

# *Digitalization of housing and communal services in the context of new industrialization*

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**Abstract** — The modern spectrum of digital technologies in various socio-economic systems exceeds all expectations of both producers and consumers of economic benefits. This encourages many researchers to search for new and more efficient ways of using digital technologies in the economy. Despite this, they don't pay enough attention in a researches to consistency and homogeneity in the pace of development, accessibility for specific consumers of primary digital technologies that contribute to the formation of the necessary infrastructure, creating conditions for improving the quality of public goods in the municipality and the region. The paper presents an attempt to formulate elements of the concept of regulating the digitalization process, taking into account the influence of stimulating and limiting factors aimed to increasing the productivity of digital technologies application in the field of housing and communal services of the local territory.

**Keywords** — *digitalization, housing and communal services, factors, limiters, models, trends.*

## I. INTRODUCTION

The creation and expansion of digital technology in the economy and society as a whole is aimed at shaping and improving the level and quality of the population life. A special place in ensuring the quality of life is occupied by the sphere of housing and communal services (HCS), which serves as a driver in the formation of a modern comfortable human environment.

Despite the fact that the phenomenon of digitalization of the economy appeared in the mid-1990s it came relatively recently at the HCS sector. This is due to the fact that the process itself, having certain advantages and disadvantages, dictated by its nature, makes significant transformational requirements-conditions for the functioning of economic sectors that implement the development path based on the information technology platform. These one should be included to the number of such requirements-conditions, based on international and national practice : technological, infrastructural, professional, organizational, economic, consumer and other. It became possible to satisfy most of these requirements in ordinary municipalities only in 2010. The main reasons were the impossibility of quick and deep implementation of the digital technologies themselves into the territorial space of the municipalities and because of the absence or insignificant number of the appropriate professional staff capable of servicing such technologies. As a result, the regions and separately taken municipal formations formed various starting opportunities for the introduction and use of technological capabilities of digitalization. Thus It is creating prerequisites at digitalization incorporating as an element of the management

system in socially significant areas of regional (municipal) development, differing significantly by scale, depth and intensity .

## II. METHODOLOGY

The methodological basis of the study was: the results of modern studies of the phenomenon of digitalization, presented in national and foreign works, systemic and process approaches to the strategizing of socio-economic systems.

In modern literature, the phenomenon of digitalization is being actively studied. However, there still has not been a single view of its entity. Analysis of the definitions of the term presented in national and foreign studies allows us to conclude that the following approaches are the most common in understanding the entity of "digitalization":

- The process of socio-economic transformation, initiated by the mass introduction and mastering of digital technologies (creation, processing, exchange and transmission of information) [1];
- the conversion of information into digital form [2];
- the modern stage of informatization development, characterized by the predominant use of digital technologies for generating, processing, transmitting, storing and visualizing information, which is caused by the emergence and spread of new hardware and software solutions [3].

## III. RESULTS AND DISCUSSIONS

The existing approaches in the modern scientific community in representing the phenomenon of "digitalization" at the same time as a process in a certain system of relations and as an activity of certain categories of economic agents allow the structuring of digitalization. According to some researchers, the prerequisites of sectoral digitalization are a significant amount of information as the main industry resource, as well as the need for innovative solutions, which can be formed in the context of digital transformation and contribute to the optimization of business processes in the industry [4]. In this regard, it is advisable to use the procedure of structuring digitalization, presenting the phenomenon being studied as an independent phenomenon in the economy, regarding its individual areas, including those located in specific territories, with specific features in order to identify the most optimal development trends in the context of modern industrial directions.

As priority strategies for logical linking in the context of modern world [5] and regional [6] trends of the digital technologies development and use should be defined:

functionally targeted, implemented by key parameters in relation to a specific spatial unit, and subject, taking into account the nature of the field of the economy in which it is intended to implement the process. Synthesis of approaches in structuring the digitalization process will provide opportunities for diagnosing the role of participants, the importance of individual elements of digitalization and future current trends in the transformation of the existing relationship system.

The proposed methodological approach in diagnosing trends of digitalization of a certain sector of the economy of a local territory in general form is a sequence consisting of: identifying factors that stimulate and limit the possibilities for the intensive development of digital technologies in the sphere of economy of interest; configuring the concept of functional segments of the backbone connections-streams of digital data; justification of the choice of the digital economy business model; the formation of concepts of current trends of digitalization of a certain sector of the economy. The implementation of consistency to achieve maximum effect should be carried out on the basis of the principles of controllability and coordination on the part of the authorities, the unity of information resources and space, and regulatory and legal support. Their observance will allow to provide qualitative and quantitative effectiveness of the approach.

Today issues of its digitalization are more relevant than ever for the HCS. This is connected with the increasing intensity of the introduction of modern technologies in the context of the industrialization of the sphere and the increasing level of claims from service consumers to the quality of the service and its level. In addition, this process is greatly influenced by the coordination strategy of all levels government. It is increasingly being activated in scale and depth in the context of the transformation and development of modern approaches to the strategizing of socio-economic development, as well as the introduction of incident management technologies. The last point reflects the need for a digitalization process not only across the country, but also in the regions. In this sense, the purpose of activation should be the formation of a monitoring and, from a part of the controlled feedback process in the socio-economic systems of the regional and municipal level between the population and the government. The functionality and performance of monitoring and controlling the feedback process can serve as the basis for building more optimal project and program activities of the authorities in the field of strategizing the development of the HCS.

However, the positive impact of the presented factors of the intensification of digitalization of the HCS sector today is faced with a number of organizational and economic constraints in the implementation of the process on the ground. First, there is an increase in the costs of the organizational and administrative element, associated, on the one hand, with the need to create additional jobs for professionals who will perform the functions of monitoring and controlling the achievement of target indicators of digitalization, and later maintaining them. On the other hand, the increase in costs is caused by the need to implement global infrastructure transformations aimed at introducing so-called "smart technologies" (for example, devices for intelligent, objective accounting of the consumption of communal resources). According to experts of the Ministry of Energy, only the installation of smart electricity metering

devices throughout Russia will cost more than 400 billion rubles. With all the obviousness of obtaining a positive effect from the introduction of these technologies in the long term at the first stages of technology introduction, the significance of the cost of their practical implementation for all participants (population, state) is such that in the near future there will be no tangible effect from digitalization in this area washed away in view of the insignificance of their implementation level. At the same time, it should be noted that for the real sector of the economy there is a slightly different situation involving digitalization (in particular, with the introduction of similar equipment) - there is a tangible gradual reduction in the cost of collecting, storing, processing data; cuts in production chains [7] and so on.

Secondly, the presence of organizational and technical gaps in ensuring the efficiency of the technical side of the process, caused by the level of development and introduction of digital technologies infrastructure tools in the regions. According to experts, the level of equipment with mechanical meters for water consumption in Russia does not exceed 70%, and thermal energy - 8%. Only 0.2 million digital and "smart" meters have been installed in the country, with a general indicator of the availability of conventional electricity meters at 99%. At the same time, an individual indicator by regions may differ 1.5-2.5 times. Against this background, the total potential of the market for smart metering devices in Russia in the segment of private utility consumption and water consumption is more than 206 million smart meters (according to a study by iKS-Consulting) [8].

Thirdly, significant differences in the degree of integration of already existing and only implemented technologies act in a number of regions not as a positive parameter, but as a serious barrier in development. Thus, according to the expert assessment of the development of smart technology "Smart City" by the 10 leading cities in the implementation of this technology, a relatively optimistic picture emerged. The city, which took the 1st place in the smart technology format, is able to provide more than 20 services to citizens on the basis of digital technologies [9].

Fourth, monitoring indicators in digital systems already used in the HCS sector in most municipalities are not consistent and for the most part are not reflected in public accounting systems, thereby affecting the strategic parameters of development. However, such indicators are actively used in operational current reporting at almost all levels of government, both in order to demonstrate the degree of control from the position of the authorities, and to justify decisions taken. In this sense, this experience has some positive properties. At the same time, a significant disadvantage of this practice is the instability, variability and having significant number cases with principle of continuous monitoring violation for such indicators. This disadvantage has developed due to the fact that the overwhelming majority of the process of digitalization in the regions and municipalities is not sufficiently regulated. Therefore, decisions made on the basis of such data do not have a sufficiently substantiated, relevant information component.

Therefore, it's not a sufficiently substantiated, relevant information component. Thus, for the HCS sector, it should be noted that the greatest disagreements arise between the powers enshrined in industry documents regulating the activities of state

and municipal authorities in the housing and utilities sphere with the requirements of modern regulatory and legal acts aimed at regulating the digital transformation of the city's economy, In particular, this refers to the centralization within the city the possibilities of using smart technologies "Smart City" and "Smart Home" and others.

Sixthly, there are significant professional and competence limitations. In addition to the known limitations of a professional nature inherent in the whole for the industrial, financial and information sectors of the economy [11], for the HCS sector, these shortcomings are aggravated by the specifics of the adopted professional standards [12] and the distribution of competences for the development of IT technologies and their introduction into the daily turnover of providing quality services to the public.

Seventhly, there is no consistent and sufficiently substantiated scientifically and organizationally-economic mechanism for introducing digital technologies into the functioning of socially significant areas of regions and municipalities, each of which, due to its variety, forms specific conditions for the use of such a mechanism, depending both on the nature of the socially significant areas of the region (municipalities) and on the level of socio-economic development of the territories and the level of importance of the need for its services for residents of the territory.

At present, this mechanism is more dependent on the interests of the business. In addition, there are special cases of modeling a specific configuration of the process and the digitalization of the services sector primarily in the interests of business structures. On the one hand, this aspect serves as a criterion for the development of digital technologies in the services sector of the territory. Since it is a developing business with interests in the region and municipalities, is one of the key investors and active "engines" of the whole process of digitalization. The experience of Good-Line company, operating in the Kuzbass telecommunication services market, should be noted as a positive practice. It provides a complete set of equipment for on-line monitoring of the adjoining space and the space inside the house belonging to the category of common property of the owners of an apartment building. Consumers, in turn, pay only for the monitoring service.

On the other hand, the authorities, as a participant in the process of digitalization of the economy, are interested in obtaining certain effects while respecting the principles of the organization and functioning of digital technologies in the territory under their jurisdiction. These principles are due not only to current and strategic economic goals (growth of business activity of economic entities, the formation of a favorable

investment climate, etc.), but also social and organizational ones, which are mainly of promising nature: providing with the benefits of digitalization of the local population, providing opportunities for the formation and implementation on the basis of operational, targeted and objective indicators of management decisions to substantiate the directions of socio-economic development in a particular area and the territory as a whole In this regard, among these principles should include: socio-economic and technical-organizational feasibility of making management decisions, timeliness and embeddability of digitalization processes in the current and strategic elements of the management system; adaptability; predictability of processes and states of the economic sphere and others.

The view from this perspective of the process of digitalization of the economy of the studied socially significant sphere today does not meet the parameters of the main business models of the digital economy: infrastructure, platform [13] and cyber physical [14]. The first model represents digitalization as an infrastructure service when a consumer uses the computing resources of a supplier. This model is in the process of becoming and is being implemented at the federal level, which predetermines the state as the main holder of the functionality of such a model. The most striking examples of the implementation of this model are GIS-Housing and Public Utilities (Federal Law dated July 21, 2014 No. 209-ФЗ "On the State Information System for the Housing and Utilities Sector"), Reform-Housing and Communal Services implemented in the network format [15]. The second model is focused on providing opportunities and tools for economic agents to use the original service of coordinating the processes and activities of market participants of the goods, work and services of interest. The implementation of this model suggests the development of a highly integrated IT infrastructure and IT competence of all participants without exception. However, for the sphere of socially significant services, including the housing and utility services sector, these requirements are practically impossible to fulfill for most territories, due to limited resources, availability of technology, geography and the lack of a desire for relationship transformation among key business entities. The third model assumes the formation and functioning of a multifunctional complex of computing resources and physical processes as a whole.

The process field of digitization of the housing and utility services sector based on the selected main components of the housing and utilities sector and digitalization to justify the direction of adaptation of the process to modern local realities should be presented as a system of elements (Figure 1).

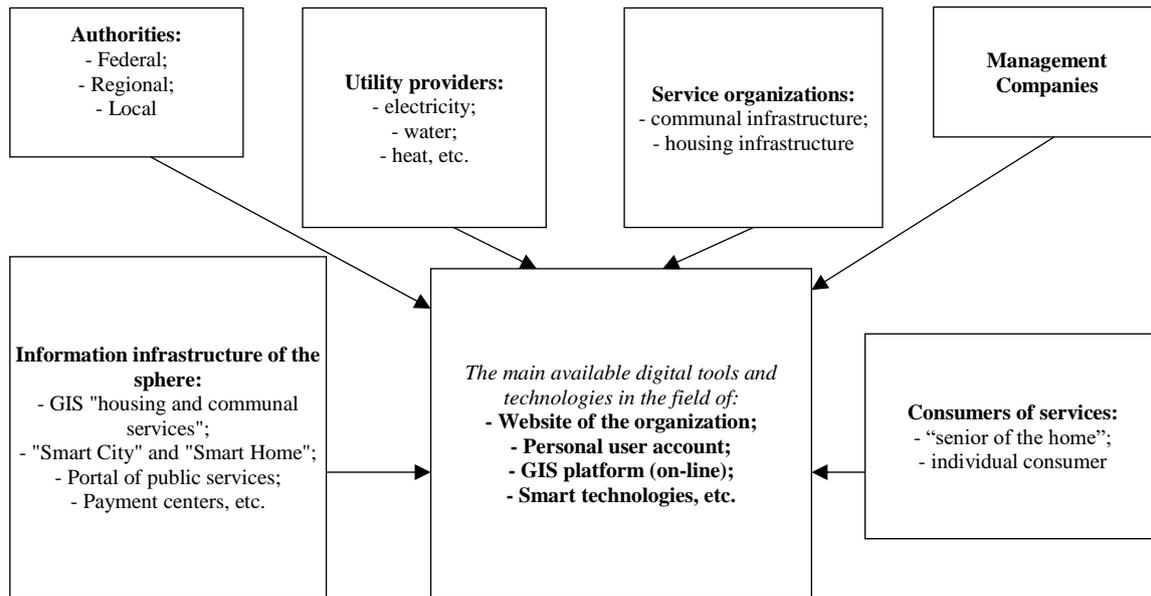


Fig. 1 Subject-object blocks of the “digitalization field” in the HCS sector

Despite the implementation of legal regulations, as well as technological advances in the provision of utility services in the field, their accessibility is significantly different, and, consequently, their relevance. According to the studies conducted in the municipalities of the Kemerovo Region, the level of accessibility for the individual consumer of utility services for digital tools and technologies ranges from 32% to 78% downstream from urbanization centers (years). Kemerovo and Novokuznetsk) to the periphery (small towns and rural settlements). Such indicators of the availability of technology have developed under the influence of the previously mentioned factors and the solvency factor of the population.

The presented structure of the elements and the digital technologies used in it already today predetermine the need to make corrections of the system-situational nature in the formation of the mechanism for introducing digital technologies in the process of functioning of socially significant spheres of regions and municipalities (in the case of the presence of its individual elements in some territories). In this regard, the sphere of utility services should be divided into subsystems relative to the provision of digital technologies and tools.

The subsystem of the first level involves the introduction of digital technologies of the current (short-term) horizon of

development, aimed at the formation of information and digital flows from consumers of services addressed to service providers and regulatory authorities. In particular, we are talking about the formation (transformation) of information-digital communication channels regarding the complaints and wishes of service consumers.

The second level subsystem is focused on introducing technologies of a strategic (long-term) development horizon aimed at incorporating individual digital technologies in certain segments of the housing and utilities sector into a single information-digital space within a specific territory.

The main goal of structuring the services sector in relation to the horizons of introducing of digital technologies is the achievement of the key adaptation characteristics of the general management system of the socially significant sector of the economy and increase of the effectiveness of the implemented mechanism. It is recommended as key criteria for structuring the researching service sector the following ones: technical capabilities, including accessibility, level of costs and the level of their coverage with budgetary and extra-budgetary investment resources. In accordance with these settings, it is possible to identify the basic parameters of potential trends in digitization of the housing and utilities sector (Table 1).

TABLE I. POTENTIAL TRENDS IN DIGITIZATION OF HOUSING AND UTILITY SERVICES IN THE REGIONS AND MUNICIPALITIES

Digitalization direction	The goal of managing the digitalization process from a position		Result for the sphere as a whole	Active target segment of the sphere	Business model
	authorities	business entities			
Providing high-quality information exchange of individual parameters on the state of the sphere	Increase the level of decisions' proving	Formation of primary digital infrastructure	Increasing the degree of controllability of service delivery processes	Sphere infrastructure	Infrastructure

Digitized databases forming for the sphere state indication	Expansion of possibilities and accuracy of forecasting and strategy development of the sphere	Formation of digital technologies operating in individual segments of the sphere	Increase the level of substantiation of strategic areas of development	Authorities, manufacturers, service and management companies,	Platform
Ensuring capable digital platforms in the field	Receiving opportunities for timely control and coordination of the functioning and development of the sphere	Development of multifunctional digital platforms providing services	Improving the quality of services provided and their competitiveness in the market	Consumer directly receiving the service	Cyber-physical

Following the logic of the potential trends presented, the central pivot of digital processes is the formation of strategic concepts for managing data in a socially significant sector of the economy in relation to a specific territory. Therefore, initially, a methodological and technical elaboration of interactions based on information-digital technologies, a service provider - a consumer [16], is necessary as a guarantee of the “demand-

supply” dialogue that is continuously adapted to the needs and level of socio-economic development of a certain area. The next step should be the development of an organizational-methodological concept aimed at creating a single information-digital management resource for providing quality services and competitive services within the territory. In general, it is presented in Figure 2.

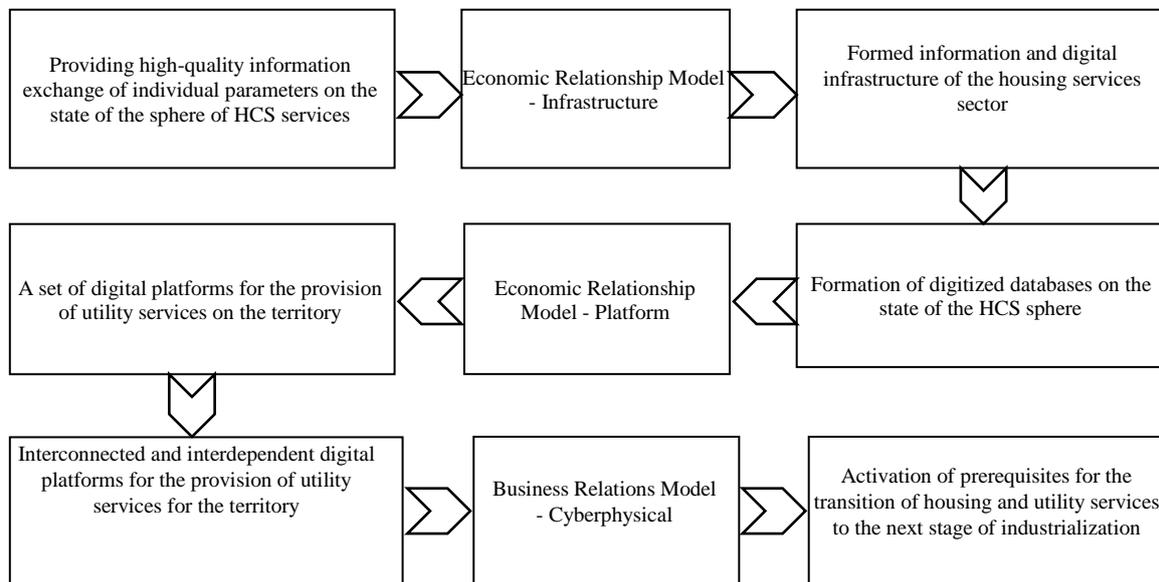


Fig. 2. Schematic diagram of the concept of introducing models of doing business in the field of utilities in the context of digital transformation

Thus, the built-in functional-target sequence of mastering models for building economic relations in the housing and utility sector in a certain area in the logic of digitalization will allow to form real prerequisites for the development of the sphere in the context of modern challenges of the global economy transformation.

IV. CONCLUSION

The analysis of modern factors and trends in the development of the housing and utility services sector allows us to conclude that the tools and technologies used today in digitalization of this sphere are fragmentary and belong to the two simplest models of economic relations of business

subjects in the context of globalization of information-digital processes. The lack of proper regulation of the use of individual elements of the models does not allow speeding up the process itself, reducing the costs of its implementation and ensuring the system performance of its direct use, which is characteristic of most sectors of the economy. The author's vision of structuring the process of digitalization presented in the paper is one of the possible approaches to its system-functional regulation aimed at improving the socio-economic effectiveness of the application of digital technologies in the HCS sector in a certain area

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