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Issue Article

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APPLICATION OF BIG DATA IN STATISTICAL RESEARCH

Abstract: *The main disadvantage of traditional methods of statistical data processing that require the introduction of new digital technologies is the low speed of data processing, big data storage systems, the inability to process unstructured data, etc. One of the main directions of the development of the digital economy is the creation of a developed information infrastructure, and its main end-to-end digital technologies are Big Data. The article discusses the application of Big Data in statistics.*

Key words: *Big Data, digital technology, unstructured data, databases, statistical indicator, statistical methodology.*

Language: *English*

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Introduction

The Statistical Commission of the United Nations Economic and Social Council established the Global Working Group on the Use of Big Data for Official Statistics, which structured its programmed of work for 2014-2015 years.

The objectives of the Global Working Group are to provide guidance for a global program on the use of Big Data for official statistics, including their use in quantifying implementation indicators and in the area of sustainable development for the period up to 2030, for their various policy applications and to promote capacity-building activities in the field of Big Data. Big Data is a modern digital data processing technology that provides high processing speed and enables decentralized storage of big data, work with unstructured data, etc. Big Data characterized by a set of approaches, tools and methods for processing structured and unstructured large amounts of data, and a significant variety of data to obtain effective results and distribute them across numerous nodes of a computer network [1,2].

This is an alternative to traditional database management systems and solutions of the Business Intelligence (BI) class. There are characteristics that allow you to attribute information and data specifically to Big Data. That is, not all data may be suitable for analytics. In these characteristics, the key concept of big date just laid down.

Features of the general classification of statistical indicators

In relation to statistical science: the actual statistical indicators; indicators of other sciences.

According to the method of determining the quantitative content: absolute; relative.

According to the territorial coverage of the object: global; continental; groups of countries; individual countries; regional; administrative units; cities; enterprises, organizations, etc.

By objects and types of economic activity: firm; association; subtype of economic activity; type of economic activity.

According to the time covered: instant; interval.

According to the degree of variability in time: static; dynamic.

According to the degree of complexity of the formation of a sign: one-dimensional; multidimensional.

In relation to the characterized object: directly characterizing the object - "direct"; indirectly, through another object - "indirect".

In relation to the characteristics of the described process:extensive (volumetric);intensive (qualitative).

According to the degree of complexity of the calculation method: obtained because of applying a

separate statistical method; obtained because of applying a set of statistical methods.

In relation to reality: characterizing reality (real); characterizing the possibility (potential, normative, predictive, and planned).

- In relation to the task of the study: initial (input); productive (weekend).

They all fit in three V.

1. Volume. The data measured in the size of the physical volume of the "document" to analyze;

2. Velocity. The data is not in its development, but is constantly growing, which is why their rapid processing is required to obtain results;

3. Variety. The data may not be single-format. That is, they can be scattered, structured or partially structured.

However, from time to time, a fourth V (veracity - reliability / plausibility of data) and a fifth V are added to the VVV (in some variants it is viability - viability, in others it is value - value).

In the scientific literature, Big Data understood as a set of data with possible exponential growth that is too large, too unformatted or too unstructured for analysis by traditional methods [3].

Big Data is one of the approaches, tools and methods of processing structured and unstructured huge amounts of information.

In addition, Big Data tools and methods are fundamentally different from working with conventional databases, if the amount of information in conventional databases takes from several gigabytes (109 bytes) to terabytes (1012 bytes), then the volume of the BigData database reaches from several petabytes (1015 bytes) to several Exabyte's (1018 bytes) and comparative. The BigData criterion is the way information is stored and processed.

BigData characterized by a decentralized way of storing information, which is due to the advent of personal computers. This approach makes it possible to divide the information base into several separated ones and allows each client to use its own database, which can be either part of the general information base or a copy of the information base as a whole [4].

BigData characterized by a decentralized way of storing information, which is due to the advent of personal computers. This approach makes it possible to split the information base into several separated ones and allows each client to use their own database, which can be either part of a common information base or a copy of the information base as a whole. The semi-structured or unstructured nature of the Big Data database is another difference from traditional data, for which structuring is inherent. Structuring refers to the presence of established relationships and relationships between elements within the system, the distribution of system elements by hierarchy levels. Big Data partially or completely does not have the above features. Another criterion for comparing Big Data and traditional data can be data generation. If traditional data sources always assume the presence of a person, then Big Data often generated automatically, without human involvement [5].

Big Data has a number of fundamental differences from traditional data, due to which they have both a number of advantages and contain certain difficulties. The main advantage of big data in statistical research is the timely receipt of voluminous arrays of information with least financial and time costs. Currently, the collection and storage of big data on servers is difficult due to technical capabilities, so cloud technologies are becoming increasingly popular in statistical organizations. To date, only a few countries have developed a long-term strategy for using big data. In order to minimize risks in the development of new technologies, leading countries cooperate within the framework of global research centers, such as the UN Statistical Commission and the Global Working Group on Big Data in Official Statistics.

Mobile communications and the global coordinate system (GPS), geospatial information and social networks considered as the main sources forming big data for their subsequent application in statistics. Some of this data is not publicly available, but is the property of the private sector, so there is a need to establish interaction between statistical research bodies and companies. Based on the definition of Big Data, it is possible to formulate the basic principles of working with such data:

1. Horizontal scalability. Since there can be as much data as you like, any system that involves processing big data must be extensible. The amount of data has increased by 2 times - the amount of iron in the cluster has increased by 2 times and everything has continued to work [6].

2. Fault tolerance. The principle of horizontal scalability implies that there can be many machines in a cluster. For example, Yahoo's Hadoop cluster has more than 42,000 machines.

This means that some of these machines will guaranteed to fail. Methods of working with big data should take into account the possibility of such failures and survive them without any significant consequences.

3. Data locality. In large distributed systems, data distributed across a large number of machines. If the data is physically located on one server and processed on another, the data transfer costs may exceed the costs of processing itself. Therefore, one of the most important principles of designing BigData solutions is the principle of data locality - if possible, we process data on the same machine on which we store them. All modern tools for working with big data somehow follow these three principles. In order to follow them, it is necessary to come up with some methods, methods and paradigms for developing data development tools [7].

Working with Big Data requires good theoretical training and experience, the ability to search and filter information (Data mining). Data mining methods lie at the intersection of databases, statistics and artificial intelligence. The basis of Data mining methods are all kinds of statistical methods: classifications, typologies, descriptive analysis, correlation and regression analysis, factor analysis, variance analysis, component analysis, discriminant analysis, time series analysis, survival analysis, relationship analysis, modeling and forecasting, pattern recognition methods, the use of decision trees, artificial neural networks, genetic algorithms, evolutionary programming, associative memory, fuzzy logic.

One of the most important purposes of Data mining is also to visually present results of calculations (visualization). Currently, Micro Soft, Oracle, IBM, SAP companies are developing tools for working with Big Data [8-11].

The fundamental principles of statistics inevitably follow the fundamental principles of statistics: uniformity of data, their comparability in time and space, relevance of statistical indicators of the essence of the measured processes, aggregation and disaggregation of data, confidentiality of personal data. A statistical indicator is one of the basic concepts in the statistical methodology of cognition, which understood as a statistical characteristic, in the unity of quantity and quality (content), of various phenomena and processes under study in a particular place and time. A statistical indicator is a generalized characteristic of a set of phenomena and the necessity of combining quantitative expressions and qualitative determinations in the processes and phenomena under study, including in the "digital economy".

This indicator includes the object of the study; the time of the measurement; the place of its determination; the unit of definition (measurement); the calculation method (especially important in international comparisons), the numerical value. The statistical characteristic should include the state, dynamics or variation, ratio, relationship, structure of the statistical aggregate or individual phenomenon.

The active involvement of statistics in the digital economy and the formation of a digital economy ecosystem around it to serve strategic goals is associated with a change in its development paradigm: it is necessary to move from primarily collecting information to its search and analysis, the creation of a statistical information technology platform Stat-net.

The leading principles of statistical information are access to statistical information, the development of "smart statistics" [9-15].

A statistical indicator, most often, generalized characteristic of set of phenomena;

- the necessity of combining quantitative expressions and qualitative determinations in the processes and phenomena under study, including in the "digital economy";
- Statistical indicator should include – the object of research;
- Time of measurement; the place of its determination;
- Unit of definition (measurement);
- Calculation methodology (especially important in international comparisons), a numerical value;
- Statistical characteristic should include – the state, dynamics or variation, ratio, relationship, structure of a statistical aggregate or an individual phenomenon.

Digitalization of the economy should contribute to solving the problem of building a system of indicators of sustainable development. The success of the development of state statistics largely depends on the cooperation of statisticians with the expert community and on the activity of the professional International Statistical Institute (ISI).

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