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EXPENDITURE ON THE DIGITAL ECONOMY: WHAT IS IT AND HOW TO MEASURE IT?

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EXPENDITURE ON THE DIGITAL ECONOMY: WHAT IS IT AND HOW TO MEASURE IT?[6]

This paper describes an approach to measuring the gross domestic expenditures on the development of the digital economy. International attempts to define the digital economy and research expenditures on it are considered. As part of the methodology's development, key definitions were presented: digital economy, digital technologies, and digital economy costs. Based on international experience, as well as on the specifics of Russian statistics, a methodology of measurement for the expenditures on the digital economy was proposed. The structure of the obtained indicator is multidimensional, which makes it possible to evaluate both the indicator as a whole and its sections. The proposed methodology involved making modifications to existing questionnaires and the first estimates based on them were made in 2020.
The results of the study made it possible to estimate the domestic expenditures on the development the digital economy in comparison with the set goals approved by the national program «Digital Economy of the Russian Federation». In addition, the multidimensionality of the indicator revealed those areas of the digital economy that represented the «growth points» of the digital economy as a whole.
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Introduction

Digital technologies are rapidly developing and permeating all spheres of society. Both social and economic processes are changing. Thus, a person's life is placed in a smartphone, where everyone can communicate with friends, get new information, buy and sell goods, and even interact with governmental agencies. The modern world also implies the transfer of a significant part of labor activity and its conduct to the digital space: more and more business tasks are solved using digital technologies.

Digital technologies also have an impact upon the enterprises of all types of economic activity. Many tasks are transferred to the digital environment, allowing one to increase productivity and simplify participation in global economic networks [*Miller, Atkinson*, 2014]. Digitalization contributes to the development of the functioning of state bodies, increasing the efficiency of public policy processes. Thus, the active introduction of digital technologies in various spheres of society implies an increase in their consumption, which entails the growth of these expenditures.

The importance of expenditures on the digital economy is also taken into account at the state level. For instance, in 2018, one of the points of the presidential decrees was the development of the digital economy. The national program «Digital Economy of the Russian Federation» [RF Government, 2018] was developed to systematize and streamline the achievement of this goal. Increasing expenditures on the digital economy is one of the main policy priorities in which the state invests. The national program structures the process of the digitalization of society, setting consistent goals. The achievement of these goals is tracked primarily on the basis of quantitative indicators. Therefore, timely statistical information is required to monitor the implementation of the program, as well as to adjust it and develop further steps. One of the key indicators of the realization of the state policy in the field of digital economy is the expenditures on its development.

From the above, it follows that statistical data on the expenditures on economic development seem to be in high demand in Russia. However, the digital economy poses new challenges for Russian statistics. Thus, on the one hand, due to the relative novelty of the field, unified and internationally recognized standards and approaches to measuring the digital economy and the expenditures on its development have not yet developed. On the other hand, the digital sphere is developing rapidly. Therefore, the subject of studying statistics undergoes constant changes, which makes it necessary to constantly update the methodology [*Abdrakhmanova G., Gokhberg L., Sokolov A.*, 2019]. It highlights the relevance of developing a methodology for measuring the expenditures on the digital economy: innovative solutions may be of interest to researchers and experts in the field of statistics.

1. Approaches to Determining Expenditure on the Digital Economy: Literature Review, Existing Practices, and Standards

In order to measure expenditure on the digital economy, its clear definition should be formulates. However, there are still ongoing debates at the international organizations about the substance of the digital economy and what it includes.

Earlier there were several attempts to identify the digital economy on a national and international scale. Most of them (Table 1) focus on the technologies and interactions of the economic agents which are associated with the use of these technologies and also mention either particular types of technologies or different variations of economic processes. Moreover, the definition of the digital economy is often replaced by a list of the directions by which it can influence economic and social spheres. Finally, we should also mention that national sources, unlike international ones, focus on the global substance of the economy that could not be limited by the state and which is a part of the international net.

Table 1

International Approaches to Defining the Digital Economy

Organization	Definition
OECD	«The digital economy is characterised by an unparalleled reliance on intangibles, the massive use of data (notably personal data), the widespread adoption of multi-sided business models capturing value from externalities generated by free products, and the difficulty of determining the jurisdiction in which value creation occurs» [OECD, 2015].
	«The Digital Economy incorporates all economic activity reliant on, or significantly enhanced by the use of digital inputs, including digital technologies, digital infrastructure, digital services and data. It refers to all producers and consumers, including government, that are utilising these digital inputs in their economic activities» [OECD, 2020]
World Bank	A new mode of economy based on knowledge and digital technologies, which creates new digital skills and opportunities for society, business and the state [World Bank, 2016].
IMF	«The "digital economy" is sometimes defined narrowly as online platforms, and activities that owe their existence to such platforms, yet, in a broad sense, all activities that use digitized data are part of the digital economy: in modern economies, the entire economy» [International Monetary Fund, 2018]
UNCTAD	«The digital economy – the application of internet-based digital technologies to the production and trade of goods and services.» [United Nations Conference of Trade and Development, 2017]
European Parliament	«A complex structure of several levels/layers connected with each other by an almost endless and always growing number of nodes. Platforms are stacked on each other allowing for multiple routes to reach end-users and making it difficult to exclude certain players, i.e. competitors» [European Parliament, 2015].
European Commission	«An economy based on digital technologies (sometimes called the internet economy)» [European Commission, 2014].

G20 DETF	«The digital economy refers to a broad range of economic activities that include using digitized information and knowledge as the key factor of production, modern information networks as an important activity space, and the effective use of information and communication technology (ICT) as an important driver of productivity growth and economic structural optimization» [G20 DETF, 2016].
Australian Government	«The global network of economic and social activities that are enabled by digital technology, such as the internet and mobile networks» [DBCDE, 2013].
British Computer Society	«The digital economy refers to an economy based on digital technologies, although we increasingly perceive this as conducting business through markets based on the internet and the World Wide Web» [British Computer Society, 2013].

Digital technologies form the backbone of the digital economy. That is why they are the basis for defining the digital economy, which is consistent with global standards. In order to form a definition for Russia, we do not limit digital technologies to certain types. If digital technologies are reduced to only a narrow selection of them, the definition will be devoid of universalism, because all new technologies appear along with the digitalization process.

However, despite the existing uncertainty in definitions and conceptual scope, international organizations have made attempts to statistically measure the expenditures on digital technologies (Table 2). It should be noted that the studies proposed below were guided by a specific issue. For this reason, almost none of the methodologies focuses on the aggregate expenditures of the digital economy, but rather on the expenditures of enterprises. Nevertheless, as part of the study of the digital economy in Russia, it was decided not to be limited to its specific agent, but to consider it in its entirety.

Table 2

Approaches of International Organizations to Measuring Expenditure on Digital Technologies

Approaches	**Advantages**	**Disadvantages**
According to the proposed methodology, costs constitute the volume of demand provided for ICT goods and services. There are four elements in demand: – international trade in ICT goods and services; – household expenditure on ICT goods and services; – business and government current and capital	ICT goods and services involved in international exchange are classified based on the international Harmonized system classification of traded goods (HS). The classification includes 10 categories. The advantage of the classification is to structurally represent international flows of ICT goods and services and to	Household demand for ICT goods and services is not measured in monetary terms, but through access to ICT. Moreover, the government does not include in the methodology a separate agent of the digital economy that produces and consumes ICT.

Approaches	Advantages	Disadvantages
expenditure on ICT goods and services; – domestic production of ICT goods and services. [OECD, 2011]	estimate the total volume of their exports/imports in monetary terms.	
Within the OECD model, the expenditures of business include: – The cost of acquiring ICT, depending on the type of software tools (software, hardware or services (website design, data processing, etc.)). And acquisition channels (purchase, rent, own expense, capitalized / uncapitalized costs); - The cost of data analysis. [OECD, 2015a]	Aiming at comparability, OECD method enlarges the elements of the expenditure structure of enterprises for ICT.	The expenditures of other agents of the digital economy have not been considered and still do not have monetary value.
Evaluation of investments/expenditures on ICT in business – Purchases of IT and communication goods – Investments in IT and communication goods – Purchases of other ICT goods – Investments in other ICT goods – Purchases of pre-packaged and custom-made software – Investments in pre-packaged and custom-made software – Labor input in own-account software – Purchases of IT consultancy, other ICT services – Investments in IT consultancy, other ICT services – Rental and operating leasing for ICT equipment – ICT resources shared within the group, not charged for [Eurostat, 2012]	The Eurostat methodology assumes the separation of expenditures and investments, which makes it possible to avoid double counting of ICT goods and services.	As in the case of the OECD methodology, the crucial focus is on the expenditures of enterprises and households and those of the government are ignored.

Approaches	Advantages	Disadvantages
– Annual investment in telecommunications services: ▪ Annual investment in fixed-telephone services; ▪ Annual investment in fixed-broadband services; ▪ Annual investment in mobile communication services; ▪ Other annual investment in telecommunication services; – Annual investment in non-tangible assets; – Annual foreign investment in telecommunications. [ITU, 2020]	The ITU methodology focuses on telecommunications and its types.	While the methodology allows for the accounting of expenditures for other ICT goods and services (e.g., software and intellectual property), this part of the methodology is the least developed. The coverage of units is limited to licensed operators and other organizations that provide communication services and whose activities are included in ISIC Revision 4, Division 61 (Telecommunications)
– Information and communication equipment; – Software excluding games computer software packages; – Information and communication services; – Games toys and hobbies. [ITU, 2020a]	The methodology includes a fairly wide range of ICT goods purchased by households.	ICT services are underrepresented. They are limited to the connection of communications, repair and rent of ICT goods and services. The costs of acquiring ICT skills are excluded.
– Total intramural costs ▪ Current costs ▪ Labor costs for internal R&D personnel ▪ Other current costs • External R&D personnel • Purchase of services, excluding external R&D personnel (optional breakdown) • Purchase of materials (optional breakdown) • Other, not elsewhere classified (e.g., general administration costs) ▪ Capital costs ▪ Land and buildings • Land (optional breakdown) • Buildings (optional breakdown) ▪ Machinery and equipment	The methodology allows one to determine the structure of enterprises' expenditures by highlighting current and capital expenditures.	The methodology takes into account exclusively research and development costs, ignoring the expenditures of ICT.

Approaches	Advantages	Disadvantages
• Information and communications equipment (optional breakdown) Transportation equipment (optional breakdown) • Other machinery and equipment (optional breakdown) ▪ Capitalized computer software ▪ Other intellectual property products. [OECD, 2015b]		

From the above approaches to measuring the expenditures on the development of the digital economy, it can be concluded that there are two main weaknesses. Firstly, the digital economy is limited to just a few agents, most often organizations. Secondly, the presented methodologies are restricted only by those ICT goods and services that constitute the focus of the study (for example, the expenditures on telecommunications goods and services). These shortcomings were excluded from the developed methodology in order to provide a more generalized and holistic view of the digital economy. It would be wrong to say that there are no benefits provided by international research. Thus, the components of expenditures determined by the purpose of the study are presented in sufficient detail and structure. This is what will ensure the multidimensionality of the indicator.

2. Suggested Approaches to the Measurement of Gross Domestic Expenditures on the Digital Economy: Definitions, Structure, and Data Sources

The lack of unified international standards for the measurement of expenditures on the digital economy does not mean that there is no need for such statistical tools. As it was previously mentioned, their relevance is expressed in the evaluation of the processes and tendencies of the social and economic digitalization and the support of international approaches.

Taking into account international experience and the tasks facing Russian statistics, we have proposed definitions of the key concepts studied. The suggested definitions were subsequently approved by Governmental Commission [RF Government, 2019]. All further proposals are based on these definitions:

– **Digital economy** – activities directed at the creation, dissemination, and use of digital technologies and related goods and services;
– **Digital technologies** – technologies for gathering, storing, processing, searching, transferring, and presenting data in digital form;
– **Domestic expenditure on the digital economy**– enterprises' domestic expenditure on the development, dissemination, and use of digital technologies, including domestic expenditures on research and development in the field of digital technologies.

It is necessary to notice that a significant part of the digital technologies is not included in final consumption and is used for the production of other goods and services. That is why to avoid double counting another analogic rate is introduced:

– **Gross domestic expenditure on the digital economy** means enterprises' total domestic expenditure on the performance of works and provision of services concerning the development, dissemination, and use of digital technologies and related goods and services, and total household expenditures on the use of digital technologies and related goods and services.

There are specific types of expenditures for enterprises and households which are considered by the calculation of the target rate. Expenditures for enterprises are subdivided by internal and external. Internal ones are for performance by its own means while external are for the third-party service payments. Apart from that, it is better to divide internal expenditures by capital (expenditures which are related with the introduction of digital technologies) and current (expenditures which are related with the use of digital technologies) expenditures of enterprises. It is also should be mentioned that in the proposed methodology only direct expenditures are considered. The overhead expenditures are not included because of the peculiarities of Russian statistics. According to them, it is almost impossible to account for overhead expenditures, because each enterprise develops the methodology of measuring them independently. Consequently, including overhead expenditures leads to leads to a loss of objectivity in the data.

Enterprises' expenditures structure was formed on the basis of OECD approaches. Each of the already mentioned attempts to measure ICT costs was too narrow and they did not cover all of the possible costs for digital technologies. That is why expenditures of every element in the structure are based on several methods and the authors' own inferences which were presented earlier. Based on these points, the enterprises' expenditure structure is:

– Internal expenditures of enterprises (performance work and services with their own efforts:
  - Internal current expenditures:
    - Remuneration of employees involved in the creation, distribution, and use of digital technologies;

        - Insurance premiums for mandatory pension insurance, mandatory medical insurance, mandatory social insurance, accrued to the labor fund of employees engaged in the processes of spreading the use of digital technologies;
        - Digital skills training for workers;
        - Digital R&D with one's own efforts;
        - Purchase of ready-made equipment related to digital technologies (including transportation, installation, and commissioning costs);
        - Manufacturing of special equipment related to digital technologies with its own efforts (except for wages and insurance premiums);
        - Maintenance and current repair of equipment related to digital technologies (including the cost of purchasing consumables, spare parts, etc.)
        - Purchasing, updating, and technical support of ready-made software;
        - Software development with its own efforts (except for wages and insurance premiums);
        - Purchase of digital content;
        - Other material costs related to the creation, distribution, and use of digital technologies (costs for raw materials, components, etc.);
        - Other current costs related to the creation, distribution, and use of digital technologies (travel expenses; taxes, fees, and other mandatory contributions included in the cost of production, etc.).
    - Capital expenditures:
        - Land;
        - Buildings;
        - Purchase, modernization, and overhaul of equipment related to digital technologies;
        - Purchase of objects related to intellectual property and products of intellectual activity (including software);
        - Other capital expenditures.
– External expenditures of enterprises (payment for services of third parties):
    - Digital skills training for employees;
    - R&D related to digital technologies;
    - Maintenance and repair of equipment related to digital technologies;
    - Rental software (including cloud services);
    - Adaptation of standard software;
    - Engineering services related to the implementation of digital technologies;
    - Consulting services related to the implementation of digital technologies;

- Data/database access services;
- Telecommunication services (including Internet access);
- Other costs related to the creation, implementation, and use of digital technologies.

Households expenditures on the development of the digital economy have an easier structure by the types of expenditures. Households' expenditures on ICT – the actual amount of money which was spend by households' members on the purchase and/or renting of ICT equipment; the exploitation and repair of ICT equipment, the purchase and/or renting of software; educational services connected with skills acquisition that are necessary for the use of ICT equipment and software, as well as the payment for telecommunication services.

It should be noticed that according the proposed methodology, ICT goods and appliances are not divided. This assumption was made consciously. Thus, it is suggested that the main part of the appliances refers to digital technologies. Thereby the indicator of households' expenditures will be slightly overstated. Moreover, due to the development of technologies, the share of ICT appliances will be arguably increased. According to the proposed methodology, households' expenditures includes:

- Digital skills training;
- Purchase, maintenance, repair, and rental of equipment related to digital technologies;
- Purchase of digital content;
- Telecommunication services;
- Purchase, update, technical support, and rental of ready-made software.

When developing a methodology for the measurement of the expenditures on the development of the digital economy, it is necessary to take into account the organizational features of data collection in order to implement it in the practice of statistical accounting. The reporting unit is a group of respondents: households or enterprises. However, there are many different types of enterprises classified based on their type of economic activity and size. In Russian statistical practice, enterprises of various types (groups of types) report in the appropriate forms. Thus, the development of a methodology for calculating domestic expenditures on the development of the digital economy of enterprises should be based on both their types and statistical forms provided for them.

According to the proposed methodology and the peculiarities of Russian statistics, government bodies are considered enterprises with specific types of activities. Consequently, government expenditures are presented as a part of enterprises' expenditures. Moreover, the evaluation of internal expenditures implies the costs of enterprises that are located within the country. That is why the consumption of digital technologies by the rest of the world is not

considered in this concept. Thereby, for the calculation of internal costs, economists use data about enterprises' expenditures (including administrative bodies) and households' expenditures.

When developing approaches to calculating the indicator of internal expenditures on the development of the digital economy, several requirements were developed. Firstly, the calculation should be based on statistical monitoring, federal information, or data which may be prepared for federal statistical observation. The second requirement is to cover all relevant activities and all actors involved in them. Finally, it is necessary to eliminate the possibility of double counting. This requirement has already been met by introducing an indicator of internal expenditures on the development of the digital economy. As noted, each group of enterprises has a specific set of statistical forms. These groups are formed based on the size of the enterprises and the type of economic activity. The biggest group is the large and medium-sized enterprises. To measure the expenditures of this group the questionnaire № 3-INFORM "Information on the use of information and communication technologies and the production of computer equipment, software and services in these areas" was used. It seems to be the most suitable one for collecting information on ICT expenditures. However, this statistical tool is not exhaustive. Firstly, small businesses are not covered by this form. Secondly, the questionnaire № 3-INFORM is not intended for all levels of educational institutions, but only for the institutions of higher education and institutions for training highly qualified personnel.

In Russia, statistical monitoring of the activities of small businesses is significantly limited at the legislative level. Therefore, to assess the internal expenditures of small businesses for digital technologies and related products and services, information obtained within the framework of federal statistical observation in the form № PM «Information about the main performance indicators of a small enterprise».

In order to reach educational institutions of all levels, it was necessary to use a set of the specific questionaries that are intended for several levels: professional, additional education, preschool education, and general education:

- № 85-K «Information about the activities of the enterprises carrying out educational activities in educational programs of preschool education, supervision and care of children»;
- № SPO-2 «Information about the material, technical and information base, financial and economic activities of a professional educational institution»;
- № OO-1 «Information about the material and technical and information base, financial and economic activities of the general educational institution»;
- № 1-PK «Information about the activities of the enterprise carrying out educational activities for additional professional programs»;

– № 1-PO «Information about the activities of the enterprise carrying out educational activities on main vocational training programs»;
– № 1-DOP «Information about additional education and sports training for children».

The primary source of data on population expenditures is the form № 1-B «The questionnaire for the survey of household budgets». The block of questions devoted to expenditures on durable goods covers ICT goods and services such as: audiovisual equipment (excluding services for receiving television broadcasting), computer, portable equipment, photo and film equipment, mobile phones, mobile communication services, etc. However, despite the wide range of considered ICT goods and services, it is not complete enough for the previously developed methodology.

The estimation of the indicator of domestic expenditures on the digital economy is based on information collected within the framework of the system of forms of federal statistical observation (Figure 1).

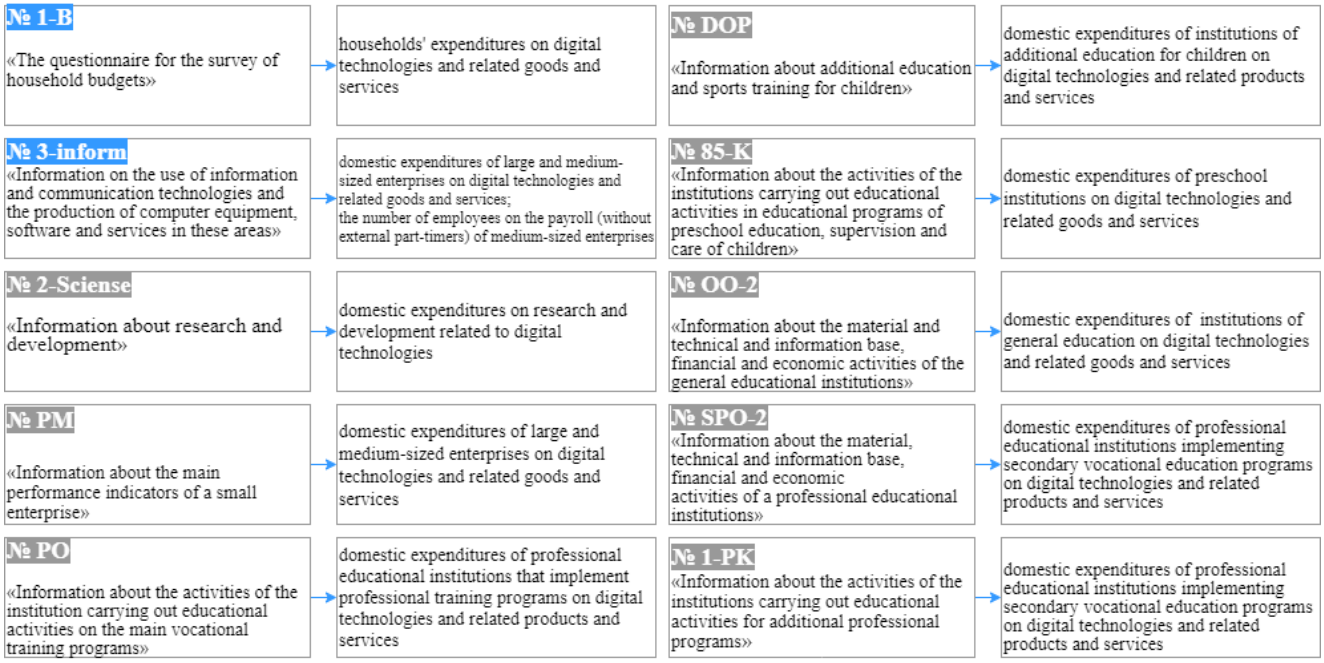
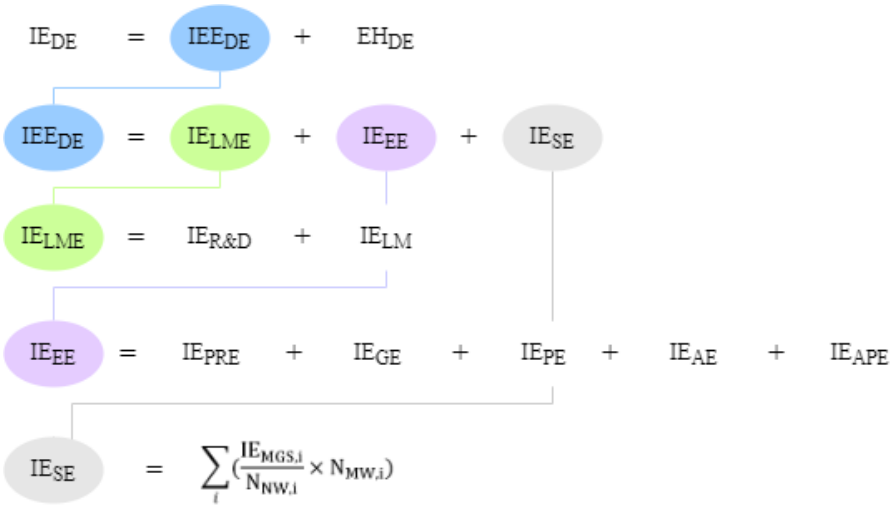


Figure 1 Information Basis for Calculating Domestic Expenditures on the Digital Economy

Based on the proposed structure of the domestic expenditures on the development of the digital economy and the system of statistical forms, a calculation methodology was formed that includes two elements: internal expenditures on the development of the digital economy of enterprises and households. The expenditures of enterprises are presented as a more multidimensional indicator. Thus, they include: internal expenditures of medium and large enterprises, internal expenditures of educational institutions, and internal expenditures of small

businesses. The first element, in turn, is divided into three further elements: the expenditures on R&D related to digital technologies, the expenditures on digital technologies, and related products and services. A schematic representation of the calculation methodology is shown in Figure 2.



IE_{DE}	domestic expenditures on the development of the digital economy
IEE_{DE}	domestic expenditures of enterprises on the digital technologies and related goods and services
EH_{DE}	households' expenditures on the digital technologies and related goods and services
IE_{LME}	domestic expenditures of large and medium-sized enterprises on digital technologies and related goods and services
IE_{EE}	domestic expenditures of educational institutions (except for educational institutions of higher education) on digital technologies and related goods and services
IE_{SE}	domestic expenditures of small businesses on digital technologies and related goods and services
$IE_{R\&D}$	domestic expenditures on R&D related to digital technologies
IE_{LM}	domestic expenditures of large and medium-sized enterprises on digital technologies and related goods and services
IE_{PRE}	domestic expenditures of preschool institutions on digital technologies and related goods and services
IE_{GE}	domestic expenditures of institutions of general education on digital technologies and related goods and services
IE_{PE}	domestic expenditures of institutions of professional education on digital technologies and related goods and services
IE_{AE}	domestic expenditures of additional educational institutions on digital technologies and products and services related to them
IE_{APE}	domestic expenditures of additional professional education institutions on digital technologies and products and services related to them
$IE_{MGS,i}$	domestic expenditures on digital technologies and products and services related to them of the medium-sized enterprise of the i-th type of economic activity
$N_{NW,i}$	the number of employees on the payroll (without external part-timers) of medium-sized organizations of the i-th type of economic activity
$N_{MW,i}$	the average number of employees on the payroll (without external part-timers) of small businesses of the i-th type of economic activity

Figure 2 Structure of Domestic Expenditures on the Digital Economy

The comprehensive system of statistical tools allows one to cover all types of enterprises. Each statistical questionnaire has its own specificities. Nevertheless, information collected from enterprises, regardless of their type, must include all elements of enterprises' expenditures, that were proposed in methodology. Consequently, it was required to make adjustments to the questionnaires, which are presented in the Table 3.

Table 3

Proposals for Improving Federal Statistical Surveys

Source of Information	**Proposed Amendment**
№ 3-Inform «Information on the use of information and communication technologies and the production of computer equipment, software and services in these areas» [Rosstat, 2019a]	Include expenditures on: • purchase, maintenance, modernization, current and major repairs of industrial machinery and equipment related to digital technologies; • purchase of digital content. Select separately: • Among other expenditures - the expenditures on the remuneration of ICT specialists and insurance deductions; • Among the expenditures on the services of third-party enterprises: – R&D related to digital technologies; – rental of machinery and equipment; – maintenance, modernization, current and major repairs of machinery and equipment; – software rental; – upgrade, maintenance, maintenance, technical support, and updates of software; – access to data / databases.
№ 85-K «Information about the activities of the enterprises carrying out educational activities in educational programs of preschool education, supervision and care of children» [Rosstat, 2019a]	Include expenditures on: • remuneration of ICT specialists and insurance deductions; • digital skills training for employees; • purchase, maintenance, modernization, current and major repairs of equipment related to digital technologies; • purchase, modernization, revision, updating, and technical support of software; • telecommunication services (including access to the Internet) • purchase of digital content; • third party services related to the creation and use of digital technologies and related products and services.
№ SPO-2 «Information about the material, technical and information base, financial and economic activities of a professional educational enterprise» [Rosstat, 2019b]	
№ OO-2 «Information about the material and technical and information base, financial and economic activities of the general educational enterprise» [Rosstat, 2019b]	
№ 1-PK «Information about the activities of the enterprise carrying out educational activities for additional professional programs» [Rosstat, 2019c]	

Source of Information	Proposed Amendment
№ 1-PO «Information about the activities of the enterprise carrying out educational activities on the main vocational training programs» [Rosstat, 2019d]	
№ 1-DOP «Information about additional education and sports training for children» [Rosstat, 2019b]	
№ 2-Science [Rosstat, 2019a]	Include: • Internal expenditures on R&D related to digital technologies

Both the proposed methodology and questionnaire adjustments were approved by the Russian government's digital economy sub-Commission. In 2020, for the first time, data were collected on updated forms and using the proposed methodology.

3. Estimation of the Gross Domestic Expenditures on the Digital Economy

In accordance with the approaches that were mentioned above, the volume of gross domestic expenditures on the development of the digital economy in 2019 was 4094 billion rubles, or 3.7% GDP (Figure 3). Experimental methods were used for the estimation of expenditures in 2017 and 2018 because other tools were applied earlier. The introduced changes were described above. Under the experimental estimation, domestic expenditures based on the available source of statistical data in 2017 and 2018 were 3324 and 3795 billion rubles, respectively. A total of 59.9% of the digital economy's expenditures in 2019 fell on enterprises' expenditures, and 40.1% – on the households' expenditures.

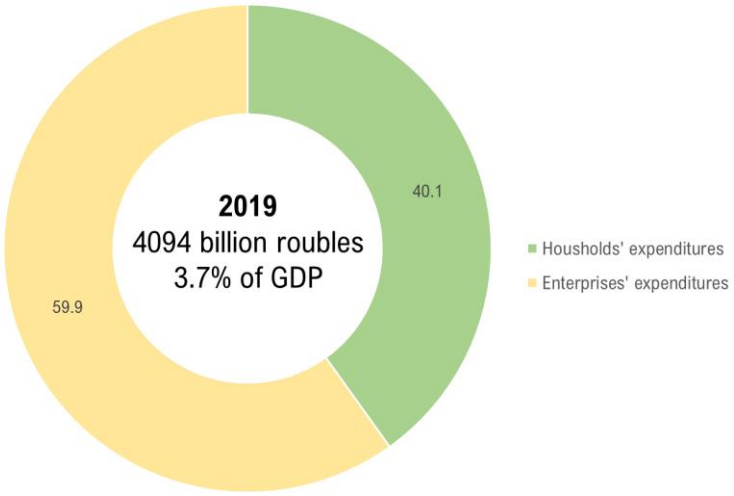


Figure 3 Gross Domestic Expenditure on Digital Economy Development: 2019

The basis for determining the target indicators of the national program «Digital Economy in the Russian Federation» is the domestic expenditures of enterprises on the development of the digital economy. Based on the obtained data, it was revealed that over the past three years the indicator reached the target volume. The change in the share of gross expenditures of GDP changes less rapidly (Figure 4)

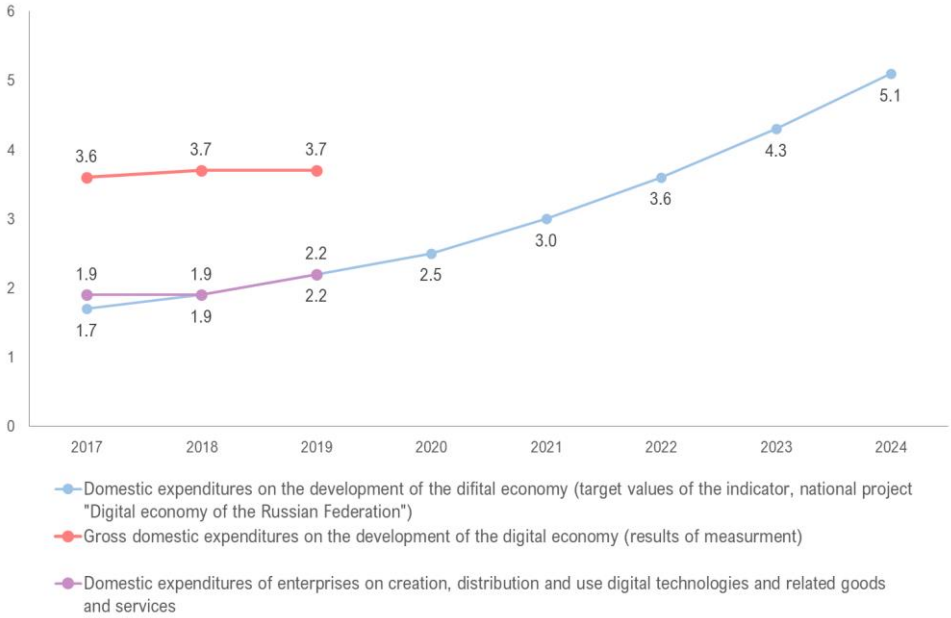


Figure 4 Gross Domestic Expenditures on the Digital Economy in Comparison with Target Values

Almost half (44.4%) of the total enterprises' expenditures on digitalization relates to the purchase of equipment. It is fair for many types of economic activities and it characterizes the initial step of digital transformation, which is connected with the technical rearmament of the existing production basis. It can be expected that the share of these expenditures would gradually decrease, as there would be more modern equipment at the enterprises. At the same time, the dominant element in the structure of expenditures on digitalization would be expenditures on software (including the development and testing of the new algorithms), digital content (including data), and electric communication services.

About a quarter (24.5%) of the expenditures on digital enterprises' transformation relates to the purchase and adaptation of software. Enterprises spent 601.2 billion rubles on these aims.

In 2019 enterprises spent just over 5 billion rubles on employees' training because of the implementation of digital technologies. It amounts to 0.2% of the total expenditures on digitalization. Apparently, it relates to the fact that nowadays administrative and managerial processes undergo digital transformation (it is proven indirectly by the structure of equipment

costs, which is connected with digital technologies). Three times as much – about 14.4 billion rubles (0.6%) – was spent on purchasing digital content (Figure 5).

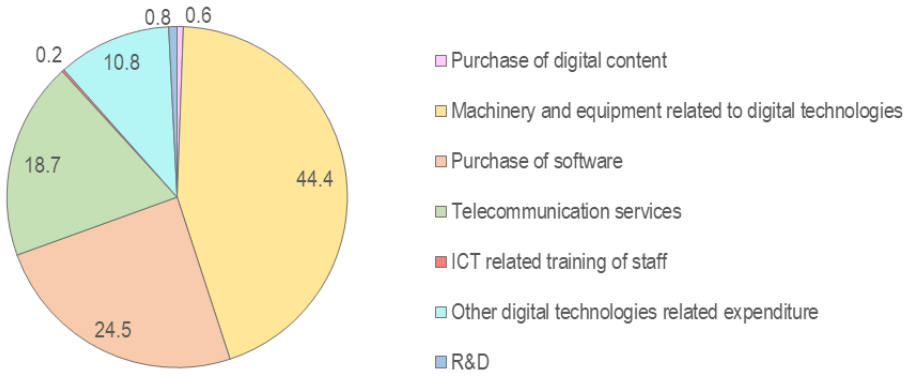


Figure 5 Structure of Domestic Expenditure of Enterprises for the Creation, Distribution, and Use of Digital Technologies and Related Products and Services by Type of Expenditure: 2019 (as a percentage of the total)

Telecommunications payments makes up the main share in the structure of population expenditures on digital technologies. In 2019, 982.4 billion rubles were spent on these aims (59.9% of the total households' expenditures on digital technologies). Almost a third of all population expenditures on digital technologies relates to the purchase, exploitation, and repair of the corresponding equipment. Moreover, in recent years the share of expenditures on portable devices has significantly increased. It happened principally due to smartphones, on which was spent about 220.5 billion rubles (13.4%) in 2019.

At the present time, the population is the main consumer of digital content. In 2019 Russians spent 180.4 billion rubles on movies, music, and e-books which was 11% of the total households' expenditures on digital technologies and related products and services (Figure 6).

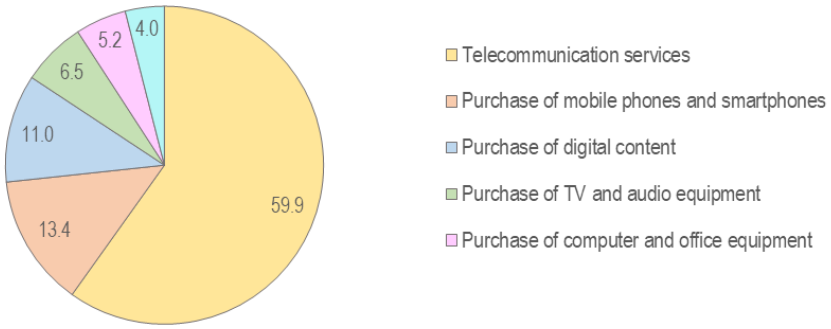


Figure 6 Structure of Household Expenditures on the Use of Digital Technologies and Related Products and Services by Type of Expenditure: 2019 (as a percentage of the total)

Conclusion

By defining digital economy and expenditures on its development, a methodology and the measurement of corresponding indexes are presented in this article. Based on international experience, the first step is the complex evaluation of the expenditures on the development of the digital economy and its agents. On the one hand, the elaborated methodology allows one to measure aggregate expenditures aimed at the development of digital economy and ICT goods and services. On the other hand, the multidimensionality of the index enables its decomposition into a variety of analytical perspectives. This structure of expenditure makes it possible to determine the priority areas for growth in the development of the digital economy. This enables the government to focus on a problem area and develop relevant tools for support.

The suggested methodology involves the transformation of the existing tools. Feedback of the respondents on the issues of updated form was collected within the data gathering. Difficulties during the filling of questionnaires were not revealed. All of the concepts and definitions were clear for the respondents. Moreover, the survey showed that respondents were ready to provide data. The proposed approach to the measurement of the domestic expenditures on the development of the digital economy has an original nature and can contribute to the creation of corresponding statistical standards on the platform of field-oriented international organizations (OECD, Eurostat, ITU) within the formation of an international system for the statistical measurement of the digital economy. Moreover, expenditures on the digital economy are the key indicator in the implementation of the national politics. Consequently, expenditure measurement serves as a mean of control for the execution of designated missions.

The proposed methodology provides relevance for both international statistical organizations and Russia. Firstly, the indicator of expenditures is valuable not only in itself, but also in the perspective of evaluating the digital economy as a whole. Therefore, the proposed methodology is an example of the development of a system of statistical indicators. Secondly, international organizations have previously attempted to estimate the expenditures of only some of the agents of the digital economy. The proposed structure takes into account all agents, and at the same time can be estimated in monetary terms. In Russia, the indicator of expenditures on the development of the digital economy, on the one hand, allows one to monitor the achievement of goals within the national program, and on the other hand, to develop a state policy in accordance with the current situation.

The measurement results provided an estimation of the domestic expenditures on developing the digital economy. The goals set in the framework of the national program were achieved. The structure of the indicator allowed us to identify those areas where the volume of

expenditures is the lowest. It is necessary to focus on their development, because they represent the current «growth points» of the digital economy.

It should be noted that the proposed methodology includes some limitations. The specificity of the toolkit implies limiting the measurement of household expenditures for purchasing goods and services related to digital technologies, which do not include software, digital content, and expenditures for acquiring digital skills. That is why the refinement of the household expenditure measurement tool is one of the issues for subsequent work in developing the methodology.

It should not be forgotten that the scope of digital technology changes rapidly Therefore, the proposed approach cannot remain unchanged. The development of society makes it necessary to constantly update statistical tools and analysis. Thus, with technological progress, the revision and addition of the methodology for estimating expenditures on the development of the digital economy is inevitable.

References

Abdrakhmanova G., Gokhberg L., Sokolov A. (2019) Indicators of Information and Communication Technology, in: Advanced Methodologies and Technologies in Artificial Intelligence, Computer Simulation, and Human-Computer Interaction (2 Volumes). Hershey: IGI Global.

Miller B., Atkinson R.D. (2014). Raising European productivity growth through ICT, The Information Technology & Innovation Foundation

OECD (2015). Addressing the Tax Challenges of the Digital Economy, Action 1 – 2015 Final Report. Paris: OECD Publishing

OECD (2015a). Model Survey on ICT Usage by Businesses, 2nd Revision

DBCDE, 2013. Advancing Australia as a Digital Economy: An Update to the National Digital Economy Strategy, Department of Broadband, Communications and the Digital Economy, Canberra. http://apo.org.au/node/34523British Computer Society (2013). The Digital Economy

The World Bank (2016). Development of the digital economy in Russia

European Parliament (2015). Challenges for Competition Policy in a Digitalised Economy.

European Commission (2014). Expert Group on Taxation of the Digital Economy.

G20 DETF (2016) G20 Digital Economy Development and Cooperation Initiative, G20 Digital Economy Task Force.

OECD (2011) Guide to Measuring the Information Society

Eurostat (2012) ICT Investment and Expenditure data collection. First results of 2012 survey

ITU (2020) Handbook for the collection of administrative data on telecommunications/ICT

ITU (2020a) Manual for measuring ICT access and use by households and individuals

OECD (2015b), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development

HSE (2020) Digital Economy: Pocket Data Book / G. Abdrakhmanova, A. Demyanova, S. Fridlyanova et al.; L. Gokhberg (ed.) Moscow: National Research University Higher School of Economics.

Rosstat (2019a) Regulation of Russian Federal State Statistics Service no. 410 dated of July 18, 2019 «On approval of forms of Federal statistical observation for the organization of Federal statistical observation of activities in the field of education, science, innovation and information technology»

Rosstat (2019b) Regulation of Russian Federal State Statistics Service no. 648 dated of November 1, 2019 «On approval of Federal statistical observation forms with instructions for completing them for the organization by the Ministry of education of the Russian Federation of Federal statistical observation in the field of General and secondary vocational education»

Rosstat (2019c) Regulation of Russian Federal State Statistics Service no.786 dated of December 20, 2019 «On approval of the Federal statistical observation form with instructions for its completion for the organization by the Ministry of science and higher education of the Russian Federation of Federal statistical observation in the field of additional professional education»

Rosstat (2019d) Regulation of Russian Federal State Statistics Service no. 695 dated of November 22, 2019«On approval of the Federal statistical observation form with instructions for its completion for the organization by the Ministry of education of the Russian Federation of Federal statistical monitoring of the activities of educational organizations that carry out educational activities in the main professional training programs»

RF Government (2019) Session Protocol no. 557pr of September 27, 2019 of the Government Comission's Digital Economy Subcommittee on the Use of Information Technologies for Improving Quality of Life and Business Environment

OECD, 2020. A roadmap toward a common framework for measuring the digital economy https://www.oecd.org/sti/roadmap-toward-a-common-framework-for-measuring-the-digital-economy.pdf

International Monetary Fund (IMF), 2018. Measuring the Digital Economy. IMF Staff Report https://www.imf.org/~/media/Files/Publications/PP/2018/022818MeasuringDigitalEconomy.ashx

United Nations Conference of Trade and Development (UNCTAD), 2017. World Investment Report 2017: Investment and the Digital Economy

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