Information system for data analysis of electronic operational documentation to support the development of economic processes

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Abstract. The article presents an information system for data analysis of electronic operational documentation, the main purpose of which is the storage, collection and analysis of information, as well as the formation of an expert decision and forecasting to improve the quality of user work and the speed of processing large amounts of information. The functional structure of maintaining operational documentation was considered, a description of data flows and business processes was carried out, and the interaction of decision support systems with the subject area was studied.

1 Introduction

In the modern world, with the naked eye, one can notice the spread of practice, when complex systems, actively developing, are built into the management activities of an enterprise. This happens among various fields, such as cybernetics, information technology, engineering, optimization, modeling, etc. This demand creates the ground for building the most efficient systems that are able to consider and use the provided knowledge to solve a large number of applied problems [1, 2].

Decision support systems are becoming the most demanded. Their widespread use can be observed in industries such as instrumentation, aviation and space industries. The name of these systems corresponds to their purpose: they are able to process incoming requests from the user and give certain expert advice on how to act in the situation that is developing on the analyzed object. At the same time, they are required to perform such an analysis at the level of an experienced person who is well versed in his field [3, 4].

In the conditions of modern scientific and technological progress, it is very difficult to take into account the current situation and management needs if the goal is to create an adequate and complete model. Modern computers are practically unable to support the implementation and further work with accurate models containing complex objects. This is explained by the fact that traditional methods of mathematical logic are used in their development, and then the system that takes into account the totality of many factors turns out to be very cumbersome. This makes it in most cases unacceptable for practical use. Otherwise, very powerful and expensive computing equipment is needed for correct

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operation, otherwise the developed system will respond very slowly to changes in the situation at the enterprise.

Given the above reasons, it becomes clear that there is a demand for the development of radically new and original methods, as well as analysis tools that could collect the advantages of both discrete control and situational modeling. This is important, for example, in flight control or test parrying of emergency situations, when it is important to quickly process information coming from instruments and operators in order to further correct their work. The temporal aspect is also important, since the analyst must track the improvement or deterioration of performance over certain specific periods.

All of the above allows us to conclude that the improvement, automation and implementation of decision-making assistance systems in the control loops of various systems are relevant [5-8].

2 Functional structure

The functional structure of maintaining operational documentation is shown in Figure 1. At the highest level, the main functions (business processes) are depicted: “activation of the SIPPR module (decision assistance system)” and “document flow”. At each successive level, there is further detailing into sub-functions. Of these, "Forecasting and Optimization", as well as "Modeling of emergency situations" deserve special attention, since information support for decision-making directly depends on their work.

![Fig. 1. The functional structure of maintaining operational documentation by the enterprise](image)

3 Description of data flows and business processes

The description of a system using IDEF0 is called a functional model, and the IDEF0 methodology itself is a tool for conveying information about a particular system using a graphical language.

The main task in developing the scheme of this system according to IDEF0 is making a decision by an expert based on the operational analysis of data collected in the documentation
database, action logs and received reports in graphical and textual form. A diagram reflecting this business function is shown in Figure 2.

Next, the main business function was broken down into the following sub-functions:
- collection of information;
- data analysis;
- formation of an expert solution;
- decision-making;
- report generation.

![Diagram](image)

**Fig. 2.** Context diagram.

The decomposition diagram of the main business function, shown in Figure 3, allows you to describe its components in more detail:
- collection of information: involves entering the operational database into the database, after which it is checked whether there were similar ones before. The database receives a request from the operator to perform test actions, after which he enters his information for analysis. The storage of operational data, the operator's request and user data are input, and the output is information for analysis;
- data analysis: it involves checking the correctness of the data entered by the operator, after which the system selects the analysis method, with its help the data is processed, and the results of the analysis are formed at the output. The input receives information for analysis and logs of operator actions;
- decision-making: involves participation in the sub-function not only of the system, but also of the user in the person of an analyst or expert, who brings the output information to a conclusion. The input is an expert solution generated by the system, it is analyzed, and the user evaluates the skill level of the operator who performed the actions. Depending on the
decision made, he can change the status of the operator by updating the data in the database, and also save the data log to generate a report for the current operator;

– report generation: it involves displaying the statistics necessary for the expert, as well as adding additional information and expert comments to the current report of the operator, after which, if desired, the report editor starts searching the database for all other information related to it and generates a complete history of its actions at the output.

![Decomposition diagram](image)

**Fig. 3.** Decomposition diagram.

### 4 Problems of building modern decision support systems

Modern decision support systems use a variety of methods to be as adaptable as possible to solving managerial problems and to assist decision makers. Among them are situational and data mining, information retrieval, knowledge base filling, simulation modeling, evolutionary calculations and genetic algorithms, neural networks, cognitive modeling, and so on. Due to this diversity, decision support systems are suitable even when choosing decisions in conditions of unstructured and semi-structured tasks containing many criteria (Figure 4).

![Interaction of decision support systems with a weakly structured subject area](image)

**Fig. 4.** Interaction of decision support systems with a weakly structured subject area.
In recent years, making optimal decisions has become more difficult, facing difficulties in the form of a rapidly growing volume and heterogeneity of information, the development of competition, and an increase in the complexity and cost of information projects. All this expands the range of possible errors and complicates making the right decision. In addition, it is still critically important for the system to have a visual form of information presentation, quickly receive new types of reporting, and analyze current and historical data.

Conventional and customary types of decision support systems cannot provide the highest level of decent analysis and form clear management impacts at those moments when the system does not have a sufficient level of awareness of what is happening in a functioning external environment, or, for example, if you have to take into account attention to a large number of conditions that are difficult to predict, especially if they are constantly changing or are subjective. Also, a problem can arise when the goals and conditions of the required level of management are unstable.

Intelligent information systems have a certain advantage that makes them preferable compared to those systems that work according to a pre-learned scheme - it is flexibility. It is she who allows us to consider a variety of solutions in any situation that arises, since it follows from the fact that the solutions were heuristic. All this is feasible, since information about all ongoing processes can be accumulated in the knowledge base, and the created knowledge base itself can change dynamically [9, 10].

The main goal for it is the ability to work with specialized operational documentation, data analysis and forecasting, as well as the creation of an interface that is understandable to analysts, but does not require large hardware costs. An important aspect is the visualization of data in the form of logs and reports, so that on their basis it is possible to make final decisions.

5 Conclusion

In the course of the research work, a description of data flows and business processes was made on the basis of IDEF0 diagrams. The system performs the assigned tasks for analysis, collects statistics to obtain graphical reports, performs the tasks of forecasting and creating recommendations in accordance with the subject area.

This system can be used to analyze data, both scenarios of emergency situations, and any operational documentation. Its use will be useful in industries such as instrumentation, aviation and space industry, since the use of analytical processing and forecasting is a necessary part of the work there. Possible users of the system can be not only data analysts and experts, but also ordinary employees, as well as other users. The implementation of this project of the information system will allow to efficiently store information, conduct quick expert analysis, improve the quality of user work and the speed of processing large amounts of information.

References


