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EFFECT OF CONSTRAINING AND STIMULATING FACTORS ON THE SUSTAINABLE DEVELOPMENT OF THE INFORMATION SPHERE OF UKRAINE

Keywords: information sphere, constraining and stimulating factors, sustainable development.

The article is focused on modern aspects of the development of the information sphere of Ukraine taking into consideration influence of constraining and stimulating factors. Thus, authors investigated the essence of those factors, some actual trends of it's recent definition and applied socio-economic outcomes for state regulation. Consequently, a research methodology model was elaborated grounded on matrix form assessment of expert qualitative considerations towards analyzing finite set of factors.

Introduction. In the second half of the 20th century the society has experienced an enormous increase in the flow of vital information. In many countries, a new system of prioritization of resources was developed with preference increasingly given to unlimited resources (information and knowledge). This was caused not only by their vastness, but also the ability to more effectively use the limited resources i.e. land, water, minerals, and reduce adverse human effect on the environment. Each of us while directly perceiving information rethinks and uses it well to ensure viability and ensure our own participation in the social (socio-economic) processes. Knowledge gained new importance, it is treated primarily as a means of creating advanced technologies for innovative development under the limited natural resources. It is important that information and knowledge are increasingly perceived not only as a new resource of human development, but also as components of the certain area — information — that affects the society and individuals, changing the traditional boundaries and principles of public relations, and therefore they need scientific analysis to develop effective means of control and regulation.

Recent research and publications review. The investigations of informational sphere and its elements are carried out by domestic researchers (their works are mostly focused on informational policy, organizational and legislative foundations of informational sphere, functional economics of its components): I. Aristova, O. Baranov, Yu. Burilo, V. Glushkov, V. Horoviy, S. Zvezhinskiy, V. Konah, O. Lytvynenko, O. Onyschenko, E. Semenyuk, M. Senchenko, O. Chubukova, whilst in many cases there is only a constituency of current situation, without grounded investigation of that social relations sphere content and results of sufficient economic activities, thus it turned complicated elaboration of regulation and ensuring its sustainable development.

Main goal of publication. The main goal of this research is to provide appropriate toolkit for prognosis of constraining and stimulating factors influence over informational sphere in short- and medium-term period grounded on hierarchical arrangement. The implemented approaches for this research were previously described [1]. In measures of the research there were imposed calculation and estimations accordingly to methodology presented in [2]. Results and outcomes of the investigation evidence adequate convergence level of comparison process as well as concordance of expert evaluations concerning weight of constraining and stimulating factors of informational sphere sustainable development.

Research main results. Ukraine officially acceded to several international treaties on sustainable development [3-8], signing of the EU Association Agreement [9] has become an impetus to adopt the Ukraine 2020 Sustainable Development Strategy [10]. The implementation of the Strategy will lead to «sustainable development of the state, structural reforms and, consequently, improve living standards. Ukraine should become a country with a strong economy and cutting-edge innovations. To this end, first of all, it's necessary to restore macroeconomic stability, ensure sustainable economic growth in an environmentally sustainable way, create favorable conditions for business...» [10], which should take place also by upgrading the national information sphere on the basis of sustainable development principles and taking into account globalization processes in the course of such transformations.

In the current circumstances it is particularly important to establish the balance between the opportunities of population to use information resources and at the same time preserving the sovereignty of the country's information under external threats. The information sphere should be regarded as an economic system to include the following items (according to the life cycle of information products): authorial environment, information and analytical activities, information services, social communications and consumer information products. Existing elements (or subsystems) of the information sphere ensure relatively closed nature of the system and determine its efficacy (ability to act appropriately), which is a precondition for the successful solution of the emerging tasks and those constantly arising over time.

Development of globalization processes and research attempts to identify economical foundations of current informational sphere evolution coincide towards establishment of knowledge (or digital) economy concept, grounded on information digitalization as inexhaustible resource, further processing of traditional resources (even financial) into digital format. Thus, taking into consideration special essence of informational products, influence over social life, at the early XXI a discourse originated related to informational sphere development under framework of so-called creative economy, having main features infrastructurally connected creativity, culture, economy and technology, that together generate information in measures of visual, audio, text or symbols, shaping the information products. Recently, in terms of corporative analyses, those issues aggregate markets and branches, forming an informational sphere as complex system of entertainment and media interconnection[1].

Developing all system entities, however, or that the economic system could not own or possess the capacity for sustainable development. The capacity for sustainable development of the informational sphere determine the inherent economic and scientific-technical potential, the relationship

[1] It is usually understood that radio, television, newspapers and journals and Internet are main media as a summation [1113] or main channels of information and entertainment dissemination for broad audiences [14; 15]. Whilst mass-media could be defined as information sources that reach and influence broad audience or subjects generating information for public [16]. Thus, informational sphere in terms of market economy definitions is traditionally identified as media or media-industry (processing of media-production).

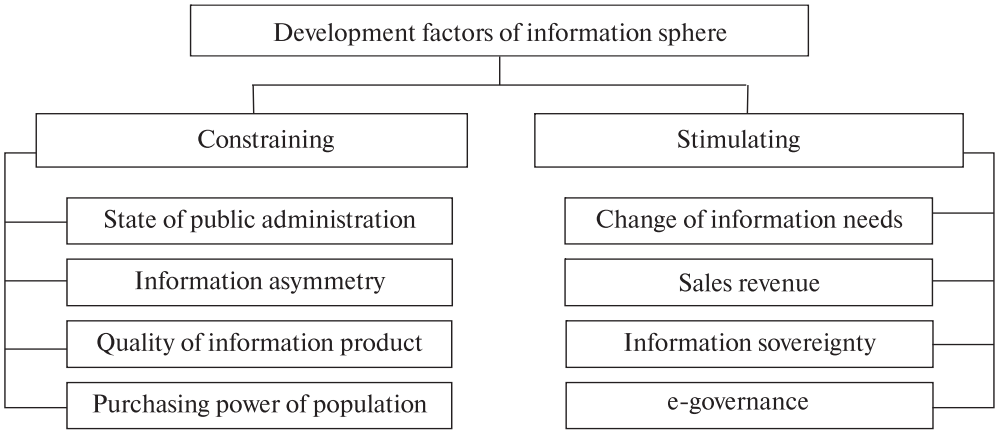

Fig. 1. Constraining and stimulating factors of development of information sphere in Ukraine
Source: Kotlyarevskyy Ya., Melnikov A., Shtangret A., Pushak H. Sustainable development of informational sphere in Ukraine. *European cooperation*. 2016. Vol. 8 (15). P. 83

with the environment. Put in other words, the *sustainable development* of the information sphere is to create the right conditions for sustainable growth in elaboration of information products that can ensure the interests of present and future generations provided information security.

Developing all system entities, however, or that the economic system cannot own or possess the capacity for sustainable development. The capacity for sustainable development of the information sphere determine the inherent economic and scientific-technical potential, the relationship with the environment. Put in other words, the *sustainable development* of the information sphere is to create the right conditions for sustainable growth in production of information products that can ensure the interests of present and future generations provided information security.

Therefore, *Information security* should be understood as ensuring access of an individual and citizen at any time to the information products required for its full development (i.e. the conditions of completeness, timeliness and accessibility of information are to be met). Subject to achieving information security products information is public and every citizen that needs it, can get it free (unless required by law).

Hence the *interests of a citizen* in the information sphere consist in the realization of his constitutional rights to free access and use of information for products not prohibited by the law of physical and intellectual development. Accordingly, the *public interests* in the information sector is to ensure that the interests of people and citizens in this area, the continuation of democratic development, achieving and maintaining social consensus and *interests of the state* — is to create conditions for the sustainable development of information infrastructure, ensuring the constitutional rights and freedoms of citizens to access and use of information products to ensure the inviolability of the constitutional order, sovereignty and territorial integrity of Ukraine, political, economic and social stability.

Implementing the concept of sustainable development information sphere provides appropriate mechanisms to address issues in this area at the level of government, legal, financial and organizational support, and the development of international cooperation. How does the information sphere is not isolated and is influenced by external and internal factors. The authors carried out theoretical and methodological studies of the Ukraine's information sphere [1; 2; 17] which allowed to identify the combination of key constraining and stimulating factors (Fig. 1).

Let's try, as briefly as possible, to characterize the constraining and stimulating factors of development of the information sphere in Ukraine.

The state of public administration. Examination of the national information legislation, which is often carried out by international organizations in recent years, shows that the regulatory framework of the information sphere of Ukraine generally meets European standards. However, a significant number of legislative acts shall be taken to address specific tactical tasks, often without the strategic guidelines of the information sphere. Indicative of this view is the attempt to revise legislation to permit advertising of alcohol and tobacco.

One of the areas of improvement of the system of information legislation Ukraine may be the development and adoption of Information Code of Ukraine, which will resolve the problem of overcoming differences in legislative and regulatory acts to ensure uniformity and integrity of the legal framework [18].

In our view, the need to improve governance and regulation of information sphere requires not only identification and general characteristics of the problem, but further work on it, particularly in terms of developing mechanism to transform the structure of relevant state authorities — subjects of information sphere to meet national interests and protect information sphere of our country. As an example of movement in this direction is the establishment of the Ministry of Informational policy of Ukraine, establishment of the Ukrainian Book Institute [19].

Information asymmetry. Among the factors restricting the development of information sphere of Ukraine there is the problem of the *digital divide* or information asymmetry that is the difference in scope between those with technical, political, social or economic reasons, have access to information and communication technologies and those who have not. This gap exists not only between countries but also between different regions and social groups even within countries. Therefore, when discussing the problem of access to the benefits of the Information Society usually paid special attention to the rights of people with disabilities or gender equality.

For example, according to the Kyiv International Institute of Sociology (KIIS) in February 2016 61.6% of the adult population of Ukraine used the Internet. Internet use varies significantly depending on location. Most households with household connections observed in the capital (78%), whereas in Kropyvnitskyy region of almost 2.5 times less. It should also be noted that the development of the Internet creates another kind of social differentiation: the rural population, people with low income and older age groups use the Internet much less than others [20].

There are different views on the scope and importance of information asymmetry for us, including the dynamics of change, but should accept the fact that this factor is one of the important characteristics of social inequality in the country.

Quality of information products. Already for a long time researchers note television as a main channel of information which role is growing all the time. According to a survey of the same KIIS conducted in October 2014, television remains the primary source of news for the majority of Ukrainians (83.5% of respondents called Ukrainian TV their main source of information, 31% — Internet sites, 29% — friends, relatives etc.) [21].

Large part of the population has long had a feeling that the TV programs can successfully replace theater, concert or a play, or books. Television is especially important for people with low educational background, whose participation in traditional forms of information interexchange and consumption has always been limited. Educated people tend to give more importance to traditional forms of information and they want to take an active part. This is the evidence of progressive stratification and polarization of society in relation to traditional information activities. Even now this process goes quite rapidly, leading eventually to the emergence of elites that are involved in traditional forms of information while preserving traditional values and systems exist alongside less educated population groups whose contacts are limited mainly by TV.

Purchasing power of population. Modern research shows that the level of income significantly modifies the way of using free time. If ones financial resource amounts increases the frequency of referring to television levels up as a form of entertainment, along with the constrained possibility to other forms of spending free time such as Internet browsing, computer games, theaters, concerts, visiting and hosting guests, sports. The severe reduction of the range of entertaining events due to low welfare of respondents brings almost to nothing all achievements in the development of the information sphere. The situation is worsened by the fact that necessitated abandonment of visiting the places of entertainment exclude, in fact, people from the field of information exchange.

Based on the studies conducted by the State Statistical Service of Ukraine during last years (see [22]) it's known that monthly household food expenditures amounted more than 53% of the total expenses. So it is clear that the low purchasing power of the population limits domestic investment and restricts the development of the information sphere.

As for the stimulating factors of sustainable development of information sphere there is another framework.

Changes in the information needs of society. In the last years of the XX century the development of simulation rather than information technologies i.e. virtual reality technologies became a priority. As a result of increased random access memory and processing speed of the computer, development of the new software rather than having qualitatively new forms of dissemination and processing of data as achieved by growing similarities between work and computer-controlled real objects, the similarity in online communications with communication in real world. Innovations that replace each other, do not bring any fundamental changes in the functioning of a personal computer or the Internet. Each time the increase of performance of a computer much more is required to improve the visual and sound effects than to develop functionality of the equipment [23].

Summarizing data on the nature of the changes in the structure of free time, it should be noted that in recent decades there was a sort of polarization the forms of its use. In the 1950—60s and 1970—80ies on the one hand, increased consumption of a socially organized recreational services within the active implementation of developmental uses of free time. On the other hand, was a very significant share of free time, which was spent mostly at home: watching TV, reading, receiving and visiting friends etc. These accounted for 50% of the time. But even back then television began to replace a number of forms of home entertainment. In 1970—80ies about 30% of the free time spent at home consisted of inactive leisure, 26% — watching TV, 24% — reading and 9% — receptions and visitations [24]. Thus, the four traditional recreational activities at home accounted for 90% of free time. Note that a kind of stereotype of in-house use of time was created: the monotony of entertaining activities, proneness to easier and more accessible forms of participation in cultural life and consumption of entertaining information. These trends persisted and deepened at the end of the XX—XXI century: dormant rest gave first place to watching TV and reception and visiting guests, reading of fiction replaced reading of newspapers.

Increasing added value and revenues on information products and markets. Over the past decades, those people who got accustomed to relatively "cheap" mass culture during the Soviet times, keenly felt the financial barrier in accessing it. The fundamental changes in accessibility of culture and its perception in society are self-evident. The main directions of the changes are, on the one hand, the diminished public interest in the traditional forms of cultural participation (movies, concerts and theater performances, museums, reading newspapers, magazines and books), and on the other — growing importance of audiovisual and mobile media communication. These trends have intensified over the years and are clearly manifested in recent decades.

Visits to cultural institutions in free time become less frequent. The "leaders" are cinemas — attendance rate has sharply decreased from 552 to 11 million viewers in 1992 and 2015 respectively. Along with 50-time decrease in the number of spectators the number of demonstrators in the country decreased by 25 times as well. Slump in watching movies in cinemas other than financial reasons is also associated with the continuing increase in television and Internet channels consuming. A similar situation with visiting concerts and theater performances. In Ukraine over the past quarter century the number of people attending concerts decreased by six times (with 65% increased in the number of concert organizations). Theater attendance during the same period decreased by three times (with almost no change in number of theaters) [25].

TV replaces not only visiting various kinds of entertainment facilities, but such an important means of mass communication such as radio. After the emergence of television in the 1950s the radio audience hasn't just shrunk, it continued to steadily decrease from year to year. Radio mostly became an accompanying activity: it's listened to when and where there is no TV. Today it is clear that the future of radio is connected with modern music [26]. As for television, it must be borne in mind that the time a person spends watching TV cannot increase (in fact, it even reduced). With the increase of living standards in the community, the quality press and Internet, especially in the age group of 18 to 45, are mostly demanded, while television around the world is transformed into a means of mass communication for older and low income persons.

Information sovereignty. Ukrainian legislation [27] stipulates that the basis of information sovereignty of Ukraine is national information resources. In this case, however, according to the law, information sovereignty of Ukraine is applicable only to the resources that were created by the state budget. Therefore, an important issue that requires

a solution, is the establishment of the joint protected information and telecommunication system of public authorities. Thus, the state interests in the information sphere is to protect its information sovereignty.

E-governance. An important part of ensuring national information sovereignty is the introduction of e-governance where e-government is automation of public service provision [28]. This means that the introduction of e-government does not change the essence of the government and only provides national authorities with additional tools for optimal and effective solving of society's problems [29]. The optimality of decision-making and the effectiveness of management are dependent on completeness of interaction of the public and government.

The establishment and use of state information resources should be based on the principle of direct access to central data banks. Efficient provision of information services to the public should be provided by a network of dedicated centers that accumulate information resources of the area and information about information resources and other areas and the access procedure. Central to e-government should be analytical system that will specialize in support of decision-making, development forecasts and modeling developments. To achieve this all available information resources of the state should be effectively regulated [30].

Knowing the nature of the factors that determine the development of information sphere of Ukraine let us now try to hierarchically organize them in terms of impact importance.

To resolve the abovementioned task authors applied a method [2; 31] based on publications [32; 33].

The method consists in analyzing finite set of elements (in this case, factors) $C = \{c_1, c_2,..., c_n\}$. The expert, based on the qualitative considerations regarding the advantage of any element the set C over other element of this set, it is necessary to assign each element $c_i \in C$ certain weight w_i, where

$$w_i \succ 0, \sum_{i=1}^{k} w_i = 1. \qquad (1)$$

When comparing two arbitrary elements c_i and c_j of the set C, the expert shall use the scale of relative importance of elements from 1 to 9. Let's give an example of the expert reasoning: if there is a reason of significant advantage of factor c_i over c_j, we'll obtain the rank equal to 7, and vice versa — c_j significantly exceeds c_i, the rank amounts to 1/7.

The result of pair comparison of factors from the set C is building pair comparison matrix $A = \|a_i\|_{(k \times k)}$, which arbitrary element is the estimate of relevant advantage of element c_i, as compared with element c_j. It's obvious that

$$a_{ii} = 1,\ a_{ij} = 1/a_{ji} \text{ for all } i,\ j = \overline{1,k}. \qquad (2)$$

Matrix A is called consistent (A') if

$$a_{ij} = w_i/w_j \text{ for all } i,\ j = \overline{1,k}. \qquad (3)$$

If element c_i is q times more than c_j, the weight of w_i should be q times more than that of w_j. In this case the expert responses are fully consistent with each other. The consistent pair comparison matrix has the following look:

$$A' = \begin{pmatrix} 1 & \frac{w_1}{w_2} & \dots & \frac{w_1}{w_k} \\ \frac{w_2}{w_1} & 1 & \dots & \frac{w_2}{w_k} \\ \dots & \dots & \dots & \dots \\ \frac{w_k}{w_1} & \frac{w_k}{w_2} & \dots & 1 \end{pmatrix} \qquad (4)$$

In a consistent matrix

$$a_{ij} = a_{rj}/\, a_{ri} \text{ for all } i, j,\ r = \overline{1,k}. \qquad (5)$$

The property of consistent matrix A' means also a linear dependence of all rows (columns) of the matrix. Arbitrary i ($i = \overline{2,k}$) line of the matrix A' may be obtained from the first row by multiplying the first by number w_i/w_1.

The own vector of the consistent matrix A' is

$$\overline{w} = (w_1, w_2,..., w_k)^T, \qquad (6)$$

that corresponds to a single other than zero, own number $k_{max} = k$. *"T"* denotes a matrix created as a result of unary operation of initial matrix transposition: substituting its columns for rows.

$$A'\overline{w} = \begin{pmatrix} 1 & \frac{w_1}{w_2} & \dots & \frac{w_1}{w_k} \\ \frac{w_2}{w_1} & 1 & \dots & \frac{w_2}{w_k} \\ \dots & \dots & \dots & \dots \\ \frac{w_k}{w_1} & \frac{w_k}{w_2} & \dots & 1 \end{pmatrix} \times \begin{pmatrix} w_1 \\ w_2 \\ \dots \\ w_k \end{pmatrix} =$$

$$= \begin{pmatrix} k \times w_1 \\ k \times w_2 \\ \dots \\ k \times w_k \end{pmatrix} = k \times \begin{pmatrix} w_1 \\ w_2 \\ \dots \\ w_k \end{pmatrix} = k\overline{w}. \quad (7)$$

The sum of elements of j column:

$$S_j^{/} = \sum_{i=1}^{k} \frac{w_i}{w_j} = \frac{1}{w_j} \sum_{i=1}^{k} w_i = \frac{1}{w_j} (j = \overline{1,k}). \quad (8)$$

The normalized matrix is obtained after normalizing elements of the matrix A', by dividing each element $a_{ij} = w_i / w_j (i, j = \overline{1,k})$ by the sum of elements of j column $S_j^{/} (j = \overline{1,k})$:

$$N' = \begin{pmatrix} w_1 & w_1 & \dots & w_1 \\ w_2 & w_2 & \dots & w_2 \\ \dots & \dots & \dots & \dots \\ w_k & w_k & \dots & w_k \end{pmatrix}. \quad (9)$$

The 2×2 pair comparison matrix A is always consistent.

While filling a pair comparison matrix

$$A = \begin{pmatrix} 1 & a_{12} & \dots & a_{1k} \\ a_{21} & 1 & \dots & a_{2k} \\ \dots & \dots & \dots & \dots \\ a_{k1} & a_{k2} & \dots & 1 \end{pmatrix} =$$

$$= \begin{pmatrix} 1 & a_{12} & \dots & a_{1k} \\ \frac{1}{a_{21}} & 1 & \dots & a_{2k} \\ \dots & \dots & \dots & \dots \\ \frac{1}{a_{k1}} & \frac{1}{a_{k2}} & \dots & 1 \end{pmatrix} \quad (10)$$

an expert can make a mistake and cause the inconsistency of A.

1. Transitivity violation:

$\exists i, j, r, s$, that from $a_{ij} \phi a_{jr}$, $a_{jr} \phi a_{js}$,does non procesed

$$a_{ij} \phi a_s (i, j, r, s = \overline{1,k}). \quad (11)$$

2. Inconsistency of the matrix elements:

$$\exists i, j, r, \text{ that } a_{ij} \neq \frac{a_{rj}}{a_{ri}} (i, j, r = \overline{1,k}) \quad (12)$$

Normalized matrix N, comprised of matrix A by dividing each element $a_{ij} (i, j = \overline{1,k})$ by the sum of elements of the j row $S_j (j = \overline{1,k})$, shall have the following look: that

$$N = \begin{pmatrix} \frac{1}{S_1} & \frac{a_{12}}{S_2} & \dots & \frac{a_{1k}}{S_k} \\ \frac{a_{21}}{S_1} & \frac{1}{S_2} & \dots & \frac{a_{2k}}{S_k} \\ \dots & \dots & \dots & \dots \\ \frac{a_{k1}}{S_1} & \frac{a_{k2}}{S_2} & \dots & \frac{1}{S_k} \end{pmatrix} \quad (13)$$

Usually matrix A is discordant, therefore elements of the arbitrary row of the normalize matrix N may not coincide unlike N'

$$(\exists i, j, r : \frac{a_{ij}}{S_j} \neq \frac{a_{ir}}{S_r} (i, j, r = \overline{1,k}) \quad (14)$$

In this case element $c_i \in C$ gains such weight:

$$w_i = \frac{1}{k} \sum_{j=1}^{k} \frac{a_{ij}}{S_j} (i = \overline{1,k}) \quad (15)$$

Inequality $w_i > 0$ is apparent since $a_{ij} > 0$ $(i, j = \overline{1,k})$.

The relation $\sum_{i=1}^{k} w_i = 1$ is also true since

$$\sum_{i=1}^{k} w_i = \frac{1}{k} \sum_{i=1}^{k} (\sum_{j=1}^{k} \frac{a_{ij}}{S_j}) = \frac{1}{k} \sum_{j=1}^{k} (\frac{1}{S_j} \sum_{i=1}^{k} a_{ij}) =$$

$$= \frac{1}{k} \sum_{j=1}^{k} (\frac{1}{S_j} \times S_j) = \frac{1}{k} \times k = 1. \quad (16)$$

For inconsistent matrix it is important to calculate the consistency index in order to determine the level of confidence in the results of pair comparisons.

After building the pair comparison matrix A and calculating coordinates of the weight vector $\overline{w} = (w_1, w_2, \dots, w_k)^T$ the largest eigenvalue k_{max} of matrix A, that corresponds to the own vector $\overline{w}$. The closer k_{max} comes to k, the more consistent are the expert judgments as to relative advantage of elements $c_i \in C$.

In accordance with pair comparison method a notion of consistency index is introduced. The consistency coefficient of matrix A:

$$CR = CI / RI, \quad (17)$$

where $CI = (k_{max} - k)/(k-1)$.

Stochastic coefficient of consistency of matrix A:

$$RI = 1.98(k-2)/k \quad CR \le 0,1, \tag{18}$$

Consistency stochastic coefficient RI is determined empirically as mean value of coefficient CI for large sample of randomly generated pair comparison matrices A. Note that

$$k_{\max} = \sum_{i=1}^{k}(\sum_{j=1}^{k} a_{ij}\overline{w}) \tag{19}$$

If consistency index is

$$CR \le 0,1, \tag{20}$$

the result of pair comparison of factors by expert are regarded satisfactory. Otherwise the inconsistency level of matrix will be high, the expert needs to specify the ranks of relative importance scale of elements of the pair comparison matrix.

We structured the above constraining and stimulating factors in the table and will supplement their names for clarity with alphabetic symbols (Table 1).

We perform calculations according to the paired comparisons method (1) — (20).

We will omit the previously published calculations [2], noting that the sums of elements obtained column matrix of paired comparisons constraints, most of the actual number and consistency coefficient and matrix inconsistent level are satisfactory i.e. satisfies the condition (20). Thus we have a sufficient level of convergence and proper coordination of expert opinions regarding weight value factors. For the constraints obtained the hierarchy shall be as follows (from least important to most important upward) — Fig. 2.

After the respective calculations we shall obtain the hierarchy of effect on the process for the stimulating factors — Fig. 3.

Let us now, based on knowledge of the current situation with the development of information sphere of Ukraine focus on prognosys. Given that the forecast means the process of obtaining scientifically sound information about the future period of the object.

In this case, we consider the forecast as a guide to structural changes in the economy of the information sphere. Timeline, covering predictions is determined by various researchers determined somewhat different, but usually forecasts cover the following time intervals: short-term — from one to five years; medium-term — from five to ten years; long term — from ten to thirty years; very-long-term — 30 years. In our analysis we'll limit ourselves to medium-term and short-term forecasts to improve their reliability.

Scientific forecasts can be divided into three main groups:

Purchasing power of population	Tier 1
State of public administration	Tier 2
Information asymmetry	Tier 3
Quality of information products	Tier 4

Fig. 2. Priority of the constraining factors' effect on the development of information sphere of Ukraine

Information needs of society	Tier 1
E-governance	Tier 2
Information sovereignty	Tier 3
Revenues and added value	Tier 4

Fig. 3. Priority of the stimulating factor effect on the development of information sphere of Ukraine

TABLE 1. **Constraining and stimulating factors of the development of information sphere in Ukraine**

Constraining	a_n	Stimulating	b_n
State of public administration	a_1	Information needs of society	b_1
Information asymmetry	a_2	Revenues and added value	b_2
Quality of information products	a_3	Information sovereignty	b_3
Purchasing power of population	a_4	E-governance	b_4

Source: Kotlyarevskyy Ya.V., Melnikov A.V., Shtangret A.M., Ratushnyak Y.V. *Hierarchical ordering of the factors that hinder or promote the development of information sphere in Ukraine*. Scientific paper. Financial Research Institute. 2016, Vol. 2 (75): 42

Group I — realistic describing trends and prospects of particular phenomena for a specified time in the future.

Group II — pessimistic describing the most likely state at some specified time in the future.

Group III — optimistic describing the desired state of the phenomenon in the future [34].

Therefore, taking into account the above analysis (2016-2018), the effect of constraining and stimulating factors the development of information sphere of Ukraine in the short (2019-2020) and medium (2021-2025) was forecasted by hierarchical ordering.

Having generalized expert opinions on the future changes in the situation of the constraining factors of the development of information sphere of Ukraine (Table 2) let us make calculations using the paired comparisons method (1) — (20). Calculations performed similarly to the above will be omitted and their readings will be shown in Table 3.

We note only that the level of mismatch of paired comparisons matrices for which calculations were carried out with a sufficient level of convergence and proper coordination of expert opinions regarding weight values constraints.

Having generalized the expert opinions on future changes in the situation of the stimulating factors of the development of information sphere of Ukraine (Table 4), let us make calculations using the paired comparisons method (1) — (20). The results are given in Table 5.

Analyzing the results of expert opinions it should be noted that some trends typical of the periods analyzed. Table 3 shows that the solvency of the population a_4 dominates among constraints not only today (2016-2018), but also realistic developments in subsequent periods 2019-2020 and 2021-2025 years. This is associated primarily with the fact that the country's household spending on transportation, health care, communications, for the purchase of household items, household equipment and routine maintenance of housing, recreation and culture, education for the first nine months of 2015 comprised 4 to 1.2% of the total

TABLE 2. **Generalized of expert opinion on how the situation with constraining factors of development of the information sphere of Ukraine will change**

Factors	2019-2020			2021-2025		
	Groups of forecasts					
	I	II	III	I	II	III
a_1	↕	↕	↓	↕	↓	↓
a_2	↕	↑	↕	↕	↑	↑
a_3	↕	↕	↑	↕	↕	↑
a_4	↕	↓	↓	↕	↕	↓

Explanation of the graphic symbols in the table: ↕ — situation unchanged; ↓ — decreased effect; ↑ — increased effect

TABLE 3. **Priority of constraining factors effect on the development of the information sphere of Ukraine during the periods analyzed**

No. of factor in rating	2016-2018	2019-2020			2021-2025		
		Groups of forecasts					
		I	II	III	I	II	III
1	a_4	a_4	a_2	a_3	a_4	a_4	a_3
2	a_1	a_1	a_1	a_4	a_1	a_2	a_2
3	a_2	a_2	a_4	a_2	a_2	a_1	a_1
4	a_3	a_3	a_3	a_1	a_3	a_3	a_4

TABLE 4. **Generalized expert opinion on how the situation with stimulating factors of the development of information sphere of Ukraine will change**

Factors	2019-2020			2021-2025		
	Groups of forecasts					
	I	II	III	I	II	III
b_1	↕	↓	↓	↓	↓	↓
b_2	↓	↑	↑	↑	↑	↑
b_3	↕	↓	↑	↕	↓	↑
b_4	↓	↓	↓	↓	↓	↓

Explanation of graphic symbols in the table: ↕ — situation unchanged; ↓ — decreased effect; ↑ — increased effect

TABLE 5. **Prioritization of the stimulating factor effect on the development of the information sphere of Ukraine during the periods analyzed**

No. factor in rating	2016-2018	2019-2020			2021-2025		
		Groups of forecasts					
		I	II	III	I	II	III
1	b_1	b_1	b_2	b_2	b_2	b_2	b_2
2	b_4	b_2	b_1	b_3	b_1	b_1	b_3
3	b_3	b_3	b_4	b_4	b_3	b_4	b_4
4	b_2	b_4	b_3	b_1	b_4	b_3	b_1

costs [35], which is not enough for normal development of the information sphere.

The state of public administration of information sphere a_1 preserves its importance for the further development of information sphere in almost all the analyzed periods because in reality Ukrainian central authorities elaborate and implement public policy in areas such as:

education and science, intellectual property, science, technology and innovation, information, development and use of national electronic information resources, creating conditions for the development of information society, as well as state supervision (control) over the activities of educational institutions regardless of their type of ownership and subordination;

culture and arts, cultural heritage protection, export, import and return of cultural property, the state language policy, as well as development and implementation of state policy in cinematography;

information, e-governance, development and use of national electronic information resources, development of the information society;

TV and radio, information and publishing activities.

The consequence of such situation (financial hardship of the majority of population and the lack of coordination between public institutions) means that overcoming of information asymmetry a_2 most likely will not be the priority in the future development of the information sphere.

From all the above it is clear enough that only the optimistic scenario quality information products a_3 in the future (2019-2020 and 2021-2025) may be the largest obstacle to the normal development of the information sphere.

Analyzing the situation with priority of the effect of certain stimulating factors (Table 7) it should be noted that almost all scenarios (realistic, optimistic and optimal) the profits of producers of information products b_2 come first which closely depends to change its information needs b_1.

The automation of public service provision falls somewhat behind the above outlined factors in value (e-government) b_4, which is closely related to the maintenance of information sovereignty b_3, which covers only those resources that have been created at the expense of the state budget of Ukraine.

Summing up the overall results we see that the forecast of the situation with stimulating factors is more «homogeneous» than with the constraints and the reasons for this is the current difficult social and political situation in our country as it's easier to predict what will stimulate the development of a social system than to prognosticate what will slow its development in the next ten years.

Research outcomes and conclusion

It should be emphasized that of the totality of the constraining and stimulating factors we have taken only the most essential that in the future, by applying the paired comparisons method are hierarchically ordered. The results are averaged and thus can be used as some guide in developing and implementing certain management measures on the state level and individual regions.

The quality and reliability of the forecast is contingent on how deep the tendencies that determine development are identified. Collection of materials, their systematization and analysis, taking into account the huge number of factors that influence the development of the information sphere are of great importance. One of the prerequisites for predicting the future is the history of the system, which future should be predicted. Another condition that affects the probability of prediction is a delay time that is, the time between the prediction of any event and the time of the actual occurrence.

The exact definition of the problem, which needs to be explored almost automatically opens important characteristic parameters that affect the solution.

In this case, when the objects of study are not identified both quantitatively and qualitatively to a degree of precision where the concept of function could be applied, the extrapolation is meant i.e. logical process of transferring the conclusions obtained within the period of observation (on some subset) on phenomena outside the observation segment (on a different subset or whole set).

We performed methodological and applied review of special approach to information sphere further structuring, measurement of constraining and stimulating influence factors and profoundly deepened their definition, provide toolkit for further prioritization, grounded hierarchy and forecasting.

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ВЛИЯНИЕ СДЕРЖИВАЮЩИХ И СТИМУЛИРУЮЩИХ ФАКТОРОВ НА РАЗВИТИЕ ИНФОРМАЦИОННОЙ СФЕРЫ УКРАИНЫ

Украина официально присоединилась к ряду международных соглашений по устойчивому развитию, а заключение Соглашения об ассоциации с ЕС послужило толчком к принятию Стратегии устойчивого развития «Украина — 2020». Реализация этой Стратегии, среди прочего, должна привести к модернизации национальной информационной сферы на принципах устойчивого развития и с учетом влияния процессов глобализации. В современных условиях важно установление баланса между возможностями населения использовать информационные ресурсы и сохранением информационного суверенитета страны под влиянием внешних угроз. Информационную сферу следует рассматривать как совокупность социально-экономических отношений, возникающих в связи с обеспечением информационных потребностей членов общества путем создания, реализации и распространения информационной продукции. Цель данного исследования — прогнозирование влияния сдерживающих и стимулирующих факторов развития информационной сферы Украины в кратко- и среднесрочной перспективе путем их иерархического упорядочения. Для осуществления этих прогнозов был применен метод математической обработки экспертных оценок. Развиваются все системные образования, однако та или иная экономическая система может обладать или не обладать способностью к устойчивому развитию. Устойчивое развитие именно информационной сферы заключается в создании соответствующих условий для устойчивого роста производства информационной продукции и в способности удовлетворить интересы нынешнего и грядущего поколений при условии обеспечения информационной безопасности. Под информационной безопасностью в исследовании понимается обеспечение доступа человека и общественных институтов в любое время к информационной продукции, необходимой для всестороннего развития, то есть должны выполняться условия полноты, своевременности и доступности информации. Основываясь на этих базовых положениях в процессе выполнения исследования были идентифицированы ключевые факторы, сдерживающие или стимулирующие развитие информационной сферы. Благодаря обобщению информации о приоритетности влияния совокупности выделенных факторов путем применения метода парных сравнений осуществлено их иерархическое упорядочение и построены соответствующие модели. Следует подчеркнуть, что из всей совокупности сдерживающих и стимулирующих факторов для анализа авторами были взяты только наиболее существенные. Полученные результаты являются усредненными, поэтому могут быть использованы как некий ориентир при разработке и реализации определенных управленческих мер на уровне государства и отдельных регионов.

Ключевые слова: информационная сфера, сдерживающие и стимулирующие факторы, устойчивое развитие Украины.

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ВПЛИВ ФАКТОРІВ СТРИМУВАННЯ І СТИМУЛЮВАННЯ НА РОЗВИТОК ІНФОРМАЦІЙНОЇ СФЕРИ УКРАЇНИ

Україна офіційно приєдналася до низки міжнародних рішень щодо сталого розвитку, а процес укладання Угоди про асоціацію з ЄС спричинив ухвалення Стратегії сталого розвитку «Україна — 2020». Реалізація цієї Стратегії має призвести, зокрема, до модернізації національної інформаційної сфери на принципах сталого розвитку та

з урахуванням впливу процесів глобалізації. У сучасних умовах важливим є встановлення балансу між можливостями населення використовувати інформаційні ресурси та збереженням інформаційного суверенітету країни під впливом зовнішніх загроз. Інформаційну сферу слід розглядати як сукупність соціально-економічних відносин, що виникають у зв'язку із забезпеченням інформаційних потреб членів суспільства шляхом створення, реалізації та поширення інформаційної продукції. Метою даного дослідження є прогнозування впливу факторів стримування і стимулювання розвитку інформаційної сфери України в коротко- та середньостроковій перспективі шляхом їхнього ієрархічного упорядкування. Для здійснення цих прогнозів застосовано метод математичної обробки експертних оцінок. Розвиваються всі системні утворення, однак та чи інша економічна система може володіти чи не володіти здатністю до стійкого розвитку. Сталий розвиток саме інформаційної сфери полягає у створенні відповідних умов для стійкого зростання виробництва інформаційної продукції, здатного задовольнити інтереси теперішнього та прийдешнього поколінь за умови забезпечення інформаційної безпеки. Під інформаційною безпекою в дослідженні розуміють забезпечення доступу людини і суспільних інститутів у будь-який час до інформаційної продукції, необхідної для всебічного розвитку, тобто мають бути дотримані умови повноти, своєчасності та доступності інформації. На основі цих базових положень у ході дослідження були ідентифіковані ключові фактори, що стримують або стимулюють розвиток інформаційної сфери. Завдяки узагальненню інформації про пріоритетність впливу сукупності виділених факторів шляхом застосування методу парних порівнянь здійснено їх ієрархічне упорядкування і побудовані відповідні моделі. Потрібно підкреслити, що з усієї сукупності факторів стримування і стимулювання для аналізу автори взяли лише найістотніші. Отримані результати є усередненими, тому можуть бути використані як певний орієнтир для напрацювання та реалізації певних управлінських заходів на рівні держави та окремих регіонів.

Ключові слова: інформаційна сфера, фактори стримування і стимулювання, сталий розвиток України.