distinguished.

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