Methodical Bases for the Regional Information Potential Estimation

Svetlana I. Ashmarina[a], Gabibulla R. Khasaev[a], Valentina V. Mantulenko[a], Stanislav V. Kasarin[b] and Evgenij M. Dorozhkin[c]

[a]Samara State University of Economics, Samara, RUSSIA; [b]Samara Region Government, Samara, RUSSIA; [c]Russian State Vocational Pedagogical University, Ekaterinburg, RUSSIA

ABSTRACT

The relevance of the investigated problem is caused by the need to assess the implementation of informatization level of the region and the insufficient development of the theoretical, content-technological, scientific and methodological aspects of the assessment of the region's information potential. The aim of the research work is to develop a methodology for assessing the information potential of the region and its approbation. The key method used while studying the problem is the method of multidimensional integral assessment of the region's informatization development level which allows to consider the problem from the system approach. Results: methodical approach to the assessment of the region's information potential, including 45 partial indicators of the information potential combined into five subgroups: indicators of the IT application level; indicators of economic activity results, based on the use of information and communication technologies in organizations; indicators of the technical security for informatization processes; indicators of the global information networks data use in the work, of the use of specialized information programs; labor indicators and the integral indicator of the region's informatization development level. Practical value is determined by the formation of some theoretical and methodical aspects and recommendations for the development of regional information management, based on the improvement of methodical principles and instruments for the assessment of information processes in the region.

Introduction

The development of the modern society is accompanied by the increasing level of the informatization of all areas of human activity and functioning. Nowadays this area is a determinant of the human society which has a

CORRESPONDENCE Gabibulla R. Khasaev ✉ ecun@sseu.ru

significant impact on its socio-economic and political structure. Information development is becoming the most effective way of realization of the intellectual potential (the most important resource for the formation of an innovative economy) (Toktagazin et al., 2016; Kirilova & Vlasova, 2016). The informatization unites economics and politics. The information lack often leads to the dissociation of economic interests of the whole and its parts and to conflicts between economic structures and even between the state and its subjects. The economic fragmentation is not less dangerous than the political or territorial ones. The informatization allows a new understanding and implementing the state's role in the modern economy.

The information scenario of the national economy modernization is based on the processes informatization taking place on the level of regional socio-economic development. At the same time a high level of the technological and human resource gap of our state compared with the world in the information economy leading countries does not allow our regions to implement the informatization fully. Besides the poor scientific and methodical basis for the transition to an information society doesn't also contribute to the information development of the regions. The major problem of the regional informatization management (Shandan et al., 2012; Kerimbaeva et al., 2014) is connected with the fact that the necessity of its solution determines the possibility of the formation in our country a developed information society, which is the foundation for the creation of competitive advantages of the Russian economy and the state as a whole.

A serious difficulty in planning and management of informatization processes is the lack of a clear methodological basis for the assessment the region's information potential development level. The regional informatization is realized on the mesolevel in the development of globalization processes in the economy and in the context of the intensifying creation process of a global information space in the system «region- country-world». This combination of evolutionary processes makes the regional informatization an object for the intense study and research (Rus, 2012; Xie Jie, 2001). The justification of assessment tools needed for the regional information potential is becoming one of the biggest challenges by the development of regional informatization programs and the same is related to the management tools.

All these aspects define the relevance and the timeliness of the research.

Methods

Research Methods

During the research the following methods were used: the PATTERN method with the access to particular informatization indicators; the method of determining the level of the integral level of the economic branch informatization; the ranking the economic branches in the level of the informatization; the method determining variation, median and mode coefficients.

Experimental research base

The experimental base of the research work was the Samara region of the Russian Federation.

Research Stages

The research was conducted in two phases:

- on the first stage we carried out an analysis of existing theoretical and methodological approaches to the assessment of the region's information potential;

- on the second stage the research group developed methods for the integrated assessment of the region's informatization potential, including the analysis of the information development level in different industrial branches based on the rating by the informatization level.

Results, Discussions and Conclusion

Assessment methods of the region's information potential

To analyze the informatization level a complex system of indicators is needed which would determine as well the informatization condition in certain types of the economic activity as the informatization level in general. This system of indicators is necessary because of the fact that nowadays there is no unified indicator in the scientific literature which allows to measure the level of the region's informatization development.

We offer a comprehensive method based on the author's technique for the region's informatization level assessment. The method is based on a system of 45 indicators, combined into five subgroups. We also substantiated some methodical aspects for evaluating the integral index of the IT development level and an integrated multi-dimensional assessment of IT development level (Kasarin, 2015).

Here we will consider the selected groups of indicators in details, specifying the particular indicators. The first group includes indicators determining the degree of the information and communication technologies use and reflecting different possibilities of this use – organizational, financial and human. Grouped indicators are statistical indicators, therefore they have a high degree of reliability. These are following indicators:

1) the number of organizations that use modern information and communication technologies;

2) the number of organizations that do not use information and communication technologies in a certain year and do not plan to use them in the next year;

3) the number of organizations planning to start using information and communication technologies in the coming year;

According to figures 1-3 in the appropriate forms of statistical reports the distribution of organizations is carried out by the types of used technologies: personal computers, other types of computer, local area networks, e-mail, global information networks, dedicated communication channels. It's also mentioned how many organizations have their own web-sites on the Internet.

4) expenses on the information and communication technologies;

It must be emphasized that for analytical purposes we must consider both the sum of the expenses (in absolute terms) and their structure (in relative terms). Accordingly, the following expenses are allocated:

- the purchase of the computer equipment (including its installation and commissioning);

- the purchase of software;

- telecommunication fees (including the Internet access costs);

- staff training related to the development and the use of the information and communication technologies;

- the payment to the third-party organizations, specialists and services which are related to the information and communication technologies (except telecommunications services and training);

- other expenses on the information and communication technologies.

5) the number of employees of the surveyed organizations;

From the total number of employees those were chosen who used information and communication technologies, which, in turn, are structured by the technology type. This structure, which is quite logical, is in accordance with the structure used for the indicators 1-3.

6) the number of specialists in the information and communication technologies sphere;

They officially include two groups: firstly, these are high qualified workers (in particular, the developers of computer systems, electronics engineers, programmers, instrumentation engineers, etc.); secondly, workers of the average level of qualification (for example, operators of equipment for radio and television broadcasting, electronics technicians, operators servicing industrial robots, etc.).

The second group includes indicators of the economic activity effectiveness, determined by the efficiency of the IT use.

7) how many goods of the own production were shipped, how many items of work and services were done on their own, how many goods of the own production were sold (without VAT, excise duties and similar payments);

In fact, the sum of these indicators is the turnover of organizations belonging to the system of national accounts indicators. A special group is formed by organizations using the Internet.

8) how many goods (items of work, services) were sold by organizations making purchases by orders got through the Internet resources;

9) the separation of organizations by the share of sales by orders received over the Internet;

10) how many goods (items of work, services) were sold by organizations by the orders got through the Internet resources;

11) the separation of organizations by the share of purchases by orders transferred via the Internet.

It is important to emphasize that the degree of the Internet use by the purchases and sales of goods (services) is different in every organization. For some of them such orders are a one-time, single action and don't have any impact on the commodity turnover; for others it is an essential element of their business. In this context, statistics usually select the share of purchases by orders transferred by Internet resources (the share of sales by orders received via the Internet resources).

12) the separation of organizations by the share of sales taking into account their use of the Internet for different types of customers;

This indicator shows more details of the sales structure (in 5 groups of organizations), depending on the type of customers (legal entity or physical entity).

The third group is formed by indicators characterizing the technical security of organizations with information and communication technologies.

13) the availability of personal computers;

14) the number of personal computers per 100 employees;

These indicators are calculated both as a whole for all personal computers, as well as for those that have the access to the global network.

15) the separation of organizations' workers based on their maximum use of personal computers;

16) the separation of organizations by the share of workers using personal computers the most (selected groups: up to 10% of the staff, 10 − 29% 30 − 49% 50 − 69% 70 − 100%).

The fourth group is formed by indicators which determine the use of global networks and special software.

17) the number of organizations specifying the type of their Internet connection (including connection types such as modems, digital subscriber line, wireless, etc.);

18) the number of organizations indicating a maximum data transfer speed via the Internet;

The are 7 types of the maximum speed:128 Kbps and below; 129 − 256 Kbps; 257 − 512 Kbps; 513 Kbps − 1 Mbit / s; 1.1-1.4 Mbit / s; 1.5-1.9 Mbit / s; above 2 Mbit / s.

19) the number of organizations with special software;

This indicator demonstrates in details purposes of the special programs use. These can be scientific, educational goals, design goals and goals of the financial and economic calculations, publishing, electronic and legal reference systems, CRM-, ERP-, SCM-systems and others (their total number is 13).

20) the number of organizations with CRM-, ERP-, SCM-systems and their own web-sites;

21) the number of organizations using different security tools for the data transmitted via the global network;

22) the number of organizations using the Internet for commercial purposes and different security tools for the information transmitted over the WAN.

For the information protection different tools can be used, for example, encryption means, the digital signature and others. Moreover, the organization reports should indicate whether they plan to begin (or to continue) the use of certain types of the information security in the coming year.

23) the number of organizations using the Internet for general purposes;

24) the number of organizations using the Internet for commercial purposes;

25) the number of organizations using the Internet to interact with the management bodies;

26) the number of organizations that have received some production results from the Internet usage;

27) the number of organizations that have received some changes in employment sphere from the usage of the Internet;

28) the separation of organizations by the share of employees using the Internet;

29) the separation of organizations by the share of employees using the Extranet;

30) the separation of organizations by the share of employees using the Intranet;

31) the separation of organizations by the share of employees using other global information networks;

32) the separation of the workers number by the share of employees using different Internet resources;

33) the separation of the workers number by the share of employees using the Extranet;

34) the separation of the workers number by the share of employees using the Intranet;

35) the separation of the organizations' workers number by the share of employees using other global information networks;

The fifth group is formed by indicators that determine the human potential for the information and communication technologies use.

36) the number of organizations feeling the need for specialists and users of information and communication technologies;

Some organizations were highlighted because they use the global networks and feel the need for specialists and IT users.

37) the number of organizations which conducted the training of specialists and users of information and communication technologies;

38) the number of organizations which assessed the causes and the significance of difficulties by the recruiting of specialists in information and communication technologies;

39) the number of organizations which assessed the causes and the significance of difficulties by the recruiting of users of information and communication technologies;

40) the number of organizations involving specialists in information and communication technologies for the fulfilling some kinds of work.

Methods of the integrated assessment of the region's informatization development potential

The «PATTERN» method was used for the general assessment of the region's informatization level. The method consists in comparing the individual values of various indicators (for certain activities – Yi) with the largest values (Ymax):

$$t_i = \frac{Y_i}{Y_{max}}.$$

At the final stage the multidimensional integrated index is calculated for the indicators of each activity, on the basis of which the aggregation units are ranked by the level of the information and communication technologies development. The higher the integral score is, the higher the rating rank of the activity is.

In our study, the calculation of the integral index of the IT development level was held by 8 criteria, particular indicators of the informatization level. Their choice is determined by two factors:

1) the availability of data for different types of economic activity (in some cases we will use the traditional term – «industry branch»);

2) their prevalence in the Samara region's economy. We should explain this statement in details. In the above mentioned set of indicators there is a number of other parameters in the context of their types. However, their quantitative values for many economic activities tend to 0 (for example, a very small percentage of organizations use the Extranet, and in a number of activities there are not more than 10 such organizations). Consequently, these indicators can not serve as a reliable characteristic of the IT development by the construction of the integral index.

The list of indicators:

Y1 – the proportion of organizations using personal computers (PCs), % of all the surveyed organizations of this type of activity;

Y2 – the proportion of organizations using computers of other types, % of all the surveyed organizations of this type of activity;

Y3 – the proportion of organizations using local networks, % of all the surveyed organizations of this type of activity;

Y4 – the proportion of organizations using global computer networks, % of all the surveyed organizations of this type of activity;

Y5 – the proportion of organizations with own web-sites, % of all the surveyed organizations of this type of activity;

Y6 – the number of personal computers (PCs) per 100 employees, in units;

Y7 – the proportion of PCs with the access to the Internet, % of the total number of PCs;

Y8 – expenses on the information and communication technologies for each surveyed organization, in thousand rubles.

Theoretically, if the information were more complete, there could be more indicators in the calculation.

The calculation results are interpreted so: for example, a value of 0.842, marked by section C (indicator Y8), says that expenses on IT for the activity «Mining» make up 84.2% of the best values for this indicator (represented by the activity «Production and distribution of electricity, gas and water»).

Similarly the integral index of the IT development level is interpreted (Table 1). For example, it is 0.851 for section M. Thus, the IT development level in the field of education is on the average rate of 85.1% of the best value. This is

the best result that gave the first rating to this type of activity. It has the best values in three particular indicators (Y2, Y5, Y7). The only weak point is the indicator of the expenses on the information and communication technologies (only 6.6% of the best value), which can be explained with the mainly budgetary financing of the industry. The question is: why doesn't the activity with the first rating have the integral index of the IT development level equal to 1 (that means 100%)? This could happen if all the particular indicators of the leading activity type were the best. In our case it is not so, different activities have the best values of different indicators.

Table 1. The economic activity rating of the Samara region based on the integral index of IT development level in 2013

Rating	Types of Economic Activity	The value of the integral index of the IT development level
1	M «Education»	0,851
2	C «Mining»	0,758
3	J «Financing»	0,705
4	E «Production and distribution of electricity, gas and water»	0,681 (0,6814)
5	L «Public administration and defense security; compulsory social security»	0,681 (0,6805)
6	D «Manufacturing»	0,665
7	I «Transport and communication»	0,610
8	G «Wholesale and retail trade; repair of motor vehicles, motorcycles, household goods and personal items»	0,588
9	N «Health care and social services»	0,571
10	A «Agriculture, hunting and forestry»	0,552
11	F «Building»	0,516
12	H «Hotels and restaurants»	0,497
13	Other	0,479
14	K «Real estate and rental services»	0,413

Section C «Mining» took the second rank. The value of the integral index of the IT development level, equal to 0.718, is very high, but no particular indicator for this type of activity has the best value. The weak point is the provision of employees with personal computers (only 35.2% of the best value), which indicates a high level of manual (physical) labor in the industry.

Another pole of the Table 1 is section K (0,413). The low level of informatization in the field of real estate and rental services is largely related to specifics of the industry in which information and communication technologies play mostly a supporting role and do not require large expenses. The information and communication technologies are developed not enough in the economic activity types, combined in the section «Other». These include such spheres as «Other community, social and personal services», «Housekeeping services» etc. (with the indicator's value of 0.479), where the major role is played by factors that are difficult to formalize – the manual labor, the human factor, as well as the section «Hotels and restaurants» (the indicator's value 0.497), that demonstrates the technical backwardness of these organizations from the world standards. This is largely because of the fact that there are practically no top-

level restaurants and hotels in the Samara region that are now high-tech service enterprises.

If we consider the calculation of the integral index for the activity type «Education», we can see the following characteristics of this branch:

Y1 – 98,8% (the maximum value of the indicator was in section A – 100%), it means that the particular value is 98.5 / 100 = 0.985;

Y2 – 39,4% (the maximum value of the index), it means that the particular value is 39.4 / 39.4 = 1.000;

Y3 – 89,4% (the maximum value of the indicator was in section A – 100%), it means that the particular value is 89.4 / 100 = 0.894;

Y4 – 98,5% (the maximum value of the indicator was in section A – 100%), it means that the particular value is 98.5 / 100 = 0.985;

Y5 – 77,3% (this is the maximum value of the index), it means that the particular value is 77.3 / 77.3 = 1.000;

Y6 – 97 units (the maximum value was in section J – 110 units), it means that the particular value is 97/110 = 0.882;

Y7 – 83,5% (this is the maximum value of the index), it means that the particular value is 83.5 / 83.5 = 1.000;

Y8 – 105,7 thousand rubles (the maximum value was in section E – 1606,1 thousand rubles), it means that the particular value is 105.7 / 1606.1 = 0.006.

Then, the average multidimensional value of all eight particular values is calculated:

$$\frac{0{,}985 + 1 + 0{,}894 + 0{,}985 + 1 + 0{,}882 + 1 + 0{,}006}{8} = 0{,}851.$$

Figure 2 shows the matrix of particular values for the Samara region's economic activities.

Indicators for different activity types								Integral index	The rate of the activity type
Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8		
A 1	0	1	1	0,215	0,210	0,988	0,002	0,552	10
C 0,972	0,958	0,783	0,972	0,453	0,401	0,679	0,843	0,758	2
D 0,964	0,715	0,842	0,932	0,701	0,246	0,753	0,162	0,664	6
E 0,928	0,786	0,626	0,729	0,409	0,319	0,649	1	0,681	4
F 0,812	0,415	0,624	0,772	0,404	0,228	0,861	0,008	0,516	11
G 0,928	0,628	0,694	0,817	0,472	0,383	0,769	0,009	0,588	8
H 0,905	0,382	0,641	0,829	0,390	0,146	0,673	0,005	0,496	12
I 0,901	0,646	0,779	0,834	0,461	0,310	0,633	0,315	0,610	7
J 0,776	0,900	0,667	0,735	0,619	1	0,598	0,344	0,705	3
K 0,705	0,271	0,465	0,607	0,268	0,392	0,556	0,038	0,413	14
L 0,985	0,527	0,737	0,963	0,422	0,819	0,558	0,429	0,680	5
M 0,984	1	0,893	0,984	1	0,883	1	0,067	0,851	1
N 0,954	0,550	0,820	0,942	0,408	0,246	0,531	0,115	0,571	9
0,854	0,230	0,535	0,783	0,324	0,310	0,774	0,016	0,478	13

Figure 1. The matrix of the particular values for economic activity types in the Samara region calculated with the PATTERN method

Despite the fact that the regional informatization management problems are studied quite well, a large number of issues remain unsolved, including aspects related to the formation of a high-quality information system in the region, the problems of the tools development for the regional information space management and others. So far there is no clear classification of the factorial indicators of the information society, the conceptual framework of information processes are specified not enough, there is no comprehensive concept of the information environment formation, including the formation principles of the unified information system, principals and tools for the assessment of its parameters, structure, methodology for its condition assessment etc (Sapargaliyev & Shulenbayeva, 2013).

The identified problems became the basis for the study, which result was the formation of methodological tools for the integral assessment of the region's information potential.

It was found that the efficiency increase of the region's information management process is possible only on the basis of the information potential development level evaluation, and therefore the importance of the developed methodological assessment tools for the region's information potential is high enough.

Implications and Recommendations

The article issues can be valuable for decision makers in the public administration bodies (government), as well as for researchers engaged in the study of the informatization management field.

Notes on contributors

Svetlana I. Ashmarina is Professor of Samara State University of Economics, Samara, Russia.

Gabibulla R. Khasaev is Professor of Samara State University of Economics, Samara, Russia.

Valentina V. Mantulenko is Associate professor of Samara State University of Economics, Samara, Russia.

Stanislav V. Kasarin is Deputy Chairman of the Government of Samara region, Samara, Russia.

Evgenij M. Dorozhkin is Professor of Russian State Vocational Pedagogical University, Ekaterinburg, Russia.

References

Kerimbaeva, B.T., Berkimbaev, K.M., Nyshanova, S.T. & Meirbekova, G.P. (2014). The Use of Information Technologies in the Training of Students. 5th World Conference on Educational Sciences - *Procedia - Social and Behavioral Sciences, 116*, 2697-2701. Retrieved from http://www.sciencedirect.com/science/article/pii/S1877042814006557.

Kirilova, G.I. & Vlasova, V.K. (2016). Information Streams of Education Content Integrative Designing at a Federal University. *IEJME-Mathematics Education, 11 (4)*, 767-778.

Rus, I. (2012). The Sustainability of Integrated Information Sistem. Methodical Bases for the Regional Information Potential Estimation. *Procedia Economics and Finance, 3*, 1005-1011. Retrieved from http://www.sciencedirect.com/science/article/pii/S2212567112002651.

Shandan, Z., Dan, F., Li, C. & Yunyun, X. (2012). The Application of the Campus Experimental Project Management System Based on Intranet Technology. International Workshop on Information and Electronics Engineering. *Procedia Engineering, 29*, 504-508. Retrieved from http://www.sciencedirect.com/science/article/pii/S187770581106588X.

Sapargaliyev, D. & Shulenbayeva, K. (2013). Informatization of Kazakhstani Higher Education. Procedia - Social and Behavioral Sciences. *2nd World Conference on Educational Technology Research, 83*, 468-
472. Retrieved from http://www.sciencedirect.com/science/article/pii/S1877042813011592.

Toktagazin, M.B., Turysbek, R.S., Ussen, A.A., Nurtazina, R.A., Korganbekov, B.S. & Hradziushka, A. A. (2016). Modern Internet Epistolary in Information and Media Discourse. *IEJME-Mathematics Education, 11 (5)*, 1305-1319.

Xie Jie (2001). Informatization Management Thinking of Strengthen Personnel Service in Colleges and Universities. *Procedia Engineering, 15*, 2757-2761. RETRIEVED FROM http://www.sciencedirect.com/science/article/pii/S1877705811020200.