Event-driven simulation of the state institution activity for the service provision based on business processes

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Abstract. The paper presents an approach, based on business processes, assessment and control of the state of the state institution, the social insurance Fund. The paper describes the application of business processes, such as items with clear measurable parameters that need to be determined, controlled and changed for management. The example of one of the business processes of the state institutions, which shows the ability to solve management tasks, is given. The authors of the paper demonstrate the possibility of applying the mathematical apparatus of imitative simulation for solving management tasks.

1. Introduction

In the modern world, the problem of quality is the most important factor in improving the standard of living, economic, social and environmental security. The most important component of the whole system is the quality of products or services. The international organization for standardization (ISO) defines quality as the totality of features and characteristics of products (services) that allows them to meet the resulting implied needs. The ISO standard has the following definition: "quality is the degree of correspondence between the characteristics and inherent requirements" [1-3].

The orientation of the economic and production indicators at a level, sufficient to determine control functions, which are determined by situations that may arise, characterizes the approaches to defining the quality in companies of different levels. We should note that each time a new situation arises, there is a necessity of constant changes of information flows and indicators, which complicates the correct and timely management decisions [4-7].

Systematization of information flows, their logical interrelationship and conversion are possible at a higher time and technical level in such areas as business processes. The primary use of the business processes is to increase the efficiency of the functioning of the company management due to the logical structuring of information flows. In modern conditions, it is expedient to develop new approaches that allow researchers and practitioners to use necessary theoretical and practical tools. In [8], a process-oriented approach to enterprise management, which is based on business processes, was developed. This article provides a review of the application of this approach to managing processes of state public institutions.

2. Task management based on business processes

Standards for the provision of public services formulate systematic, generalized demands so that state services can be rendered by state agencies, which normally are not applied to special cases that comprise the practice.

Fig. 1 shows a modified management structure of the company, when the production activity generates specific flow indicators that are analyzed in different structures of the company. And, on the basis of this analysis, a decision that affects the production process is made. The modification, which was performed by the authors of this article, is the inclusion of a model in business processes of the enterprise and comparison of actual inflows and indicators calculated by the model. This comparison allows one to clearly identify the direction and magnitude of changes in indicators and to determine the kind and the place of action on decisions.

The low efficiency of management decisions, made on the basis of intuition, indicates that causes and effects in complex systems, distributed in time and space, make it difficult for people to predict what consequences will be caused by one or another decision. Evaluation of the consequences of decisions when working with real systems is too expensive. Therefore, for this purpose we will use simulation.
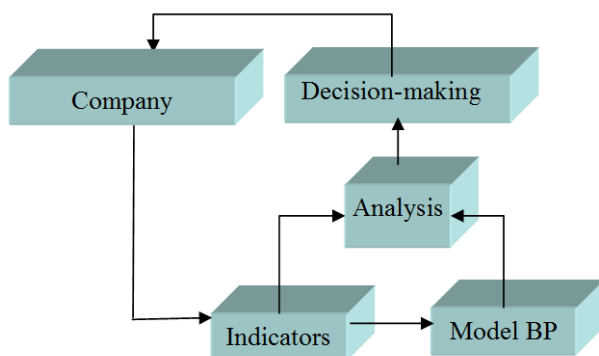

Figure 1. Streamline structure blocks showing the decision-making process based on the business processes.

3. The object of study and business processes of its activities

The social insurance Fund (SIF) is an independent financial-credit institution. Its budget is approved every year by a separate act. The Fund activity is aimed at implementation of the state policy in the field of insurance as an integral part of state social insurance. The Federal Fund, created by the Government of the Russian Federation, and its branches are formed by constituent entities of the Russian Federation. The main sources of Federal Fund establishment are the premiums of business entities for compulsory social insurance, budget appropriations and other receipts.
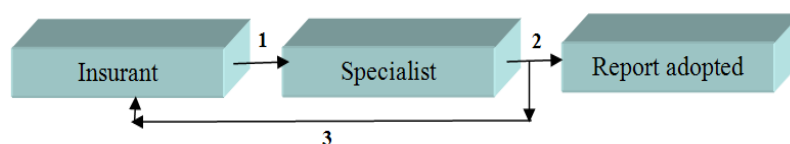

Figure 2. A business process "submission of report 4SIF".

Among many business processes [http://fss.ru], which implement the FSS, "the Reception of the report 4SIF" is central. This business process is a public service for receiving reports (calculation) provided by the companies and persons who entered into a legal relationship with compulsory social insurance against temporary disability and in connection with motherhood. The insurant generates a report and transmits it to the SIF in person to the specialist by mail or e-mail (see Fig. 2, direction 1). After verification of the report by the specialist, the error correction by the insurant (if any), a report is signed and sent to other specialists for treatment (see Fig. 2, direction 2). From the description, it is

seen that in certain cases, a business process is linear, and when conditions change (error), the iteration arises (see Fig. 2, directions 1-2-3-1).

This feature leads to the fact that the time for provision of public services is changing – increasing with the restriction that the service is performed for a fixed number of days. This problem has a strong influence on the performance of the unit, which provides this service. An isolated case, of course, can not but arise the concern for the mass provision of services to insurants, but at a certain threshold, of course, it will be affected. The solution to this problem requires that the head will make relevant decisions according to the schema (see Fig. 1).

4. Statement of the problem

The social insurance Fund covers the expenditures on social insurance. The Fund is aimed at implementation of state policy in the field of obligatory medical insurance of citizens as a component part of state social insurance. The Federal Fund is created by the Government of the Russian Federation and territorial funds are formed, respectively, by the representative of the Executive bodies of the republics within the Russian Federation and in other regions. The main sources of Federal and territorial funds are allotments of insurance premiums by business entities to compulsory medical insurance, budget allocations and other revenues. The funds are obtained from Finance mandatory medical insurance and other related activities. The budget of Federal compulsory medical insurance Fund and report on its implementation are reviewed annually by the State Duma.

It is necessary that business processes of management of the organization were understandable for the client in the terms of procedures and conditions of providing services, and for the organization – in terms of arrangement and regulation of its current activities. Distinctive features of the management of public organizations are their typical structure. Such structure of business processes is presented in a standard chain of business-processes at various levels (see Fig. 3).

It is important to note that all major business processes are related to FSS services, which are regulated by various government decrees. This imposes special restrictions on the activities of the organization in performing obligations, and on the state, as well as legal entities and individuals.
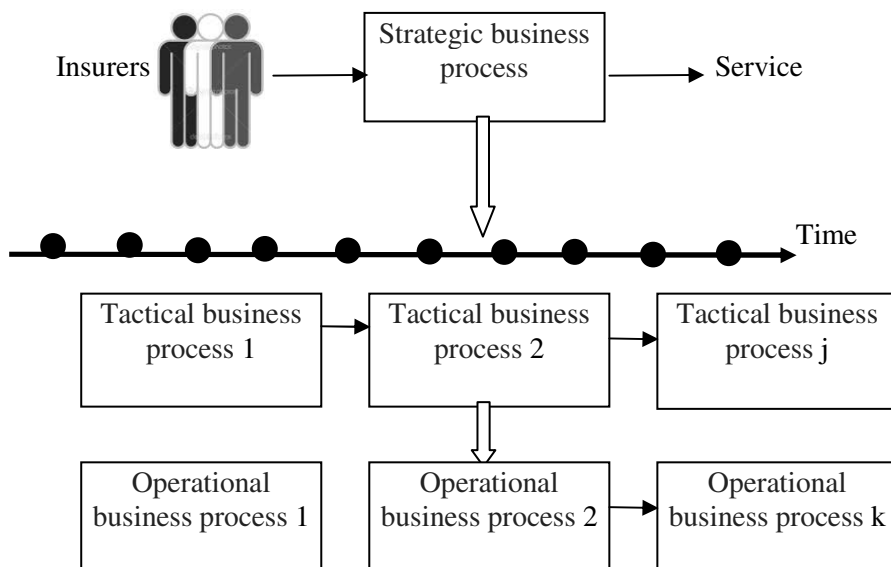

Figure 3. The structure of a business process at different levels (strategic, tactical and operational).

Note that every structural unit of the FSS exists due to a significant number of insurers and this makes the implementation of all planned indicators for services rather sensitive to influence of external and internal factors. The external factors include weather conditions and emergency conditions, and internal factors can be a breakdown of equipment, an illness and business trips, etc. So

when performing management tasks in such organization, their roles become similar, which predicts management decisions and becomes extremely important.

Effective and timely management decisions require application of new concepts of management that can quickly respond to emerging situations while executing the business processes of rendering public services. In this respect, only the construction of an intelligent management system is a reasonable step. Figure 4 shows the block diagram of the system of management of the complex system [1]. The description of the mathematical model is the following.

A formal description of business processes is called a four-ordered description [6]:

$$P = <S, R, T, I>, \tag{1}$$

where S – cost, R – resources, T – time, I – information.

It is important to note that for public organizations, the group of parameters {S, R} is specified, and the only managed parameters are groups {T, I}. Each process of the tactical level is executed for a certain period of time (see Fig.1) and carries a set of information (input and output). The execution of the strategic business process by the group is regulated by law and, accordingly, the business processes can be still only occasionally managed at a tactical level. The information option is virtually unchanged, but is important for performance (the correctness of certain forms, timeliness and accuracy specified in the form settings).

We assume that each m-th business process of the tactical level (m=1,...,M), for the lifetime of TM, receives the set of information necessary to provide quality of service (complete and on time). And if we do not care about the sequence of operations of the operational business processes involved in implementation of this business process, there is a linear dependence of the set of parameters {T, I} in the entire cycle.

5. Modeling of the business process of the state institution

Many techniques and methodologies are applied for modeling of business processes. These methodologies provide the developer with a specific language to describe real world objects using a specially designed syntax (a number of graphic symbols), reflecting the real objects and the relationships between them, as well as a way of describing the activities of the institution. Let us note that known methodologies (IDEF, ARIS, UML, etc.) allow one to build a visual (better) form of business processes, which can be verified in a variety of specially designed applications. The obtained results do not allow seeing the quantitative performance of business processes and, moreover, predicting events.

Figure 3 shows a sequence diagram of processing of the flow of requests (reports) by the example of a business process "submission of report 4SIF" (see Fig. 2). The processing sequence consists of the formation of queues of insurants and consistent reception of them by their specialists, in the course of which the test report is drawn up. A feature is its queue structure associated with the relationship to the property (public institutions, enterprises and individual entrepreneurs). It defines only one element of service that is associated with the time.
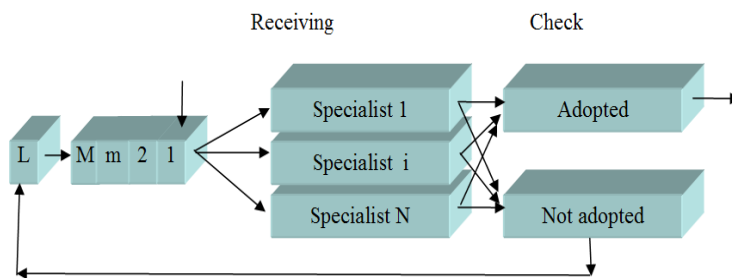

Figure 4. A diagram of the processing sequence of the flow of requests (reports).

In the course of the inspection report (submitted applications) preparation, for a certain period of time, a specialist, approved by the regulation, checks the report for fidelity of completion and then

makes two decisions: the report is either accepted or not. All specialists are $i=1,...,N$ persons and insurants are $K=L+M$ people, where $m=1,...,M$ is the number of insurants shown up to check and adopt the report for the first time, and $j=1,...,L$ – the number of insurers, who came to a specialist to check the report (of the application) for the second time. The number of insurers is much greater than that of the specialists, and the queue is random in terms of size K. To obtain quantitative results, we propose to apply the mathematical apparatus of the theory of systems of queueing system [9-10].

6. Conclusion

In the article, the approach based on event-driven simulation allowing one to simulate the performance of public enterprises for service provision is described. The institution of the social insurance Fund (SIF) was selected as a public institution and "receiving report 4SIF" – as a single business process. We have considered a queuing system as considered prerequisites for the use of event simulation and the model.

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