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Logistic methodology of development of the regional digital economy

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Abstract. Currently it is of immediate interest to develop unified approaches and theoretic conceptions of regional development which comply with principles of the digital economy, technologic and sociocultural challenges of the 21 century and are aimed at overcoming the spatial factor as a factor responsible for the inequality of opportunities of economic agents located in a certain limited theory. The theory of innovation networks in the fundamental basis of regional economics supplements the main directions of research as locational direction which considers the most profitable (optimal) location of production, regional direction with the aim of determining the optimal structure and size of production in regions or at the center and also the complex direction of developing the general theory on the basis of which both locational and regional problems could be solved. Digitalization of regions development, based on active use of communicational technologies for exchanging information, requires developing the corresponding methodological support of processes of flow control management. Conceptual and theoretical apparatus of the regional digital economy may be improved based on the scientific approach of logical methodology.

1. The concept of digitalization of a region development in the context of logical methodology

Logical methodology allows to combine different theoretic approaches to developing regions suggesting conceptual framework of balanced managing flows of material, financial and information resources. The modern era of digitalization presupposes that there is pursuance of innovations and increase in the cost of assets of Research, Development and Engineering, intellectual capital and virtual business-processes. According to A. Shatel's opinion, one of the main principles of the digital economy is the aim of companies to combine the complex of human features, such as perceptiveness, imagination, now-how, sensibility and the passion for perfection, so as to increase the client-centeredness of services provided and production made [1]. At that, Shatel uses the term of "the human-intensive digital age" confirming that the aim of digitalization consists not of replacing people with technologies but of creating innovative business-processes which promote intellectualization of assistants for satisfying human needs.

The term of "digital economy", suggested by an American scientist N. Negroponte in 1995 [2], is now known as Internet economy, new economy or web-economy, and is related to economy which is considerably based on digital technologies including digital communication networks. In other words, the term "digital economy" is related to the flow of information and technologies which stimulate

electronic trade and enormous organizational changes [3]. In the work [4] several definitions of the digital economy concept are suggested considered from different points of view, united by the concepts of collecting, storing, processing, transformation and transfer of information, socio-economic and organizational and technical relations based on using digital informational and telecommunication technologies and also sharing knowledge.

E. Yu. Hohlov suggests a definition of the digital economy in the wide and narrow sense supplementing them with a concept "digital sector" [5].

Researches lay emphasis on development of information and communication instruments, program software for sharing documents, videoconferences, wireless mobile devices contributing to exchanging resources with more flexibility independent of their location [6] as one of directions of transforming influence of digital technologies on economic activity.

Active convergence between ICT and economy at an unprecedented rate supposing a significant contribution into further innovations, economic growth and social prosperity, introduces the concept of the "Internet of things". The term "Internet of things" (IoT) is related to combining a growing number of devices and objects with the help of the information-telecommunication Internet network. It is expected that there will be exponential growth of IoT by means of connecting several billions of devices in a relatively short time, including those in private residences and related to such functions as controlling energy, security or entertainment. The Internet of Things is also developing in such fields as transport, healthcare and production and that contributes to timeliness of developing mechanisms of measuring elements of IoT which have the greatest significance for economic development of regions.

Under the conditions of digital economy, the information, collected, systematized and stored without any growth of costs so far as its volumes increase, becomes a new economic resource which supplements the "classic" triad in economic models – "Earth, labor, capital" – as well as the pair, more popular while solving private tasks, – "labor, capital" – which is often modified by means of distinguishing categories of capital, for example, "financial capital", "human capital". The growing significance of flows of information resources, with the help of which managing influence on finances and flows of material resources is implemented, preconditions methods and models of managing the flows of resources which constitute the scientific apparatus of logistic methodology. The theory of logistics embraces the complex of methods of scientific cognition of economic reality which is changing under the influence of digitalization and that enables improving theoretic provisions of development of the regional digital economy.

Two types of regional programs of digital economy development can be distinguished. The first type of regional programs is aimed at supporting global competitive ability of a region by means of providing a high technical level of the most developed sectors which contribute a lot into the economy of the region. Such programs represent supporting digitalization. The second type of regional programs can be considered as developing digitalization. It includes programs focused on increasing efficiency of functioning sectors which are supposed to be developed for supporting the status and authenticity in the global space. Within the limits of the global digital space, regions may act as independent subjects of global processes, and socio-economic structure of the region, under the conditions of the digital economy, becomes both a condition for self-identification and its system peculiarity (added value) which defines the possibilities of successful development in the global world. It is possible to distinguish the following factors of developing the regional digital economy on the basis of considering the discourse of development as the continuum of constant changes which happen both under the influence of objective laws and mechanisms that don't depend on will and intentions, and as a result of a subject's task-oriented actions.

1) digitally proven product & mature services;
2) complete model of intellectual support of products and services-24x7;
3) minimization of consumers' risks by means of transferring the risks to the provider (including by means of attracting an integral logistic provider on a scale of a region);
4) developing intellectual systems of providing results and quality of production processes;

5) capital investments in the region from the side of the supplier (development of regional logistical technologies in distributing production and services).

Digitalization of regional development reveals new aspects of established paradigms of a "region as a quasi-state" for researching homogeneous regions (macro logistical systems) and the paradigm of a "region as a quasi-corporation" or a "region as a marketplace" defining a region as microeconomic objects (micro logistical systems) and, to a greater extent, it can be applied to researching heterogeneous regions.

2. The main directions of investigating a region's development

In the works of founders of regional economics, a region was considered only as concentration of natural resources and population, production and consumption of goods, services. The problems of region development have been attracting the attention of researchers for a long time and the concept of "region" has experienced a significant metamorphosis. O. M. Barbakov [7] characterizes a region as an "integral, space-oriented form of life activities of the society as a system, a complicated and complex phenomenon". He specifies that this form has its own content which consists in cooperation of subjects in the process of reprocessing life conditions; tangible factors which act as a basis of reproduction; quantitative and qualitative indicators which characterize the result – the level of socio-economic development. Besides, a region possesses functional intersystem relations resulting from ownership relations, from relations of distributing jurisdictions and powers.

Such properties as relative isolation, integrity, complexity, structuredness, dependence upon a unified goal, connections with the external environment define a region as a complicated, socio-economic system for the efficient functioning of which it is necessary to organize information flows in the management system as appropriate which have been studied by professor I. V. Ilyin from the point of view of IT development problematic [8]. A region as a system is related to the class of controlled systems. Creating equal socio-economic possibilities for the subjects having a similar status for access to economic goods presents the main task of state management; to explore it under the conditions of digitalization it is necessary to form corresponding competencies [9]. The priority of discovering the dependence of the spatial factor on profit and expenses of economic entities belongs to the German economist, theorist in the theory of agricultural economics, I. G. Tunen, who, in 1846, published the first part of his book, "Isolated State", where he concluded that the location of land plots (*the distance from the market*) influences their profitability and specialization [10].

Within the framework of the paradigm of a region as a quasi-state, the system of the national economy acts as relatively detached and leaning towards ever-greater accumulation of functions which belong to the center. Functioning of regional economies within the limits of the national economy is provided by means of cooperation of the center and regions, and also various forms of interregional economic relations.

Regions-quasi-corporations competitively struggle on the markets of goods, services and the capital, contest for a higher rating of investment attractiveness. The approach of a region as a market presupposes that there are certain boundaries of the market and it concentrates attention on enterprise climate which determines conditions of economic activity in the region and the peculiarities of regional markets. A region as a society is treated as a community of people who live on a certain territory. Reproduction of social life and conditions providing with it, and also development of the system of displacement of population are brought to the forefront in this case. This paradigm includes not only economic but also social, political, cultural and other aspects of life of the regional social medium.

In our opinion, theoretic provisions developed for the level between mega economy (global economy) and macro economy (economy of a separate state) can be adapted to a region as an intermediate link between the nationwide and local levels. In the context of this study, the concept of a region is examined within the limits of the national economy.

Considering the concept of a region as an intermediate link in the system of managing national economy it is reasonable to distinguish flows of resources in the socio-economic system on a regional and national scale and, first of all, informational resources by means of which financial and material

flows are being controlled. There are systems of different scales in the theory of logistics: micro logistic (an enterprise level), meso logistic (a group of companies, the region level) and macro logistic (branch approach). Thus, managing the regional economy can be implemented in the context of managing meso logistic and macro logistic flows of resources.

Scientists of later periods have made contributions into the development of the location theory. The German scientist, A. Veber, who addressed the issues of locating industry, tried to develop a general theory of optimal locating enterprises; in order to do that, he determined and analyzed factors which influence locating a separate industrial enterprise. The aim to minimize transport expenses was considered by A. Veber as the main factor [11].

J. Maletsky includes the actions, which attract investors, competitive on the internal and interregional/international markets, which work in the sectors of economy or services supporting technological modernization, into the recommendations for the local authorities [12]. It is also highlighted that supporting the export activity of regional producers is of primary importance. Other researchers think that it is necessary to diversify the exogenous base and develop new sectors of economy on the basis of organizing staff and tourist flows, considered in [13].

The new theory of trade is based on the role of export activity in the regional development and explains the mechanisms of getting profit from trade between regions at different stages of development. Some researchers underline that the potential trade exchange between regions is more profitable for those consuming the capital. That is why local authorities in poorer regions should support not only export and free trade but also infrastructural and institutional investments (especially, financial institutions) and specialized education [14].

According to the theory of the core product, which explains long-term factors of economic growth and is related to the conception of the economic base, regional development is achieved by means of gradual specialization of separate products, competitive on the markets outside the region. The tasks which are stipulated for all administrative bodies by this theory include: intensification of the specialization tendency, investments into infrastructure (telecommunications, transport), supporting financial and consulting institutions and delivery of services for business and education [15].

Local or regional development can be "balanced" and stable what very often means the low level of unemployment and migration. Besides, diversification of the local economic sector may happen. Widening of the main sectors may create economic boom [16].

One of the well-known economic theories is the theory of growth poles of F. Perroux suggested in 1950es [17]. A growth pole and its relations with the environment create a spatial system which is called a polarized system [18]. Approximately at the same time, polarized regional development was explored by A. Hirshman, who proved that regional development is not regular and is concentrated in the so called geographic centers from which the diffusion wave of development impulses is gradually extended into the environment [19].

The approach suggested by J. Fridman presupposes that the flow of technical and cultural innovations controlled by the center is the main factor contributing to disproportions in the development [20]. The main regions are defined as economical centers with the greatest potential of changes and they are located in the places of strong influence, and development is considered as an innovative process (production and services which are provided by the most commercially viable enterprises located in large centers which dominate the periphery).

Provisions of the conception of regional innovation networks are related to certain professional spheres. The most popular of them are those which are based on the experience of organizing an innovative network in Silicon Valley in California and in Italian industrial regions called "the Third Italy". The Italian experience and results of the research group, Groupe de Recherche Européen Surles Milieux Innovateurs (GREMI), reflect the dynamic model of innovation environment highlighting the role of local media as a generator of innovative behavior. Separate regions and enterprises should be open for radical changes; they should be ready for a new process of "creative forgetting" of noncompetitive products and technologies, participate in the cumulative process of creative "education". Modernization of the basic stock is not enough for stimulating development; innovations are necessary

which are aimed at getting new production skills [21]. The organized local medium which is constructed with the use of the logistic theory approaches contributes to forming an efficient form of economic adaptation to global changes.

3. The conception of regional innovative networks in the practice of regional digital transformation

In modern theories a region is studied as a multifunctional and multi-aspect system. A region appears not only and not so much as a territorial or historical unit but as a subject aiming at the role, functionally alternative to the state, which can take upon some state functions and act as a semi-independent unit in the economy. Forming and differentiating regions is a long-term process, it indicates the significant necessity of constant watching and registering the socio-economic reality on the regional level as a basis for forecasting the future development of the structure which includes the region as a constituent.

Considering the "Internet of things" (IoT) as a combination of a growing number of devices and objects with the help of the information-telecommunication Internet network, OECD determines IoT generally as "including all the devices and objects the condition of which can be changed through the Internet with the active participation of certain persons or without them, including notebooks, routers, servers, tablets, smart phones which are often considered as a part of the "traditional Internet". However, these devices are an integral part of work, reading and analysis of IoT-devices and very often they constitute the "heart and brain" of the system. In addition to IoT the Machine to Machine (M2M) connection as an IoT sub-aggregate is characterized by autonomous transfer of data with small interaction with a human or without it at all (OECD, 2015 [22]). Actually, OECD determines M2M as "Devices which actively communicate while using wired and wireless networks that are not computers in the traditional sense and in this or that form they use the Internet. M2M connection represents only one element of smart meters and, thanks to the logic of cloud servers and remote cooperation, the mentioned devices become "smart". RFID can be another element of a smarter environment which may be used in combination with communication and cloud services M2M" (OECD, 2012 [23]).

New flows of data for providing connection between transport means (vehicle-to- vehicle, V2V) and connection between a vehicle and any element of the environment (vehicle-to-everything, V2X) are being created. Various IT-decisions appear which require coordination of several stakeholders (interested parties) by means of using common platforms. On the IoT platform for autonomous cars the task consists in integrating many heterogeneous technologies contributing to orientation of an automobile [24]. For example, IBM is developing a new IoT platform for autonomous transport means which use cognitive calculations [25] and, on the basis of the IBM-technology for this cognitive system, determine when a person of the self-service system should control the vehicle in order to prevent collision [26]. Cooperation between various stakeholders on creating IoT platforms for automated vehicles allows to develop innovation networks in the process of digitalization of regional economy, which also includes actions in the aspect of introducing the technological platform of highly-automated driving [27].

One may emphasize the following indicators of IoT from the point of view of regional economy:
1) Smart cities:
– the quantity or percentage of transport means of common use;
– the number/percentage of the installed intellectual traffic lights;
– the quantity/percentage of cities controlled by means of data from surveillance cameras;
2) Health indicators:
– patients with chronic diseases who use IoT applications;
– economizing with IoT applications, in health units,
– IoT applications for health, developed on a region scale.
3) Indicators of digitalization of rural areas:
– the percentage of rural regions using IoT applications for monitoring the climate,
– the quantity of rural equipment or instruments (e. g. tractors) which are connected,
– control of diseases and sanitation in animal breeding;

– innovations of countries in the agricultural sector.
4) Branch indicators.

4. Conclusions

On the basis of the study it is possible to make a conclusion: one of potential narrow places (according to the terminology of the logistic theory – "chokepoints") for IoT will be represented by complexity of the environment stipulated by the objective reality, and for completely automated transport means these difficulties are connected with network connection.

One can demonstrate that digitalization of regional development is accompanied by exponential growth of the volume of data created by logistic technologies, for example, by automatic means of transportation and storage of goods, by transport means for carriage of passengers, which, as a result, may lead to problems in functioning of platforms which connect and manage data flows. The consequences of the exponential increase of data quantity depend on the condition of the following communications infrastructure elements:
– 5G;
– feedback;
– centers of processing data;
– cloud services.

Balanced development of regional digitalization in the context of IoT requires fulfilling the following conditions: 1) the possibility of connecting several digital devices; 2) low consumption of energy; 3) low cost of implementing logistic technologies; 4) reliable connection. Organization of network cooperation on the basis of logistic methodology contributes to optimal development of elements of the Internet of Things ecosystem.

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