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Review Article

APPLICATION OF "BIG DATA" IN OPERATIONAL AND INTELLECTUAL INSPECTION OF SOCIO-ECONOMIC INFORMATION

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Abstract
The purpose of the article is to consider the features of using "big data" in the operational and intellectual analysis of socio-economic information.
The use of big data allows one to not be limited to the data set of the Federal state statistics service, the information is not late (work in online mode) and allows you to make decisions with 100% coverage of the sample (in contrast to field research). Moreover, the constructed networks reproduce information cascades and are a "snapshot" of actual socio-economic processes, that is, in fact, a more accurate model for decision-making. However, the proper conceptualization necessary for further implementation of innovative tools has not been developed, and the methodological basis exists at the level of the "first approach" or general discussion.
There is an urgent need for theoretical and methodological justification of draft decisions to create a new model for making management decisions and evaluating the effectiveness of government bodies, based on comprehensive operational information support, fully taking into account the interests of the subject of management in the socio-economic sphere. This increases the role of conceptualizing digital sociology, developing new theoretical and methodological approaches to design innovative management and monitoring systems based on big data, and exploring the possibility of introducing new information processing algorithms.
The author comes to the following conclusions: the results obtained from the data inspection can be used in various ways. The first use case involves metadata monitoring: in continuous access mode, the monitoring subject receives values of key characteristics of the system under examination, as well as technical parameters of the data processing, such as the degree of utilization of computing power and data storage. In the second version, focused on monitoring information, the content of processes is reflected through a subsystem that displays such processes as receiving, collecting and analyzing data, as well as mediating navigation through them in real time.
The result of the described algorithm can be the formation of reporting forms and visualization tools for monitoring results, as well as the adaptation of an array of information for subsequent processing by statistical data inspection systems.
Based on the results of the examination, the existing approaches to the formation of monitoring systems of socio-economic orientation are systematized and the expediency of building an information system of an innovative type based on the principles of digital sociology and big data is justified. During the implementation of the project, the possibilities of collecting big data arrays were examined, as well as the most effective domestic and foreign practices of building and operating monitoring systems based on the inspection of big data of a socio-economic nature were checked.

Keywords: "big data", socio-economic information, operational inspection, intellectual inspection.

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INTRODUCTION

To date, there are no effective feedback mechanisms between the population as the bearer of power and the authorities to that the citizens have delegated authority. In this regard, there is often a situation when decisions taken by the authorities in the socio-economic sphere are not only disapproved by the public, but also cause a strong protest (for example, pension reform, the introduction of the "Platon" system, etc.).

Proper informing and explanatory work could solve some of these problems, but another, more significant part is due to the fact that even if you want to get the validation of some decisions through discussion with the citizens, the executive and legislative authorities do not have effective opportunities for this. Several issues of the problem arise regarding the social responsibility of businesses in local and regional context, as mentioned by Herringish at. al. [1] or Voronkova et al. [2]. The second aspect of the problem, which is no less important – is the lack of representation of small social groups, which is, according to Sycheva et. al., very important for different localities' development [3]. They are identical in terms of place of residence, profession, etc. (for example, residents of small localities), whose problems on the scale of the economy will never be a priority, but they are significant on the scale of communities, since they significantly worsen their quality of life.

There are many such loci, but they are distributed across the country, so they are divided, and their opinions may not be heard. At the same time, the authorities also have a request to hear these private hotbeds of problems, but an economically justified way to collect operational and relevant information has not been developed. As a result, science and public administration are forced to operate on two data sources: official statistics and the results of various field studies. In the first case, there is a narrow scope of statistical observation of socio-economic processes, a low degree of efficiency, and in the second – an exponential increase in the cost of research as the sample grows and the breadth of coverage of indicators [4].

Because of this, many people today see a possible solution to the monitoring problem in the use of digital sociology tools and big data operationalization. Big data, which is an array of structured and unstructured data that is difficult to process using traditional methods, have significant potential, allowing one to get online real-time diagnostic results, analyze the entire data set, rather than samples, and use various machine algorithms that identify implicit relationships.

MATERIALS AND METHODS

Classic tools used for statistical data processing – such as sampling and grouping, correlation and regression test, etc. – they cannot be used for big data inspection due to the exponential growth of the data volume, leaving no possibility to cover them within the framework of classical examination and generalization tools, limited by the available capacities and depending on the degree of automation of the data accumulation process.

Since it is also not possible to collect sociological data on demand online, the solution lies in the use of hidden and implicit data generated by social and economic activity of individuals, including activity in the Internet space, where the processes that occur in the "real world" in the social, political, and economic spheres of interaction are somehow projected.

The methodological basis of this research work includes general scientific methods, among which we should note the structural-functional and cause-and-effect justification of regularities, the complementarity of the objective and subjective sides of social processes. Special research methods include sampling and grouping, monitoring, and statistical inspection. In this way, the research work is based on classical examination procedures, the collection and processing of primary and secondary statistical information, interpretation of the results of third-party developments, examination of dynamics and structure, along with modern methods of operational monitoring.

The solution of problems related to the development of the concept of using big data to monitor the socio-economic situation of the population and follow its reactions involves turning to the theory and methodology of the program-target approach and the theory of systems. The volume layer of work required for the development of monitoring systems is associated with research in the field of system theory under the authorship of A. A. Bogdanov, L. Bertalanfi, and M. Mesarovich. Many significant results of a system-wide nature were obtained in the works of W. R. Ashby, P. K. Anokhin, A. Rapoport, and others.

RESULTS

The examination of various methodological approaches to the assessment of socio-economic processes allows us to state that they can be systematized into several groups. The first approach focuses on the typology of processes and building classifications. The second approach is to identify processes using evaluation matrices based on a set of characteristics. The advantages of the second approach include the result in the form of qualitative assessments and the detection of problematic parts of the process. The third approach to evaluation is based on the formation of integral indicators, which can be based on both statistical data sets and expert assessments that allows one to build ratings based on weight coefficients. When forming an integral indicator, two approaches should be noted:

– selection of a system of indicators that sufficiently covers the fundamental elements of a phenomenon or process, formation of an integral index, identification of object ratings when taking into account the weight for each indicator;
– finding priority characteristics and distinctive properties, building an integral indicator that takes into account the targets specific to the process being examined [5].

Very often integrated indicators that combine both social and economic variables are used to assess socio-economic processes. In practice, it was found that in order to evaluate complex systems; one indicator is not enough, which leads to the fact that measurements are built on the basis of a set of indicators – a multidimensional set of indicators that can be applied in a wider field of application.

Research based on the understanding of the multi-dimensionality of socio-economic space, which determines its interpretation through a set of metric and topological properties, is separately considered. One of the topological properties is connectivity, which determines its unity, and also affects the effectiveness of the implementation of socio-economic policy in the presence of spatial diversity [6].

Most researchers consider connectivity as a qualitative characteristic of space that determines the morphology and trajectory of processes. As a rule, such examinations are based on the inspection of the connectivity of characteristics, which involves the identification of relationships and the construction of graphs or matrices of relationships. This allows us to consider the connectivity of subjects through the quantifiable intensity of economic, social and other interactions, as seen in Yamova et al. [7] or in Zavyalov et al. [7]. Often, connectedness is viewed through concentration. Methods for quantifying the degree of concentration include the share of the largest entity in the market, the concentration index, the entropy index, the variance, the Lind index, the Gini index, and the Herfindal-Hirschmann index (HHI).

All these indicators are based on measuring the degree of concentration of certain resources. The most well-known indicators are the widely used CR-3 and Herfindal-Hirschmann indices due to their ease of interpretation and ease of calculation. More labor-intensive gravity models and indexes based on them are used to measure density and intensity.

However, all these methods are focused on examining the relationships and building monitoring systems, either on existing statistical data sets or on the results of field examinations that have a very narrow scope and are costly to implement on a regular basis. In this regard, the search for new ways to extract and process socio-economic data, as well as the possible identification of implicit links, is extremely promising [9].

Classical methods for creating monitoring, data collection and analysis systems no longer seem reliable due to the increase in the amount of information taken into account, which explicitly or implicitly affects decisions and behavioral choices. The need to capture exponentially growing amounts of information in the process of goal-setting or planning activities seems natural, but despite this, the tools available today for analyzing big data do not satisfy existing requests, which leads to an expansion of the niche of unsatisfied demand. The use of big data tools makes it possible to go beyond the data set provided by the Russian Statistics Authority. This model does not have a time lag due to its real-time operation, and it is possible to make decisions with a full sample. In addition, constructed networks are able to reproduce information cascades and present a snapshot of existing social processes, which actually turns them into a more accurate model for decision-making.

The use of big data allows one not to be limited to the data set of the Federal state statistics service, the information is not late (work in online mode) and allows you to make decisions with 100% coverage of the sample (in contrast to field research). Moreover, the constructed networks reproduce information cascades and are a "snapshot" of actual socio-economic processes, that is, in fact, a more accurate model for decision-making. However, the proper conceptualization necessary for further implementation of innovative tools has not been developed, and the methodological basis exists at the level of the "first approach" or general discussion.

There is an urgent need for theoretical and methodological justification of draft decisions to create in the medium term a new model for making management decisions and evaluating the effectiveness of government bodies, based on comprehensive operational information support, fully taking into account the interests of the subject of management in the socio-economic sphere. This, according to Gerasimov et al. [10], increases the role of conceptualizing digital sociology, developing new theoretical and methodological approaches to designing innovative management and monitoring systems based on big data, and exploring the possibility of introducing new information processing algorithms.

DISCUSSION

Developing an information and analytical system requires solving the following tasks:

- creation of a productive scalable data storage system, as well as a system for collecting data from social media sources, allowing timely delivery of up-to-date new information to the data storage system;
- automation of the process of forming comprehensive glossaries of named objects marked on the basis of mutual influence;
- increasing the percentage of reliable tone definitions (sentiment) in text information addressed to an object, process, or phenomenon;
- creating or adapting existing statistical and mathematical tools for calculating indicators that show the relationship of social groups or individuals to significant objects or subjects (see [11 - 15]).

Functional requirements of software and hardware include the need to collect information on the nature and propagation dynamics of signals acting on a target audience, aggregating the information about the reaction of other factors on certain signals and information cascades, to evaluate emotional information blocks, and provide a visualization of the mentioned information.
The data model includes a description of the data structure, data censorship and manipulation, and features for maintaining data integrity. We describe the components of the algorithm for the functioning of an information and analytical system based on big data [16].

1. Data reception
Effective data collection requires the identification of data sources, taking into account that they are characterized by a variety of parameters, including the following:

– frequency of data receipt from the source;
– volume of incoming data;
– data transfer rate;
– nature and type of incoming data;
– reliability of data.

Data sources can include data from repositories, aggregated data, device and sensor access interfaces, system logs, content from social networks and websites, corporate information systems, research data, and data copied or imported from other systems.

The source data format depends largely on the data sources used. As a rule, data collection in the case of working with large data sets is characterized by specificity and involves creating your own collectors, parsers, or so-called "grabbers" for each of the sources. Terms such as data crawler (for collecting information in the network) and data acquisition (for making measurements) are considered more common for collectors. Data collection involves not only the collection itself, but also the initial preparation of data with the transformation of their form in order to bring to a common format for presenting information. At this stage, the measurement system is transformed; the data are classified and checked for accuracy and reliability. Meaningful processing of data does not change the information available in them, but changes in its representations are quite possible (for example, through scaling or universalization of units of measurement).

2. Data collection
Data collection involves direct interaction with systems that allow data storage. For example, new storage technologies include (1) flexible storage regardless of the source structure, (2) high scalability and availability, and (3) ultra-fast access: data base in-memory, MapReduce. Special technologies for data collection and preparation are represented by multi-threaded continuous collection and mass-parallel simultaneous processing in real time.

Data storage involves the use of distributed systems of various types. These include file systems, mechanisms for accessing shared virtual memory, databases, and logs. Many of the storage systems are focused only on working with big data arrays, and the internal complexity of highly efficient distributed systems often leads to the fact that storage systems are characterized by a limited number of functions. In particular, in some cases it may not be possible to modify the data or simply delete it. Data acceleration is achieved by organizing parallel operation of data storage and processing systems connected to the cluster. At the same time, the possibilities of parallel computing are limited by the requirements for the stability of distributed systems, described in terms of consistency and consistency of results (the so-called Brewer hypothesis).

3. Operational and data mining.
Operational analysis reveals mainly descriptive characteristics: the frequency and context of mentions of a person in the context of qualities or work performed, comparison with competitors, key actors involved in the discussion of a person or event, attitude to the person or process (connotation of reviews), data of actors included in the target audience: names, age, geography, etc.

There are different approaches to use social networking to reach specific goals or the implementation of the research interest. No matter how the original research hypothesis is formulated, the general questions that need to be answered initially are as follows.

– what are the publications focused on;
– who represents the current and target audience;
– why actors interact via networks and what type of content interests the audience;
– what are the user's tasks and how the user uses social networks;
– whether a user is able to achieve the set tasks.

These questions and recommendations are the starting point for analyzing the use of social networks. Depending on the user and the examination, more specific tasks and hypotheses may arise that will lead to more in-depth testing. Most decisions are based on research on the experience of using social networks by specific groups.

The first steps involve a preliminary study of the group's needs. It is based on the answer to the following questions:

– what type of information do the group members want to convey;
– what type of user interaction is preferable for actors;
– which topics or activities can be well supported by social networks [17].

Thus, the examination of how actors actually use social networks can allow one to create a number of suggestions and respond to them. For example, comparing current network usage with needs helps identify whether opportunities are being used in a way that meets existing needs. Whether there are needs that are not being met and whether networks are being used to create new types of interaction. Accordingly, we can draw a conclusion about whether social networks can be used to solve new problems.

In some cases, fake accounts are used to attract attention and generate mass online movements to simulate the "situation from below", since the initiative of major actors does not always inspire confidence.

Intellectual analysis has great potential, as it involves the use of new techniques and allows one to incorporate behavioral psychology, combining it with statistically reliable methods. It forms a more complete picture of the behavior of an individual and his/her competitors.

Subsequent in-depth data analysis should include the following features:

- monitoring information published in social networks;
- conducting a linguistic analysis of aggregated posts for the content of the required objects or features in them;
- evaluation of the tonalities of users ' statements about an object or process;
- identification and measurement of indirect impacts caused by the relationship of members of one sample to a

given object in relation to their relations to another object (for example, identification of the individual and the organization with which the individual is associated);

- creating a list of significant named objects/subjects and the desired attitude of members of social groups to the listed objects/subjects;
- calculation of indicators of the relationship of social groups to objects/subjects/processes from a certain list;
- notification of employees working with the information and analytical system about the deviation (or non-compliance) of the relationship to a particular object or subject from the set / desired level [18].

As part of the data mining, it is assumed that individuals are typed according to the selected system of criteria based on the metadata collected from a specific sample. Taking into account the fact that there is a significant amount of information about user psychotypes, we can talk about the possibility of determining the potential behavior of the applicant, taking into account the available data with the behavior of users in the network. In fact, mining algorithms make it possible to identify the most likely responses of an applicant when using profile data in a social network. Models based on arrays. Big Data has a great predictive function, because the behavior of an individual in the framework of social communication always represents the characteristics of his personal qualities, which means that it is potentially predictable.

Decision-making by an individual involves taking into account no more than seven or nine objects with the use of no more than four parameters. At the same time, big data and artificial intelligence do not have the properties of "ego", and, therefore, the limitations that are inherent in the individual, despite the fact that they are able to accurately make predictions about behavior. The identification of personal characteristics of the individual built on the result of the actual consciousness of the individual, and, despite the fact that people see each other differently in behavior, tools of artificial intelligence, applying methods of working with arrays of big data, confirms that in reality, individuals use an extremely limited set of reactions, and therefore, theoretically there is the possibility of identifying artificial intelligence future needs and reactions of the individual before the individual [19, 20].

Focusing on research methods, it should be noted that the method of structural and dynamic modeling is used to design the architecture of an innovative information and analytical system for collecting and processing large socio-economic data extracted from the Internet space.

When developing algorithms for collecting, processing, filtering, and inspecting large data sets that characterize the socio-economic situation of the population, data inspection technologies are used, including the identification of implicit relationships, as well as the examining of text, visual, and cartographic information, followed by the recognition of meanings, images, and concepts. In this case, data processing is implemented using various methods that involve predictive Analytics, tools of historical and mathematical analogies, and other means of reconstructing the characteristics of social processes and phenomena. Each of them is based on specific algorithms that are activated depending on the purpose and objectives of the work. The examination can cover not only text data that characterize human speech, but also audio-visual information, as well as geographical coordinates or numerical data.

Along with a set of traditional analytical tools and procedures, deep machine learning algorithms can be used to supplement a specialist's analytical potential with the capabilities of a self-learning neural network. The set of tools here is also quite wide and extends from genetic algorithms and multidimensional data classification to building association trees, pattern recognition and recognition of meanings, emotions, speaker tonality, etc. Further in-depth data processing can help to build models based on artificial intelligence and neural networks that also allow one to build fairly reliable forecasts.

4. Presentation of results.

Examination of processes, phenomena and reactions is subject to a specific algorithm implemented on the basis of private software solutions-algorithms for data collection and processing, as well as their implementation in the form of a user interface. The functionality of the developed software solutions should provide automated execution of the following actions:

1. Algorithms collect data for the following social networks: Twitter, Facebook, Instagram, etc.
2. Module for linking input data (actors from different sources to a single database).
3. Module to display/filter data in the database.
4. Tool for uploading received data in XML/JSON/CSV formats for further analysis.

The result of these procedures should be a database on which the network can be built. Work with the resulting database is implemented using specialized software products. If the resulting arrays comply with the principles of big data, their testing requires the use of distributed computing, which is a technical resource-intensive task [21].

The research algorithm involves the implementation of a number of stages:

1. Uploading unstructured information from their social network based on a set of keywords.
1.1. Aggregation of incoming information flow into a structured array.
1.2. Excluding repetitions, the missing information and irrelevant information.
1.3. Loading data presented in a machine-readable format that allows automated processing by analytical algorithms of database management systems obtained from social networks.
2. Translation of data into a specialized software product.
3. Structuring and visualization of the graph of relationships between actors, identification of nodes of the most intensive communication-key actors.
4. Measurement of centrality coefficients and characteristics of mutual influence of actors based on key metrics of the social network.
5. Building a visual image of the architecture of relationships between key and secondary actors, analytical infographics.
6. Building subgraphs of separate factors.
7. Search for effective channels of information promotion, clusters within the network.

CONCLUSIONS

The results obtained from data examination can be used in various ways. The first use case involves metadata monitoring: in continuous access mode, the monitoring subject receives values of key characteristics of the system under examination, as well as technical parameters of the data processing, such as the degree of utilization of computing power and data storage. In the second version, focused on monitoring information, the content of processes is reflected through a subsystem that displays in real time such processes as receiving, collecting and analyzing data, as well as mediating navigation through them.

The result of the described algorithm can be the formation of reporting forms and visualization tools for monitoring results, as well as the adaptation of an array of information for subsequent processing by statistical data inspection systems [22]. The latter raises the issues of intellectual rights protection, as described by Zakieva et al. [23].

Based on the results of the examination, the existing approaches to the formation of monitoring systems of socio-economic orientation are systematized and the expediency of building an information system of an innovative type based on the principles of digital sociology and big data is justified. During the implementation of the project, the possibilities of collecting big data arrays were examined, as well as the most effective domestic and foreign practices of building and operating monitoring systems based on the examination of big data of a socio-economic nature were inspected.

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