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## **RESEARCH OF THE INFORMATIZATION PROCESS DEVELOPMENT OF THE COUNTRIES OF THE WORLD**

*Об'єктом дослідження є процес розвитку інформатизації країн світу. Одним з найбільш проблемних місць є визначення факторів розвитку процесів інформатизації країн світу з урахуванням рівня соціально-економічного розвитку.*

*Існуючі методи оцінки рівня інформатизації країн світу мають фрагментарний характер, оскільки аналізують частинні показники без урахування рівня соціально-економічного розвитку країн світу. При розробці запропонованого методу була видвинута гіпотеза про існування особливостей розвитку інформатизації груп країн зі східним рівнем їх соціально-економічного стану. Запропоновано враховувати індивідуальні відмінності в значеннях аналізованих показників розвитку інформатизації окремих країн світу на основі економіко-математичного моделювання із застосуванням інструментарію багатомірного статистичного аналізу. Запропонований метод має ряд особливостей, що стосується поєднання кластерного аналізу з іншими кількісними методами, зокрема, факторним аналізом. В ході дослідження застосовано методичний підхід до оцінки розвитку інформатизації країн світу на основі виконання наступних етапів:*

- формування вхідної інформації стану інформатизації країн світу;*
- моделювання взаємозв'язку складових впливу інформатизації країн світу у вигляді латентних факторів розвитку процесів інформатизації.*

*Виконано факторний аналіз в межах кожного кластера однорідних за рівнем інформатизації груп країн світу. Розрахунок факторних навантажень дозволив визначити найбільш впливові чинники розвитку інформатизації країн кожної групи. Завдяки цьому забезпечується можливість отримання найбільш впливових індикаторів, що формують механізм розвитку процесу інформатизації країн кожного кластеру. У порівнянні з аналогічними відомими виконане дослідження дозволило визначити основні пріоритети розвитку інформатизації країн світу у розрізі їх кластерів, сформованих за рівнем розвитку інформатизації в межах країни кожної групи. Це забезпечило наукове обґрунтування для формування рекомендацій щодо організаційних заходів задля підвищення рівня інформатизації країн світу з урахування їх соціально-економічного стану.*

**Ключові слова:** *інформатизація країн світу, фактори розвитку інформатизації, інформаційно-комунікаційні технології.*

### **1. Introduction**

The processes of informatization have opened up fundamentally new opportunities for a radical change in the direction of development of the countries of the world and civilization in general, namely, it marks the beginning of the transition to a global information society. At the same time, informatization significantly accelerates the pace of globalization of all spheres of society's life and civilizational development in general.

The development of informatization in a country depends on the degree of influence of information resources on the development of the economy, namely on the level of application of information technologies [1]. It was determined that the processes associated with the spread, readiness to use the information and communication technologies of the country are key factors for the development of informatization of the countries of the world [1]. Since the widespread use of information resources and information technologies in the economic sphere of each country is a distinctive feature of the information economy, it is important to identify the main factors influencing the processes of informatization of countries of the world. So, it is possible to conclude that the country's techno-

logical readiness to introduce information technologies and technical innovations, as well as their level of application, determine the development of informatization of the countries of the world. Therefore, it is relevant to study the specifics of informatization and the determining factors of their development for countries, in particular, taking into account the degree of their socio-economic development.

### **2. The object of research and its technological audit**

*The object of research* is development process of informatization of the countries of the world. For the study, 151 countries of the world were identified that have statistical information on informatization components. On the basis of annual reports on the NRI index, indicators have been established that affect the informatization of countries around the world.

One of the most problematic places is the study of the relationship in an analytical form between the components of information. It is equally important to determine the most influential factors in the development of informatization processes for countries in the global information space.

### 3. The aim and objectives of research

*The aim of research* is studying the process of informatization of countries in the global information space based on modeling of development factors.

To achieve the aim of research the following objectives are defined:

1. Formation of input information about the state of informatization of the countries of the world.
2. Analysis of the impact of the components of informatization of the world.

### 4. Research of existing solutions of the problem

Research by many scientists focuses on analyzing informatization as a process that characterizes the use of informatization and information technologies to such an extent that they become dominant in combination with economic, political, social and cultural factors of development. In particular, the content interdependence of the processes of informatization and integration was analyzed in [2]. The authors noted that although they explain various phenomena, there is a noticeable interweaving of their political, economic and socio-cultural functions. Although globalization is concerned with the integration of economic institutions, much of this integration is due precisely to information technology. Despite the fact that international trade is not a new phenomenon, the emergence of information technology has accelerated the pace and scale of trade. On the other hand, with the help of electronic media, the latest ideas can spread throughout the world, or news about events on one continent can significantly affect financial markets around the world. And vice versa, globalization allows to spread information technologies, creates a world market and clear strategic incentives for the development of information technologies [3].

The work [4] focuses on the definition of threats to the development of informatization processes. The main factors influencing the development of informatization, which were evaluated and identified as dangerous processes, phenomena and situations that harm the health, safety, well-being and life of all mankind, and need to be eliminated, are investigated. So, the emphasis is on analyzing the essence of the global problems of informatization and the corresponding risks. At the same time, the authors assume a prominent role in the development of informatization, the scope of which covers opportunities for the development of the knowledge economy, the use of information and communication technologies in e-government, business and society as a whole. They identify the problems of government informatization on the example of the country of China, its business and rural areas. There was a growing gap between the informatization of rural and urban areas, as well as innovative information and communication technologies aimed at overcoming this gap.

In [5], modern information risks in the global information space are considered and their classification is performed. The essence of information security is disclosed, it is one of the main factors for the sustainable development of the modern information society. The experience of Ukraine in countering modern information threats, including military information aggression from Russia, was analyzed.

In [6], methodological approaches to the study of informatization in the modern information world were developed. The proposed stages of research using the methods of statistical and comparative analysis will determine the main factors influencing the development of information processes in the network.

The work [7] is devoted to the analysis of the most popular theories of the information society during the XX–XXI centuries and explores the evolution of information theories. But it does not pay enough attention to the analytical definition of the components of the informatization process and the factors of its development in the international globalization space.

In [8], it is reasonable to question the importance of information and communication technologies in the modern information society based on the opinions of specialists from different countries of the world. But the question of the formation of trends and factors in the development of informatization of modern globalization processes has not been studied.

Partially these deficiencies are solved in [9]. In particular, the authors consider the long-term trends in the spread of information and communication technologies during the 20th and early 21st centuries, characterize the specifics of the global transformation of information processes, and study the dynamics of the digital divide.

Some researchers of informatization development factors believe that the main levers of the development of the modern information space are Internet technologies and high-tech goods imports. At the same time, it is the development of reengineering technologies based on the decomposition of imported high-tech goods that stimulates the formation of their own high-tech industries, and their entry into the global knowledge market will help increase the competitiveness of countries. And the main feature of international economic relations at the beginning of the III millennium is that their content, main trends and contradictions, dynamics, structure and forms of development are determined by the deployment of information processes, technological, information revolution [10]. It has been determined that the priority directions of informatization of the world economy are the improvement, development of the components of the informatization process, tools and information technologies, as well as their integration [11].

On the basis of the cluster analysis, the main groups of countries of the world were identified, which differ in different levels of informatization development [12]. In [13], the homogeneity of countries was established in their entirety according to the Ward method using the statistical package Statgraphics Centurion [14]. Using the calculated cluster analysis, 4 clusters were selected. A quantitative analysis of the average values of the characteristics-characteristics for each of the four calculated clusters indicates that the difference between groups of countries reaches more than twice. This justified the conclusion that the current level of development of informatization of the countries of the world is characterized by unevenness and has a heterogeneous character.

So, for the successful development and functioning of the country's economy, it is necessary to effectively manage information resources, implies the intensification of information processes. The implementation of the task involves the analysis and modeling of the development

of the process of informatization of the countries of the world based on the determination of the most important factors. The solution to this problem requires the application of an appropriate methodological approach based on the tools of mathematical modeling.

Thus, the analysis of literary sources showed considerable interest in the issue of the development of informatization of the modern information space, but also showed the insufficiency of research. In particular, in the matter of determining the factors of development of the processes of informatization of the countries of the world, taking into account the level of socio-economic development, which necessitates further research on this issue.

## 5. Methods of research

During the execution of the work, the methods of multivariate statistical analysis are applied – cluster and factor analysis. The method of cluster analysis is used to group countries according to the criterion of similarity by the level of development of informatization processes. Factor – in the study of communication components of information [15]. Also, factor analysis is proposed to determine the factors affecting the informatization level of the countries of the world.

## 6. Research results

**6.1. Formation of input information about the state of informatization of the world.** One of the most common indicators by which the state and degree of informatization in the countries of the world is assessed is the assessment of the level of development of information and communication technologies (ICT) by the Network Readiness Index (NRI) [16]. The network readiness index is an integral indicator and consists of a system of subindexes, which in turn is a system of subindexes. The International Telecommunication Union (ITU) identifies a multi-stage model by which countries or regions move in the development of informatization [17]. First, it includes the stage of preparing the environment for ICT and includes the political and legal environment, as well as the business and innovation environment in the form of relevant sub-indices. The next stage characterizes the country's «network readiness». The main sub-index is the availability and ability to information technology (IT),

which determines the spread of IT infrastructure in the country, including the degree of access of individuals, enterprises and organizations to this infrastructure. The third stage includes the intensity of ICT use, which demonstrates the effectiveness of IT application in the country, in particular, the degree of IT implementation, the emphasis is on the skills of effective use of IT, be it individual use, in the business environment or government. The last stage analyzes the impact of ICT on the overall development of the country and should assess the socio-economic consequences of its use.

In addition to the integral index NRI, there are other indicators characterizing the development of informatization of the country. This group is represented by a group of indices in a comprehensive global competitiveness measure (GCI). So, in the Table 1 grouped indicators formed from sub-indices of the considered indices. These indicators characterize the development of informatization of the country; therefore, they are applied for the corresponding cluster analysis.

So, the group of indicators characterizing the country's informatization from the system of the complex global competitiveness index (GCI), is characterized by the «Technological readiness» sub-index, which includes the technological adaptation of the country's society and the degree of ICT use. Innovations and factors of improvement, including the level of business compliance with modern requirements, and aspects related to the spread of conditions for the use of innovations in society, is also an integral part of the development of informatization of each individual country.

So, it is determined that the current level of informatization of the countries of the world is uneven [18]. It is also found homogeneous groups of countries with a similar level of development of information [19]. This makes it possible to assume that in each group of countries that have their own characteristic level of information development, there are their most influential factors determining the development of this process.

A quantitative analysis of the average values of indicators calculated by cluster analysis, on the basis of which clusterization is carried out, makes it possible to identify groups of countries in the development of the appropriate level.

Graphic interpretation of the results is presented in Fig. 1. Thus, four graphs are obtained, located at different levels.

**Table 1**

Indicators characterizing the development of informatization of the country, applied for cluster analysis

Indicator	Designation	Indicator	Designation	Indicator	Designation
Technological adaptation	$x_1$	Political and legal environment	$x_8$	Individual ICT use	$x_{15}$
ICT use	$x_2$	Business and innovation environment	$x_9$	ICT use in business	$x_{16}$
Technological readiness	$x_3$	ICT readiness	$x_{10}$	ICT use by the government	$x_{17}$
Business compliance with modern requirements	$x_4$	Infrastructure and digital content	$x_{11}$	ICT impact	$x_{18}$
Innovations	$x_5$	ICT accessibility	$x_{12}$	Economic implications of ICT use	$x_{19}$
Innovation. Improvement factors	$x_6$	ICT application ability	$x_{13}$	Social implications of ICT use	$x_{20}$
ICT environment	$x_7$	ICT use by the public	$x_{14}$		

**Note:** developed by the authors according to [16]

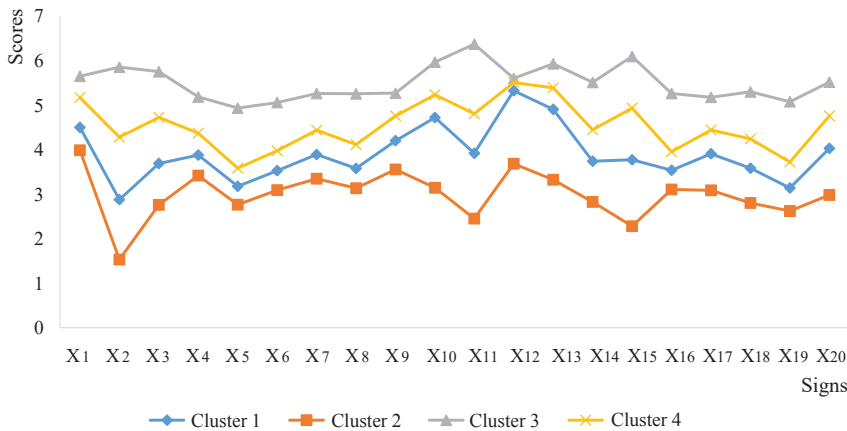


Fig. 1. The average values of signs of clusters of countries of the world in terms of the development of their informatization

Let's analyze Fig. 1. As it is possible to see, the second cluster has the lowest level of average values of features that comprehensively characterize the development of informatization of countries of the world. The second group included 22 countries, some of them: some African countries, the Baltic countries, Cyprus, some European countries (Czech Republic, Italy, Slovenia, Spain), as well as Saudi Arabia and Turkey. The position of the countries of this cluster can be attributed to the bad among the countries of the world with the lowest level of informatization.

The first cluster, by most signs, occupies a higher position than the average values of the second («bad») cluster. That is, the level of information development in the countries of this cluster is the best. It can be classified as below average. This cluster contains countries: Albania, Argentina, countries of the post-Soviet Union, in particular, Armenia, Georgia, Kazakhstan and Azerbaijan, etc., countries of the European Union (Poland, Bulgaria, Croatia, Montenegro, etc.), some African countries, Russian Federation and Ukraine. The countries included in this group can be described as countries with a sufficient level of informatization. In terms of the number of countries, it is the most representative (53 countries).

The countries of the third cluster occupy a high position among other countries by the criterion of average values of features that are characteristics of the informatization of countries of the world. That is, the position of these countries, namely, the third cluster can be called the best, and the countries included in this cluster are the countries where the development of informatization has the highest level in the world, that is, they are the most computerized countries. So, the countries with the highest level of development of informatization include the following 28 countries: Australia, developed countries of the European Union, Canada, Scandinavian (Denmark, Iceland, Sweden, etc.) and Baltic countries (Estonia), Israel, Japan, Korea, Luxembourg, Eastern countries, in particular, Singapore, China, United Arab Emirates, USA, etc.

The line of average values of signs of the countries of the fourth cluster occupies an intermediate position between the second position below the average and the third cluster, which has the best average values of signs of informatization of countries. It includes 48 countries: mainly African countries, from the edge of the post-Soviet space – Tajikistan. That is, the state of informatization

of the third cluster countries is positioned as above the average level, and the countries of this cluster are characterized by a sufficient level of informatization.

Thus, a quantitative analysis of the average values of the signs-characteristics for each of the four calculated clusters indicates that the difference between groups of countries reaches more than twice. Thus, it can be argued that the current level of informatization development of the countries of the world is characterized by unevenness and has a heterogeneous character.

Let's perform factor analysis within each cluster of homogeneous in terms of informatization of groups of countries of the world.

As signs, they will serve as a base for factor analysis, a system of indicators is proposed, which are the main characteristics of the development of informatization of countries of the world. This system is based on the Network Readiness Index (NRI) and the Global Competitiveness Index (GCI), which are officially recognized by the statistical organization of the European Commission and are provided by Eurostat (the European Statistical Office) [20].

**6.2. Analysis of the impact of the informatization components of the countries of the world.** To analyze the influence of individual factors on the effective (output) indicator, which characterizes the development of the informatization process, a factor analysis is proposed. It is determined that the scorecard for calculating the network readiness index (NRI) and the scorecard for calculating the group of global competitiveness indices (GCI) are formed on the basis of sub-indices [21]. These, in turn, are aggregates of the corresponding sub-indices [22]. Therefore, as indicators for determining the most influential factors on the informatization development of the countries of the world, it is proposed to use network readiness indices (NRI) and global competitiveness (GCI) as subindexes. So, a system of indicators is formed on the basis of the NRI and GCI sub-indices, which is the main characteristic, which forms the informatization level of the country (Table 2).

Table 2

The system of basic indices based on subindexes that affect the country's informatization

No.	Indicator code	Indicator name	Units
1	GCI.B.09	Technological readiness	Points
2	GCI.C	Innovation and improvement factors	Points
3	NRI.A	ICT environment	Points
4	NRI.B	ICT readiness	Points
5	NRI.C	ICT use	Points
6	NRI.D	ICT impact	Points

Note: developed by authors based on [19]

To determine the most significant indicators of informatization of the countries of the world, it is necessary to determine the factors that have the greatest influence on the development of these processes. For this, let's use factor analysis based on certain indicators of informatization for the studied 151 countries of the world, including Ukraine.

Since, as a result of cluster analysis, homogeneous groups of countries are identified by the level of their informatization, it is possible to assume that the influence of signs on the development of this process within each cluster is heterogeneous. Therefore, let's perform calculations using factor analysis separately for groups of countries of each of the four studied clusters. Calculations will be performed using the statistical package Statgraphics Centurion.

Let's calculate the factor analysis for the 53 countries that fall into the first cluster, and determine the latent factors of the development of informatization in these countries. Let's analyze the results of the calculated factor analysis of the informatization development of the countries of the first cluster in the form of the corresponding statistical characteristics (Table 3).

**Table 3**

Statistical characteristics of the factor analysis of the informatization development of the countries of the first cluster

Factor number	Factor Variance (Eigenvalue Factor)	The share of the total dispersion for each of the factors, %	Accumulated dispersion, %
1	2.74382	45.730	45.730
2	1.50833	25.139	70.869
3	0.694965	11.583	82.452
4	0.488134	8.136	90.588
5	0.353758	5.896	96.484
6	0.210989	3.516	100.00

As can be seen from the Table 3, there are six factors that explain the mechanism for the informatization development of the countries of the first cluster. The greatest value of the dispersion factor in the form of its own value, we have for the first factor, that is, the proportion of dispersion, which is explained by the first factor is more than 45 %. It is approximately twice the value for the second factor (2.74 compared with 1.5) and significantly exceeds the value of other factors. The percentage of the total variance for the first factor is 45.73 %, that is, the first factor almost half describes the process of informatization of the countries in the first cluster. The second factor includes about 25 % of the variance, the third factor is more than 11 %, other factors have an insignificant share of the total dispersion and contain within its range 10 %. Accordingly, the studied factors cover 100 % of the total variance, which indicates the objectivity of the study.

The analysis shows an objective opportunity to leave the first factor as the main factor for further research on the development of the informatization process in the countries of the first cluster.

Let's give the equation of the first factor, where the values of variables are standardized by subtracting and dividing by their standard deviations. Calculated analytical dependence is a mathematical model of the latent factor in the informatization development of the countries of the first cluster:

$$F_1 = 0.7962x_1 + 0.2554x_2 + 0.4428x_3 + 0.5913x_4 + 0.9189x_5 + 0.8091x_6. \quad (1)$$

Let's define the factor loadings for each feature in equation (1) as weights for each variable. Such selection helps to make a difference and to perform a meaningful interpretation of the correlation between factors and variables, which allows to provide further practical recommendations. That is why they represent the most important information on which the interpretation of the results of calculations is based.

So, the factor loads for each feature in equation (1) are ranked as follows:

$$x_5 > x_6 > x_1 > x_4 > x_3 > x_2.$$

As it is possible to see, the most influential feature in the development of the informatization process in the countries of the first cluster is «ICT use», since the values of the factor load of this indicator are 0.9189. The second most important influence on the development of informatization of the countries of the first cluster is the «ICT influence» sub-index with a weighting factor of 0.8091. The third place is occupied by the indicator «Technological readiness» with a factor load of 0.7962. The following indicator «ICT readiness» also has a significant impact on the development of informatization, the calculator has a weighting factor greater than 0.5 and is equal to 0.5913. The following three indicators do not have such a significant impact on the process of informatization of the countries of the first cluster as compared with the listed indicators, since they have insignificant (i. e. less than 0.5) factorial loads, namely:

- «Environment for ICT» indicator – 0.4428;
- «Innovations and factors of development» – 0.2554.

Thus, on the basis of the calculated factor analysis, results were obtained, the interpretation of which allows to identify the latent factor in the development of informatization of the countries of the first cluster. The calculation of the factor loadings of this factor made it possible to determine the most influential indicators that form the mechanism of the informatization process in the countries of the first cluster, namely, the use and effects of ICT, technological readiness, and ICT readiness.

Similarly, as a result of a calculated factor analysis of indicators of the development of informatization of the countries of the second cluster, six factors are obtained, each of which has a prolonged influence on the development of this process for the respective group of countries studied. For the second cluster group of countries, the first factor has the most significant indicators of dispersion – the eigenvalue of the factor, equal to 3.817, which is more than 63 % of the total dispersion. This is more than two times higher than the similar value of the following factor, namely, 1.2771, the proportion of the total dispersion of which is 21.285 %. For all the other four factors, their influence can be estimated by the cumulative dispersion value of less than 8 %. These facts indicate that it is the first factor that most explains the mechanism for the development of informatization of countries in the second cluster, and latently determines it for these countries. All factors studied cover 100 % of the total variance, which indicates the objectivity of the study.

The analysis shows an objective opportunity to leave the first factor as the main factor for further research on the development of the informatization process in the countries of the first cluster. Let's give the equation of the first factor, where the values of variables are standardized by subtracting and dividing by their standard deviations. Calculated analytical dependence is a mathematical model of the latent factor of development of informatization of the countries of the second cluster and characterizes the causal relationship of the six-part indicators taken into account, the characteristics of the informatization development of countries of the world:

$$F_2 = 0.8287x_1 + 0.8845x_2 + 0.7924x_3 + 0.226x_4 + 0.9376x_5 + 0.8888x_6,$$

$$x_5 > x_6 > x_2 > x_1 > x_3 > x_4. \quad (2)$$

Let's analyze the results of the calculated factor analysis of the informatization development of the countries of the third cluster using the appropriate statistical characteristics.

For the countries of the third cluster countries, as a result of factor analysis, six factors are also obtained that explain the mechanism for the development of informatization within this cluster. The dominant value of the dispersion factor in the form of its own value we have for the first factor, it is equal to 3.1273. The proportion of dispersion, which is explained by the first factor, is more than 52 %, which more than half describes the effect of the entire set of factors. This means that the first factor more than all the other factors together characterizes the process of informatization of countries that fall into the third cluster. Other factors have a small fraction of the total variance.

Let's give the equation of the first factor for standardized variables. Thus, the calculated analytical dependence is a mathematical model of the latent factor in the informatization development of the third cluster countries:

$$F_3 = 0.7779x_1 + 0.5786x_2 + 0.5264x_3 + 0.6505x_4 + 0.8708x_5 + 0.8537x_6. \quad (3)$$

So, the factor loads for each feature in the mathematical model of the latent factor of the informatization development of the third cluster countries (3) are ranked as follows:

$$x_5 > x_6 > x_1 > x_4 > x_2 > x_3.$$

As it is possible to see, the most influential feature in the development of the informatization process in the third cluster countries is «ICT use», since the values of the factor load of this indicator are equal to 0.8708. The second most important influence on the informatization development of the third cluster countries is the «ICT influence» sub-index with a weighting factor of 0.8537. The third place is occupied by the «Technological readiness» indicator with a factor load of 0.7779. The following indicator «ICT readiness» also has a significant impact on the informatization development, the calculator has a weighting factor equal to 0.6505. The following three indicators, namely «Innovations and improvement factors» and «ICT environment», have factor loads of 0.5786 and 0.5264, respectively.

A feature of the informatization development of countries in the third cluster of countries is that all factor loadings

are influential, since they have weights greater than 0.5 in the model of the latent factor that describes this process.

Analysis of the development factors of informatization of the fourth cluster countries shows that the first factor should be taken as the most significant one, since its own value is 2.48582, and the share of the total variance is 41.43 %.

Let's have an equation that is a mathematical model of the latent factor that describes the behavior of the informatization development of the countries of the fourth cluster:

$$F_4 = 0.8427x_1 + 0.0468x_2 + 0.411x_3 + 0.3742x_4 + 0.8369x_5 + 0.8741x_6. \quad (4)$$

So, factor loadings are distributed in the following rating:

$$x_6 > x_1 > x_5 > x_3 > x_2 > x_4.$$

Interpretation of the results shows that the most influential factor in the informatization development of the fourth cluster countries is ICT influence with a value of 0.8741 Technological readiness – 0.8427 and ICT use with a weighting factor of 0.8369. Other factors do not have a significant impact within the country of the fourth cluster on the studied process of the development of their informatization.

Thus, using factor analysis, in particular, factor loads in the form of standardized coefficients of the most influential features, identified the main priorities for the informatization development of the countries of the world by their clusters according to the level of informatization development in the countries of each group.

## 7. SWOT analysis of research results

*Strengths.* It is determined that the indicators for the greatest impact on the level of informatization for countries:

- 1) the first cluster are:
  - ICT use;
  - ICT impact;
  - technological readiness;
- 2) the second cluster are:
  - ICT use;
  - ICT impact;
  - innovation and improvement factors;
  - technological readiness;
  - ICT environment;
- 3) the third cluster are:
  - ICT use;
  - ICT impact;
  - technological readiness;
  - ICT readiness;
  - innovation and improvement factors;
  - ICT environment;
- 4) the fourth group are:
  - ICT impact;
  - technological readiness;
  - ICT use.

They are decisive in the mechanism of formation of the processes of informatization of the countries of the corresponding cluster. Increasing the level of each of these indicators has a positive effect on the informatization level of the countries of the world.

*Weaknesses.* The least influential factors in the informatization development for the countries of the first cluster are:

- ICT readiness;
- ICT environment;
- innovation and improvement factors.

For the second group of countries, only one factor turned out to be such, namely, ICT readiness.

The third group of countries is distinguished in that all factors influencing the informatization development are influential.

For the countries of the fourth cluster, the factors of the slightest influence determine:

- ICT environment;
- innovation and improvement factors;
- ICT readiness.

The least influential factors are identified are the weak side in the mechanism of formation of the process of informatization of the countries of the world. This can be explained by the fact that they have virtually no, or have little impact on the development of information.

*Opportunities.* Analysis of the results of factors characterizing the development of informatization of countries of the world, and the extent of their influence within each cluster reflects the characteristics of the current state and the specifics of informatization of the countries of each group. The revealed patterns of influence on the level of informatization of countries of the world in the context of each cluster form the basis for practical recommendations for the effective development of the process of informatization for the countries of each group in a strategic perspective. In addition, it is the basis for the formation of recommendations of organizational measures to increase the level of their informatization.

*Threats.* Although the calculation of the factor loads of these factors allows to determine the most influential indicators that form the mechanism of the informatization process in the countries of each cluster. Interpretation of the results allows to determine the most influential factors in the development of informatization of the countries of each group. But the results of factor analysis are not straightforward. Both the composition of country clusters and the influence of factor signs may change. Since they are dependent on a selected set of factors influencing the informatization processes of countries of the world. Therefore, a more perfect substantiation of the chosen basis of the set of features for research is required.

## 8. Conclusions

1. An approach to assessing the informatization development of the world is studied based on the following steps: formation of input information on the state of informatization of countries of the world, an approach to assessing the influence degree of informatization of countries of the world using cluster analysis, modeling the relationship of components of the influence of informatization of countries.

Homogeneous groups of countries with a similar level of information development are also found. This gave grounds to assert that in each group of countries that have their own characteristic level of informatization development, there are their most influential factors determining the development of this process.

2. A factor analysis is performed within each cluster of homogeneous in terms of informatization of groups of countries of the world. As features that served as the

basis for factor analysis, a system of indicators is proposed that are the main characteristics of the informatization development of the countries of the world. This system is based on Networked Readiness Index (NRI) indicators and a group of Global Competitiveness Indexes (GCI).

Thus, on the basis of the calculated factor analysis, in particular, factor loads in the form of standardized coefficients of the most influential features, influence factors are obtained that form the mechanism for the development of the informatization process in the countries of each cluster. Interpretation of the results allowed to identify latent factors – the main priorities of the informatization development in the context of clusters according to the level of informatization development in the countries of each group.

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UDC 338 (470.41)

JEL Classification: E61, F62, O33

DOI: 10.15587/2312-8372.2018.150767

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## ANALYSIS OF GLOBAL ASPECT OF FORMATION OF INSTITUTIONAL INNOVATIVE STRATEGIES

Об'єктом дослідження є інституційні стратегії інноваційного розвитку, що враховують міжнародний фактор. Сучасному світу характерні глобальна доступність, відкритість та стрімке поширення інформації й інновацій у глобальному економічному середовищі, віртуалізація, а відтак і неконтрольованість фінансової сфери та зростання ролі інших факторів глобалізації. Одним з найбільш проблемних місць є те, що уряди мають більш ефективно вибирати пріоритети в рамках міжнародних політико-економічних стратегій з метою посилення власного позиціонування в сфері конкуренції.

В дослідженні було використано як класичні наукові методи (аналізу та синтезу, логічного узагальнення, аналогій, порівняльного співставлення), так і специфічні методи економіки високих технологій та інноваційного менеджменту.

Проведено аналіз еволюції інноваційної політики та визначено, що сучасна інноваційна політика виступає як частина зовнішньополітичної стратегії держави на міжнародній арені в умовах конкуренції за ринки збуту, інвестиції та ресурси. Визначено зміст державної інноваційної політики, у тому числі її геополітичний контекст, в рамках процесів за чотирма основними напрямками: розробка пріоритетів, розподіл бюджету та оцінка; механізми політичної координації; система взаємодії з зовнішніми стейкхолдерами.

Проаналізовано вплив міжнародного фактору на стратегічну державну політику. В рамках такого підходу інноваційна політика розглянута як скоординована державна ініціатива з мобілізації національних ресурсів з метою прискорення технологічних змін та утримання лідерства в світовій конкуренції.

Визначено завдання стратегічної аналітики інновацій, зокрема, розвиток системи інформаційно-аналітичного забезпечення інституційної взаємодії по пріоритетних напрямках науково-технічної й інноваційної політики для адаптації кращого світового досвіду та вирішення завдань забезпечення ефективного вирішення соціально-економічних проблем. А також інтеграції учасників інноваційної системи у міжнародні наукові мережі та проекти.

Завдяки розгляду концептуальних основ інноваційних стратегій забезпечується можливість розробки відповідної державної політики.

**Ключові слова:** інноваційна стратегія, державна політика, інноваційні мережі, стратегічна аналітика інновацій.

### 1. Introduction

The relevance of research on various aspects of innovation in the XXI century is due to the fact that the level of socio-economic development of any state was largely determined by its innovative level. It is based on intellectual resources, high technologies, efficient use and qualitative improvement of all factors of production.

International cooperation in the field of innovation is critical in the sixth technological order. It develops on the basis of intersectoral interactions, and then requires the involvement of resources from various sectors and different countries, global space research projects, plans for the extraction of minerals in space and other similar global initiatives.

As a result, international relations began to center around technology and innovation. The author of [1] precisely