ANALYSIS OF APPROACHES TO THE DESCRIPTION OF BUSINESS-PROCESSES AND EVALUATION OF THEIR PRACTICAL APPLICABILITY

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Abstract: *in this paper, the authors consider existing methods for describing and designing business processes of companies (graphic-analytical, mathematical, formal), and also analyze the most common in the modern Russian and foreign literature approaches to modeling and optimizing business processes of various organizations. The article also gives evaluation to the applicability of the considered models, and you are the most significant problems in applying the tools, methods and approaches described in it.*
Keywords: *business-processes, process modeling, process description methods.*

АНАЛИЗ ПОДХОДОВ К ОПИСАНИЮ БИЗНЕС–ПРОЦЕССОВ И ИХ ОЦЕНКА

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Аннотация: *в настоящей работе авторы рассматривают существующие методы описания и проектирования бизнес-процессов компаний (графоаналитические, математические, формальные), а также анализируют наиболее часто встречающиеся в современной как российской, так и зарубежной литературе подходы к моделированию и оптимизации бизнес-процессов различных организаций. В статье также оценивается применимость рассмотренных моделей и выявляются наиболее значимые проблемы при применении описываемых в ней моделей, методов и подходов.*
Ключевые слова*: бизнес–процессы, моделирование процессов, методы описания процессов.*

Using the process approach, an organization gets the opportunity to manage its activities through the definition and description of its processes, their implementation according to the described procedures, as well as increase the company's efficiency by improving business processes according to the results of monitoring and analyzing the results of the processes.

Currently, many authors are trying to form a unified approach to the description of business processes through the development of their standard set [11], but since each company has its own specific activities, there is no ideal process model for any organization.

Widely used nowadays means of formalizing business processes are quite limited. Visual grapho-analytical models [5], created with various notations, are used as the main tool for describing processes. They provide a step-by-step description of the actions of the participants, inputs and outputs of the processes. Text and tabular descriptions of workflows, resources and information are also often used [6].

Existing business process description models can be conditionally grouped into three categories [4]:

- diagram models that describe processes using visual diagrams;
- mathematical models that give to all the elements of a business process a mathematical or formal explanation;
- formal business process description languages use special formal languages to describe the business process.

The most popular graphic methods for describing business processes include:

- ***IDEF0***(Integrated Computer Aided Manufacturing Definition) consider the logical relationship between the specified works instead of the temporal sequence (workflows).
- ***IDEF3*** describes the organization's process model as an ordered sequence of events with a simultaneous description of objects related to the corresponding process.

• ***DFD*** (data flow diagrams, Диаграммы потоков данных) reflects the sources and targets of the data, storages and data streams accessed in the description of the system.

• EPC(event-driven process chain) uses the description of the structure of the sequence of decisions, functions, events and other elements of the business process.

• ***SAS*** (state automated system) is a description of processes through graphical-analytical interaction schemes.

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• ***BPMN***(Business Process Model and Notation) is a set of symbols for displaying in the form of diagrams of elements of processes and business processes.

• ***UML***(Unified Modeling Language) uses graphic symbols to describe the abstract business process model (UML model).

When using the mentioned above approaches to the description of the process model of the organization, management and optimization of business processes is reduced to the implementation of individual measures for their formalization and partial improvement [12]. At the same time, the optimality and effectiveness of the activities carried out is rather difficult to evaluate, since there are no mathematical grounds for carrying out the appropriate optimization [10].

The mathematical models describe the description of business processes are:

• model proposed in the work of Hofacker I., Vetschera R.[2];

• business performance evaluation model developed by Valiris и Glykas, [1] etc.

The formulation of mentioned mathematical models describing business processes is provided below.

Model proposed in the work of Hofacker I., VetscheraR.[2], suggesting the presence of I_{glob} inputs in the process and O_{glob} outputs of its performance. According to this model, in general, a business process can be described as:

$P = \{(a_i, p_i)\}$,

Where (a_i, p_i) - set of ordered pairs;

a_i– activity;

p_i – activity a_i, start time.

Using this model for constructing business processes is possible under the following two conditions:

1. For all activities a_i all resources (inputs) encountered in the process I_i must either refer to the inputs set I_{glob}, either form in any activity a_j, which is characterized by $p_j<p_i$. For all material resources, each resource should be used only within one activity.
2. All outputs O_{glob} are created in any of the activities a_i.

The elements of performance evaluation according to the model of Valiris and Glykas include [1]:

• fragmentation / concentration of workers, determined by the ratio:

$$\frac{number\ of\ employees\ involved\ in\ t\square e\ process}{total\ number\ of\ company\ employees}$$

The higher this indicator, the higher the degree of concentration of workers.

• equivalent salary, which determines whether the process can be carried out at lower cost, for example, by relocating employees within the company or outsourcing the business process to a third-party organization. This salary is calculated as:

$$\text{Equivalent salary} = \frac{total\ process\ costs}{number\ of\ employees\ involved\ in\ t\square e\ process}$$

In addition to the models described above, an example of the mathematical description of the company's processes can be the Calculus of Communicating Systems (CCS), developed by the English scientist Robin Milner in 1980 [9]. The basis of this approach to calculating processes is a model of indivisible communication between exactly two participants. Set of CCS processes can be defined as:

$$P ::= \emptyset\ |a.P_1|\ A\ |P_1 + P_2|\ P_1|P_2|P_1[b/a]|P_1\backslash a,$$

Where $\emptyset$ - corresponding CCS process

$a.P_1$ - action a, ongoing as a process P_1,

A – identifier referring to the process P_1 ($A \stackrel{def}{=} P_1$),

P_1+P_2 – processes that can go on either as P_1, or as P_2,

$P_1| P_2$ – processes occurring simultaneously,

$P_1 [b/a]$ – process P_1, in which actions a are renamed into actions b,

$P_1\backslash a$ – process P_1, not including actions a.

There are other similar models for processes calculating:

• Communicating Sequential Processes (CSP) Anthony Hoare, developed by the scientist in 1978-1985 [8]. It is a formal language for describing interaction in parallel systems.

• Pi - calculus, which is a parallel computing model. Pi - calculus considers [7] any action as a sequential sending and receiving of messages by business processes through communication channels whose names are the initial concepts of pi - calculus.

In general, the names of these channels in the system of pi-calculations look like this:

$x, y, \in X$.

The process in pi-calculus methodology may look like one of the following ways [7]:

$c(x).P$ – input, receiving x data from channel c

$\bar{C}(y).P$ – output, transfer data y over channel c

$P|Q$ - parallel execution of two processes

$!P$ – process synchronization (replication) P

$(vx)P$– declaration of the channel in use and the following process

τ_P – action inside the process

0 – empty (zero) process

• PEPA – Performance Evaluation Process Algebra, developed by Jane Hillston [13].

Performance Evaluation Process Algebra is a language for modeling distributed systems. PEPA models [3] are based on the composition of components that perform individual actions or collaborate with common ones. Each action comes with an estimate of the speed at which it can be performed. Using such a model, the system developer can determine whether the candidate process meets both the behavioral and duration requirements for it.

Despite the diversity of approaches to the mathematical description of the processes associated with time constraints, uncertainty, etc., the current models for calculating processes have some common features:

• interactions between independent processes are modeled through the transfer of messages, not though changes in the resources / states common to the specified processes;

• systems and individual processes are described using specific operations to combine a limited set of primitives.;

• algebraic laws are formulated for performing operations on processes that allow reasoning on process expressions.

As we can see, despite the diversity of approaches to modeling business processes of organizations, until now, little has been worked out on the creation of complete adaptive models that organizations could apply regardless of their size and type of activity, and would not bear significant costs for companies on introduction.

References / Список литературы

1. *Valiris George, Glykas Michalis,* 2004. "Business analysis metrics for business process redesign", Business Process Management Journal. Vol. 10 Issue: 4, Pp. 445-480.
2. *Hofacker I., Vetschera R.,* 2001. Algorithmical approaches to business process design. Computers & Operations Research.№ 28, Pp. 1253–1275.
3. PEPA Club. [Electronic resource]. URL: http://www.dcs.ed.ac.uk/pepa/about/ (date of acces: 02.12.18).
4. *Vergidis K., Tiwari A.,* 2008. Business process analysis and optimization: beyond reengineering. IEEE Transactions on Systems, Man, Cybernatics – Part C: Application and Reviews: 1–14.
5. *Galkova Ye.A., Alfimtsev A.N.* Mathematical description of a business process using pi-calculus // Electronic Journal "Youth Scientific and Technical Bulletin", Bauman Moscow State Technical University.
6. *Madera A.G.* Modeling and optimization of business processes and process systems in conditions of uncertainty // Business Informatics, 2017. № 4 (42). Pp. 74–82. DOI: 10.17323 / 1998-0663.2017.4.74.82.
7. *Matorin S.I., Mikhelev S.I. Matorin M.V.* Formalization of models of processes based on pi-calculus // Scientific Gazette of Belgorod State University. Series: Economy. Computer science, 2009. № 9 (64).
8. *Mashkov I.V.* New in business process management - S-BPM methodology and Metasonic / V Scientific-practical conference "Investments. Innovations. Information technologies". March 1-2, 2013.
9. *Mironov A.M.* Process Theory - Pereslavl-Zalessky: "University of Pereslavl", 2008. 345 pages.
10. Modeling and decision making in management. Guide for future top managers - Moscow: URSS, 2014.
11. *Ponomareva O.A.* Construction of the ontology of the reference model of business processes // Technologies for developing information systems - TRIS-2016: materials of the VII International Scientific and Technical Conference. Volume 2. Taganrog: SFU Publishing House, 2016. P. 70-74.
12. *Robson M., Ullakh F.* A practical guide to business process reengineering / Trans. from English by ed. ND Eriashvili. M.: Audit, UNITI, 1997. 224 pages.
13. «Problem-Oriented Information-Computing System». [Electronic resource]. URL: http://poivs.tsput.ru/ru/Math/Algebra/GeneralAlgebra/CalculationOfProcesses/CalculusOfInteractingSystems / (date of acces: 03.12.18).
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