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Integrated assessment approaches to network resource status of regional socio-economic systems

Novikov V.S.
Kuban State Technological University
Krasnodar, Russia
vs.novikov@mail.ru

***Abstract* — These days it is difficult to imagine a field of activity (private or public) without computer technology. One way or another, the socio-economic activity of an individual or society is performed with the help of ICT, Internet, computer technology and software products. For example, in the social sphere, these days it is difficult to imagine the functioning of the educational environment at various levels without ICT, both on the part of the teacher and the student perform many functions on the Internet. In the economic sphere, for example, the financial market, the circulation of financial resources, it is not new to anyone that elementary transactions (payment of utility bills, transfer of monetary resources between subscribers, etc.) can be implemented using a mobile phone or tablet. However, questions of a fundamental nature are not sufficiently considered, what is the current situation with the network resources of regional socio-economic systems. In our understanding, the socio-economic system is considered as an object (subject) that constantly interacts with the external environment, offers to exchange its resources (monetary or productive), such systems have boundaries within their motives and needs for interaction with the external environment. By the external environment we mean the regional territory (region) in which the socio-economic system is undertaken to realize its interests. In the materials of the publication by the author: a general approach to understanding the foundations of organizational and economic network resources of regional socio-economic systems is proposed; the fundamental constituent elements of regional socio-economic systems (economic socio-economic systems of the region (extra-regional and intra-regional), network interactions between socio-economic systems, the mechanism of state regulation of regional network interactions, the institutional environment in the region) are proposed; adapted to the subject of the study "Readiness Index for the Network Economy" proposed by the World Economic Forum; presented in the author's understanding of the economic efficiency of network resources of regional socio-economic systems.**

Keywords — virtual economy, network economy, assessment, network resources, region, socio-economic system

I. INTRODUCTION

The scientific search for more effective criteria for assessing the state of the network resources of regional socio-economic systems, including economic and social interaction [20,21,22], seems relevant. At present, the concept of the "Internet of things" has formed. It means electronic devices that have the ability to be corresponded among themselves, including mobile phones, smart watches, applications for mobile phones and smart watches, car software and smart homes, all the equipment and technologies that can be connected to the network and are controlled by a person via the Internet [10.11]. Then there is the emergence of entire virtual ecosystems, based on subject-object relations [23] on the basis of unifying platforms, mobile applications, virtual services of manufacturers. Regional socio-economic systems take a new look at the events that take place, transforming themselves from "I am the Company" to "We are all together".

II. RESEARCH METHODOLOGY

In this regard, it is necessary to formulate and solve a number of problems: determine a common approach to understanding the network resources of regional socio-economic systems; to propose the fundamental constituent elements of regional socio-economic systems; adapt to the subject of the study "Readiness Index for the Network Economy" proposed by the World Economic Forum; present the economic efficiency of regional socio-economic systems network resources in the author's understanding.

Object of study - assessment of the state of regional socio-economic systems network resources. Subject of the study - organizational and economic relations that arise in the process of increasing the efficiency of the regional socio-economic systems network resources functioning.

Research Methodology. In the framework of the goal and objectives of the study, the approach of a critical analysis of the scientific literature, regulatory documents on the implementation of network interaction in the virtual economy and practical experience in assessing the state of network resources of regional socio-economic systems is applied

Today, research economists have carried out a large number of works related to the implementation of the network integration of socio-economic systems into a single information space. Bernauer T., Achini Ch. [1] studied the integration of the world economy from the "real" state to the "virtual" one. Virtual capitalism in various manifestations was studied by Dawson M., Foster J.B. [2].

The following authors revealed in their studies the study of the "virtual economy" and the related concept of "digital economy": Kim B., Barua A., Whinston A.B.[5], Tompson W.[9], Novikov V.S., Klochko E.N., Yarushkina E.A., Zhukov B.M., Dianova V.A.[6]. Integration issues in the new economy were studied by Patrick Carr, Mark Rainbird, David Walters [7].

Epifanova T.V., Shatkovskaya T.V., Romanenko N.G., Mosienko T.A., Tkachenko M. [3] considered individual issues of innovative development of territories and

participation in such processes of socio-economic systems. The issues of the formation and development of virtual organizations, their contribution to R&D [13] of European countries were addressed by Filos E., Ouzounis V.K. [4].

Undoubtedly, the issue of financial support of "non-physical" economies remains quite relevant today - this is also the issue of cryptocurrencies, in their work Penkova I.V., Korolev V.A., Butenko E.D., Glazkova I.Y., Eldarov S.K. [8] consider in detail cryptocurrencies, how modern financial instrument of the digital economy.

III. RESULTS OF THE RESEARCH

Belova L.G. did an interesting discovery[19] based on the assertion that "in the theory of the network economy there is a pattern: if nominally present the territory in which some network is located that is geometrically similar plain rounded (in other words, a circle), the average availability within such area will monotonically increase from the centre to any point on the periphery; when you convert the boundaries of the territory of the circle in the shape of an ellipse, the difference in mean availability between the centre and the periphery increases. This pattern explains why the differences in accessibility (as one of the competitive advantages) between the center and the periphery in geometrically "elongated" countries are large compared to countries whose territory has an approximately rounded or square shape (for example, in the configuration of "square" South Korea and" elongated "Japan and Russia)."

In our understanding, the network resources of regional socio-economic systems can be defined as a combination, on the one hand, of the spatial distribution of economic entities and, on the other hand, as a network of interconnections and interactions between the structural elements of a regional economy both inside and outside its territory. From the indicated understanding, it follows the presentation of regional socio-economic systems and their constituent elements:

- managing socio-economic systems (extra-regional and intra-regional);
- network interactions between the socio-economic systems of the region;
- mechanism of state regulation of regional network interactions;
- institutional environment in the region.

This approach to the regional economy proves the availability of resources of regional socio-economic systems as a factor in the distribution of the productive forces of society. In form, the socio-economic systems of the region are a network structure of interactions that arise in the process of activities of business entities within networks and beyond.

Network relations in a virtual economy can be measured by the criterion of "E-readiness" of the surveyed states for the realization of their socio-economic interests on a global scale. In the criterion of "E-readiness", international organizations include, depending on the applied methodology (UNPAN, World Bank), existing elements of virtual infrastructure, organizational and legal conditions for implementing entrepreneurial efforts in virtual business. All this suggests that the estimates used take into account a large number (often still not characterized) of factors proving how many markets are adaptive for Internet technologies and computer programs.

One of the first indicators that began to be calculated (since 2000, the analytical center "The Economist Intelligence Unit", as applied to our research object, is the "E-Readiness Index", (ERI) represents a group of indicators of six levels of electronic readiness:

1. Connectivity (connectivity and communication and technology infrastructure, hereinafter - ICT-infrastructure) - indicators of "use" of ICT;
2. Business environment (general climate for business activity in the country);
3. Social and cultural environment (E-literacy);
4. Legal environment (legal support);
5. Government policy and regulatory environment;
6. Consumer and business perceptions (support for e-services; practical benefits to businesses and communities from the introduction of ICT).

Undoubtedly, the most frequently used method for assessing the state of network resources in a socio-economic system is the "Networked Readiness Index, NRI [14,15,18,19]" proposed by the World Economic Forum.

However, we consider it important to highlight that since 2002, when the Networked Readiness Index began to be calculated, its constituent elements have undergone changes today in view of the dynamics of the socio-economic activities of agents in the virtual economy, in view of global economic crises, etc. In the author's understanding, graphically, the Networked Readiness Index is presented in Fig.1. The basic levels of assessing the state of network resources of regional socio-economic systems are represented by 4 levels. The indicated 4 levels of assessing the state of network resources of regional socio-economic systems comprise 10 sublevels:

1. The level of people's access to the Internet, to communication technologies, to software products, to personal data protection tools and anti-virus programs. It includes the level of information infrastructure and the level of equipment for network interaction, software and their administrative support.
2. The level of current regulatory documents, provisions and directives for the implementation of network interaction that have been prepared and are currently being implemented. It includes the level of the implemented policy in the field of information and communication technologies, the level of development of the business and economic environment.
3. The level of qualitative and quantitative indicators of the formation and development of a network society. Includes the level of implementation of educational programs (of different levels) using the Internet, the novelty of personal computers, software products; level of formation and development of ICT, social and organizational environment of society.
4. The level of formation of the network economy (the functioning of enabling institutions, the development of the main types of markets (finance, consumer goods). Includes the level of interaction of participants in the virtual space; level of implementation of all e-government functions; the level of development of network interaction infrastructure for the functioning of enabling institutions

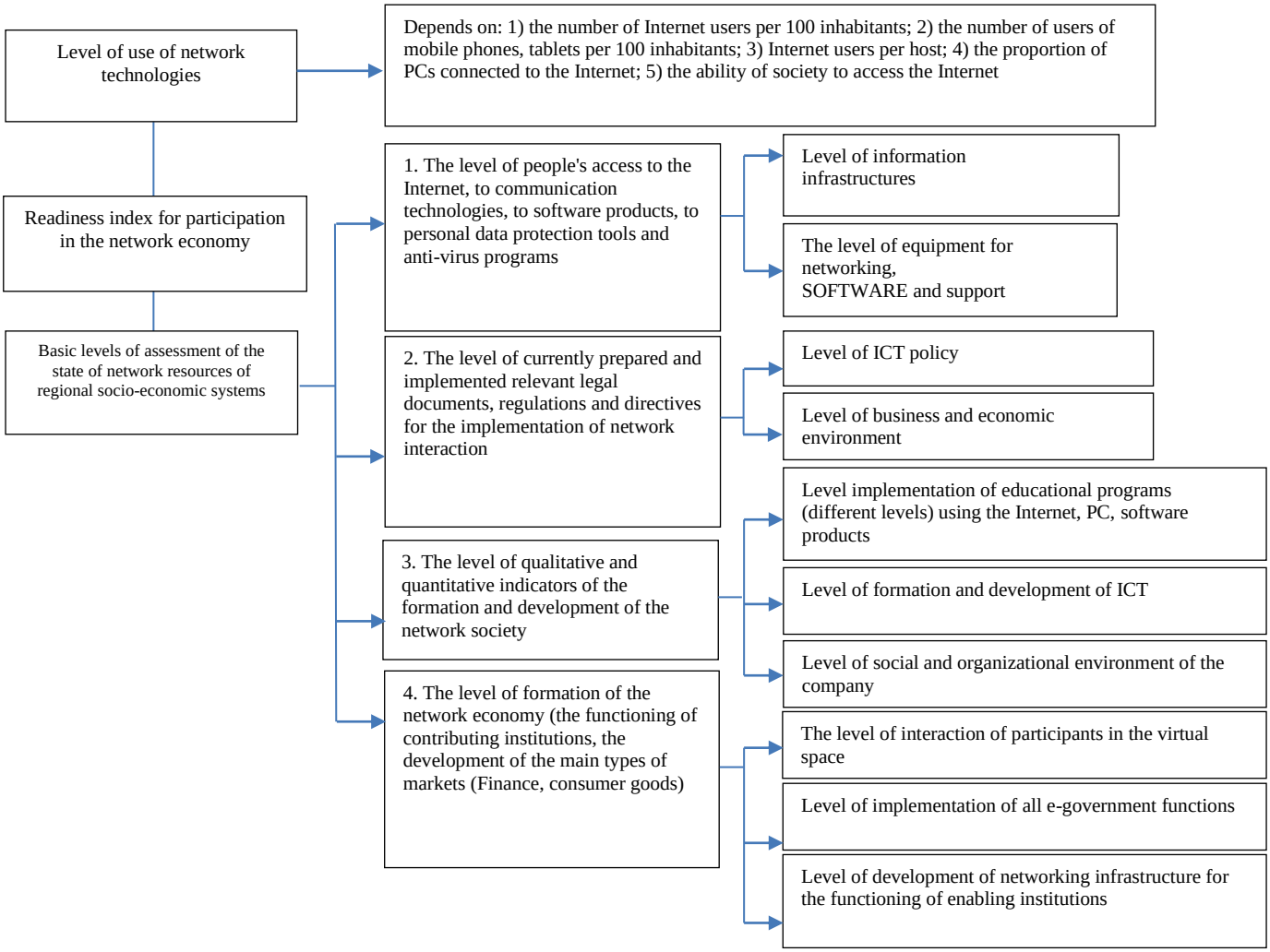

Fig. 1. Levels of the status of network resources assessment of regional socio-economic systems

(developed by the author on the basis of the "Readiness Index for the Network Economy")

When calculating the levels of the state of network resources of regional socio-economic systems assessment , indicators should be normalized (translated from 0 to 1 into the assessment). The performance of sublevels is recommended to be calculated as the arithmetic average of the estimates of indicators characterizing the corresponding subject area:

$$S = {\sum_{i=1}^{n} k_i}/{n} \quad (1)$$

where S is one of the sublevels of the state of network resources of regional socio-economic systems level assessement;

k is the indicator characterizing this sub-index of network resources of regional social and economic systems condition assessment;

n is the number of considered indicators for assessing the status of network resources of regional socio-economic systems.

adapted index for assessing the status of network resources of regional socio-economic systems $=\sum S_i$

On the basis of the General level, component levels, sublevels and estimates of individual indicators of regional development, it is possible to present the rating of districts as an arithmetic average of the rating of the regions included in this district.

IV. Discussing the Results.

In our study, the network resources of socio-economic systems are considered as a tool to increase productivity in the region, and in the state as a whole. The dynamics in the return on network resources is not achieved immediately, there is a risk of projects in the field of network resources of socio-economic systems and there are great difficulties in measuring the economic effect. "As a result, for a long time it was believed that the economic efficiency of network resources, if it can be measured, is only based on detailed data from a single socio-economic system, and then not in every case. The situation changed significantly at the turn of 1990-2000. "[16.17].

Today, network resources are specific organizational, managerial and economic benefits from the use of Internet space, computer technology and software products in the aggregate. However, the indicated tools are difficult to apply without additional knowledge and infrastructural capabilities within the regional regulatory environment in which socio-economic systems operate. Therefore, in Russian conditions, one can talk not so much about reproducing the results obtained in developed countries, but about creating their own tools taking into account the specific features of Russian socio-economic systems and the available input data.

In regional socio-economic systems, when substantiating Internet space projects, the use of computer technologies and software products, unfortunately, approaches based on "advanced business processes", "best practices", and "information technology consumption rates" are mainly used. Such an approach to business means leveling the assessment of returns on investments in network resources.

David Paul A. [24] first showed the applicability of the concept of general-purpose technology to information technology by analogy with technologies for the production, transmission and use of electricity. Subsequently, a number of studies of network resources as a general-purpose technology were carried out, in particular, in the works of Bresnahan T. [25,26], which also confirmed this view of network resources. This entails a number of consequences for assessing the economic efficiency of the network resources of socio-economic systems (Figure 2):

1. The result of network resources must be evaluated with a certain lag; the lag value must be determined empirically.
2. The result of network resources is higher when sharing a number of complementary technologies, such as a personal computer and the Internet.
3. The result of network resources is composed of two main components: positive network effects and co-invention of applied technologies by users and suppliers. Co-invention refers to the introduction of technology into an organization that occurs on the basis of scattered information, generally speaking, different for different organizations. This information includes organizational structure, business processes, personnel qualification requirements, etc. and is created during the implementation of network resources. Firms introducing the technology later than others can imitate the decisions of firms that introduced it earlier, i.e. their co-invention costs are lower.
4. Information technology can be grouped by scale, the larger the scale of application of the new technology, the higher the role of co-invention and the lower the role of network effect. On the contrary, the closer the new technology to personal use, the higher the role of network effects and the lower the role of co-invention.

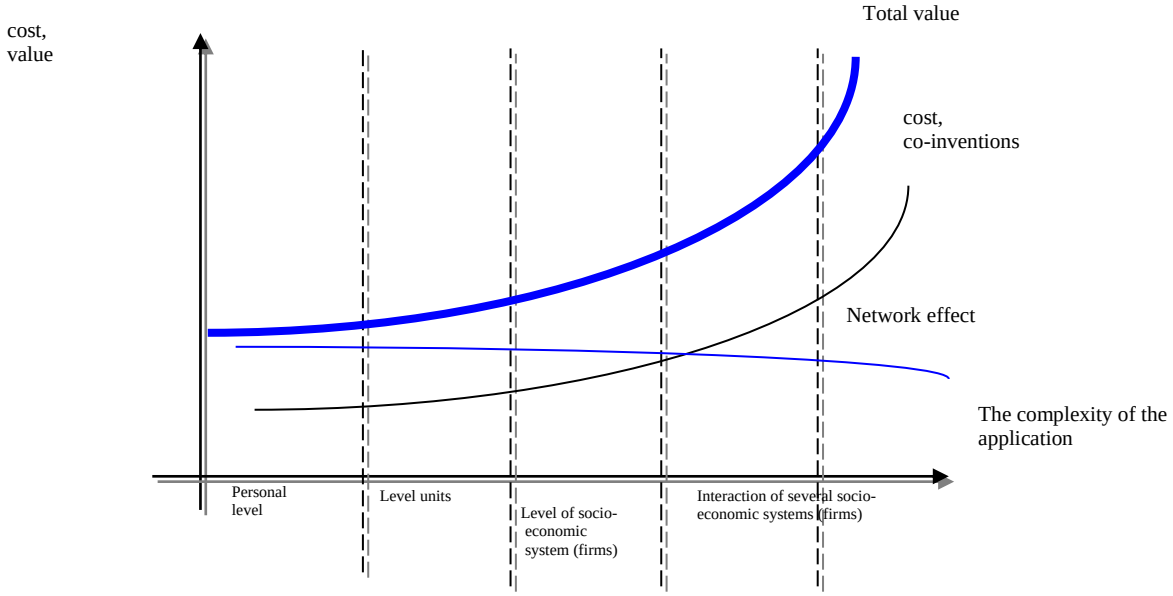

Fig. 2. Dependence of network resources of socio-economic systems value (given the scale of network resources)

The indicated dependences in Fig. 2 illustrates where the economic effect of the use of network resources is displayed, also the figure shows the reasons for which the economic effect was not identified earlier, since the time intervals between investment resources in network resources and the time period in which the first financial results appeared were not taken into account.

V. CONCLUSIONS

Our study proposes a general approach to understanding the foundations of organizational and economic network resources of regional socio-economic systems; the fundamental constituent elements of regional socio-economic systems (economic socio-economic systems of the region (extra-regional and intra-regional) are proposed, network interactions between socio-economic systems, the mechanism of state regulation of regional network interactions, the institutional environment in the region) are proposed; adapted to the subject of the study "Readiness Index for the Network Economy" proposed by the International School of Business (Business Schools for the World, Business School for World, INSEAD), the team of authors of the world economic forum in Davos (World Economic Forum) and the results of the world Bank program "Information for development" (InfoDev); the

economic efficiency of network resources of regional socio-economic systems is presented in the author's understanding of presented in the author's understanding.

The prospects for research in the selected topics open up in the search for a fair combination of an e-business-supporting legal environment and practices that help optimize the development of the virtual economy in accordance with market principles. Improving a country's ICT infrastructure and e-readiness is a complex task, challenging even for countries that have achieved high e-readiness. This task is expected to be achieved in developed countries by further developing and deepening the penetration of broadband technologies,
mobile communication of the fourth generation, strengthening public confidence in e-government.

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