

The business processes digitalization in small enterprises through mathematical modeling

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Abstract – The article deals with the problems of digitalization and business processes modeling in small and medium-sized enterprises according to the ISO 9000 standards, and considers existing approaches to describing business processes and further improving the cost management system in order to reduce spendings. The logic of model building, digitalization, the structure of the business process, approaches to the description of processes are discussed, methods for optimizing the business process depending on the results of their visual evaluation are proposed. The article identifies and justifies the need to use the seven main stages of describing a set of separate business processes in a small and medium-sized enterprise. The features of notations and the instrumental environment used for modeling are analyzed, the capabilities of ARIS eEPCs, IDEF0, IDEF3 notations are compared. In the proposed study, the author shows various interpretations of the “business process” concept in the activities of small and medium-sized enterprises, which are one of the foundations of the economy of the modern Russian Federation. Based on the study, the author states the need for business processes digitalization, proposes a way to manage costs in small and medium businesses, designed to optimize the volume and structure of consumed resources depending on the current goals of the organization.

Keywords — small business, digital economy, business process, ISO 9000, modeling, optimization of business processes, process structure, classification processes, cost management, reengineering, ARIS eEPCs, IDEF0 notation, IDEF3, DFD.

I. INTRODUCTION

The transition of companies to the digitization of business processes in the next few years is predicted by the entire Russian economy, this process will not bypass the small business of the country. In the near future, this will lead to a change in the business model, an increase in labor productivity and a reduction in bankruptcy in small business.

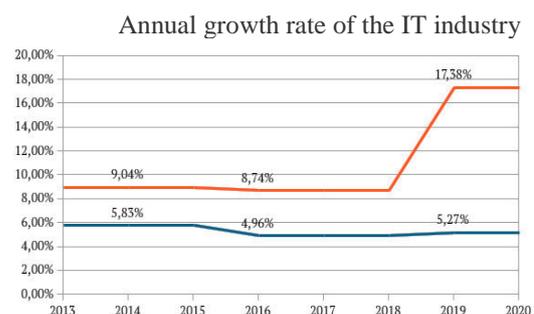
In the conditions of Russia's surmounting the economic crisis that emerged in 2018, in 2019 we are already seeing GDP growth at a record 2.3% in the last 6 years, which exceeded the latest expectations of the Ministry of Economic Development and the Central Bank of the Russian Federation, which, coupled with a fairly low inflation (about 4.3%), opened up new opportunities for development for small businesses in the country. However, only 3.4% of small companies from newly formed in the Russian Federation continue to exist on the market for more than three years, which is significantly less than in countries similar to Russia in the number of entrepreneurs: Norway - 6.15%, Finland - 6.65%, Spain - 8.39%, Greece - 12.6%. Accordingly, small

enterprises are faced with the need to improve the cost management system in order to reduce expenses. One of the most effective tools for improving the management system is digitalization and modeling of business processes.

It should be noted that about half of all Russian companies - 164.8 thousand, or 43.6% - are registered in Moscow, St. Petersburg and adjacent regions; digitalization and modeling of business processes of companies may allow developing small business in the regions of Russia more actively. Despite the emerging prospects at the beginning of 2019, the number of closed small enterprises dominates the newly formed ones. It is obvious that the formation of a successful small business should be supported by the state. First of all, the conditions for the development of digitalization and infrastructure to support small and medium businesses have been created. For example, in the US, according to the report of McKinsey Global Institute for January 2017, 51% of the tasks performed by modern American workers in various sectors of the economy (including small business) will be automated one way or another by 2055. This will «save» employers \$2.7 trillion in salary.

In 2019, the Russian Federation approved the regulation on the management of the national program «Digital economy of the Russian Federation». The document provides for the approval of the procedure for the national program passport [8] and its federal projects developing, as well as monitoring and control over the implementation of Federal projects within the national program. It is planned to spend 1 trillion 634.9 billion rubles to execute the national project. This program should give impetus to the development of including small businesses in Russia as well.

The growth of IT technologies in the country close to the proposed accelerated IT development scenario gives additional optimism in the digitization of the economy (fig. 1).



Baseline scenario – blue graph
Accelerated scenario – red graph
Fig. 1 Size of the Russian IT industry.

Source: <https://m.lenta.ru/> (date of access 25.03. 2019)

There are various interpretations of the «business process» and digitalization of the economy concepts in foreign and Russian economic literature. The most correct definition is given in the international standard ISO 9001: 2008, according to which a business process should be understood as a sustainable, purposeful set of interrelated activities that converts inputs into outputs of value to the consumer according to a certain technology [4].

It should be noted that it is acceptable to use the term «process» as a synonym, since its meaning in this case does not overlap with the meaning of the term «process», used in other fields of knowledge (probability theory, mathematical statistics, etc.) in a different context.

The functioning of business processes takes place in the formation of its own business information infrastructure (common information and analysis centers, consulting and training centers, etc.), in the creation of which all interested parties should participate. It will meet the ever-increasing information needs of small businesses [10, p. 135].

Each organization and each small and medium-sized enterprise has its own specific structure of the process, but regardless of the specifics of the organization's activities, the following main components of this structure can be identified as:

- process owner / master - an official who has process resources at his / her disposal, with certain rights, areas of responsibility and authority;
 - process technology - the order of implementation of the input and output conversion activities;
 - process management - the activity of the process owner in analyzing data on the process and making management decisions;
 - the resources and costs required to complete the process.

To solve the tasks of cost management, it is proposed to optimize business processes, which is possible only if there is a described model of existing processes in the enterprise. The methodological toolkit for making management decisions in the context of processes assumes a set of techniques for conducting the so-called plan-factor analysis of performance indicators-indicators [5, p. 213].

II. THE LITERATURE REVIEW

The most interesting work on this topic is proposed by August-Wilhelm Scheer, a German entrepreneur, a specialist in management and information technology for organizations, a professor at Saar University [9]. Some approaches have made it possible to extend the methodology by transferring the organizational and functional models. A great contribution to the radical redesign of business processes was made by Hammer M., Champi J. [2].

III. METHODS

In identifying the problem areas of the model «as is» the evaluation of the graphic schemes of the process which involves revealing the weaknesses of the process and the possibilities of their elimination plays the crucial role.

The following methods for business process optimization can be applied depending on the results of the visual assessment.

1. The method of vertical «compression» of the process.

This method involves reducing the levels of functional hierarchy used in the implementation of process operations and decision making. It is mainly used if there are lengthy reconciliation procedures in the process. In practice, the number of functional hierarchy levels required to complete the process for large enterprises can reach 8–10. This increases the execution time of the business process significantly and reduces its effectiveness.

The measures that can be taken under this method may include the following:

- delegation of decision-making authority;
- application of software tools to speed up the approval process;
- use of electronic document flow, accompanied by the use of electronic digital signature (EDS).

2. The method of horizontal «compression» of the business process.

It implies improvement of the process and the efficiency of the operations of the process at the same level of the functional hierarchy.

3. The method of eliminating duplication of operations.

This method identifies the operations of business processes that duplicate each other in whole or in part, determines the cause of duplication and develops measures to eliminate it.

4. The method of creating additional operations. It provides for the identification of missing operations and their implementation in the process.

5. The method of eliminating unnecessary process interfaces.

When transferring work to other divisions, so-called business process interfaces arise: information and material resources are transferred from one division to another.

In some cases, this method is not applicable (for example, for the production process, rolling from shop to shop), then the following method can be used.

6. The method of eliminating time gaps.

Some other optimization methods can be applied, for example, the method of creating additional interfaces, the method of creating control functions, etc. [4, p. 222] can be used depending on the goals and objectives of cost management, as well as the particular business process specifics.

IV. RESULT AND DISCUSSION

The set of critical knowledge for each business process may vary depending on the goals and objectives of cost management. It is also possible to use one of the following approaches to the description of processes.

The first approach involves the selection and description of a set of individual business processes of an organization or enterprise, and it is advisable to use it in the case of costs managing of a single unit. It allows you to solve the problem of describing a separate set of business processes quickly.

The second approach is aimed at creating a comprehensive digital model of business processes and is intended for organizations engaged in a full cycle of designing a system of business processes for cost management at the enterprise level.

Within the framework of the first approach, there is a typical plan for describing business processes, which involves the implementation of seven stages.

At the first stage, the decision to describe the business process takes place. The head of a small enterprise or business unit makes the decision on the beginning of reengineering. When making a decision, the object and purpose of the business process description should be defined

Stage 2. Selection and appointment of the owner / master of the business process is carried out. This action is also performed by the head of a small (medium) enterprise or a business unit.

Stage 3. The operations that make up the business process in a small enterprise are determined.

Stage 4. It involves identifying customers and business process outputs. For each client of the business process, the outputs of the business process are determined.

Stage 5. It is necessary to identify the suppliers and inputs of the business process. The inputs to the business process are defined for business process provider.

The collection of information necessary for stages 3-5 is carried out by conducting interviews with employees and heads of departments, studying documents and monitoring the activities of the business process.

Stage 6. It is to identify the resources of the business process. The determination of business process resources is carried out on the basis of the information contained in the documents, as well as obtained during interviews with the business process owner, manager and employees.

Stage 7. There is a formation of digital graphic diagrams of the business process with the help of the selected notation and tool environment. Graphical representation of the business process plays a crucial role in its successful optimization.

The choice of format for describing a business process should correspond to the levels of decomposition of the business process. When describing low-level processes, it is advisable to use ARIS eEPCs notation [6].

eEPC model (extendedEvent-DrivenProcessChain is an event-driven process chain) was developed by specialists from IDS Scheer AG (Germany), in particular, Professor Scheer.

This notation presupposes a combination of functions, where initial and final events are defined for each function. In contrast to functions that have some duration, events happen in an instant. Events can trigger the start of a sequence of functions (triggering events), its completion (terminating events), or a change in the execution order of functions within a business process (switching events). One event can trigger the execution of several functions simultaneously, and, conversely, a function can be the result of the occurrence of several events.

IDEF family models approved by Gosstandart of Russia [4] are the most common among modeling methodologies. However, in IDEF0, IDEF3, DFD models, events are not included in the functional flow, which is a significant drawback of these notations, since events describe the state of an object and allow you to control the business process or influence its execution.

But when you reflect all the conditions and limitations that determine the execution of functions, you need to describe a large number of events and incoming information in ARISeEPC, which makes the model quite cumbersome. IDEF3 notation also has this drawback. IDEF0 tool environment has an advantage in this respect, but at the same time IDEF0

models do not provide for the logic symbols use to describe the process execution.

Thus, the description of upper-level business processes should be done in IDEF0 notation, while the description of business processes at the lower level should be done with the help of ARISeEPC.

When deciding on the format of doing business, the most important reasons for choosing are access to resources (including technology) and response to market signals. If a company already exists, its scope for change is determined by a pool of various stimulating and restrictive factors [7]. So, it is revealed that «costs» and «expenses» are identical concepts, meaning the value terms of all the resources used in the production and economic activities of the organization during the reporting period. Expenditure is an attrition of assets or an increase in liabilities, resulting in an impairment of capital not related to the appropriation of profit among shareholders. This term is narrower than «costs», so it is advisable to talk about cost management, not expenditure management.

For cost accounting purposes, various classifications are used. The main ones are cost groupings by composition (single-element and complex); by economic content (costing items and economic elements); in relation to the volume of production (fixed and variable); by the method of inclusion in the production cost (direct and indirect); by the role in the technological process of products manufacturing and purpose (basic and overhead).

Cost management in a small (medium) business is designed to optimize the volume and structure of used resources, and depending on the current goals of the organization, it can have the following tasks:

- attraction of additional resources, entailing an increase in the costs of this enterprise;
- reduction of used resources, leading to cost minimization;
- ensuring the highest possible return on the use of available resources without increasing their consumption, accompanied by keeping the costs at approximately the same level or cost cutting.

If a small enterprise wants to be successful, its activity should be based on development. The development is based on existing and potential opportunities both inside and outside the enterprise [1, p. 69]. If a small enterprise is in crisis conditions, cost management should ensure their reduction. In such a case, it is proposed to optimize business processes using an integrated approach, which includes the following steps.

1. Comprehensive cost analysis involving:
 - factor analysis of expenses on ruble of commodity products, which allows to identify areas for further process optimization;
 - cost analysis of economic elements required to search for reserves depending on the nature of production (labor-intensive, capital-intensive or material-intensive);
 - cost analysis by costing items, which allows to determine the object of the next stage of analysis – direct or indirect costs;
 - analysis of indirect costs or factor analysis of direct costs (labor or material costs) in order to determine the reasons for their increase.
2. Selection of business processes, as a result of which the most significant costs are formed; formalization and evaluation of the selected business processes in order to determine the directions of their improvement.

3. Optimization of these processes to reduce the cost of the consumed resource.

The business process should be understood as a sustainable, purposeful set of interrelated activities, which, according to a certain technology, transforms inputs into outputs of value to the consumer. There are the following classifications of processes: depending on the place in the organizational structure of the enterprise (over-arching processes and processes of divisions); depending on the place in the hierarchy of the organization objectives (business processes of the upper level, middle level, lower level); depending on the purpose (key processes, auxiliary (supporting), business development processes); on the relationship with the external environment (processes starting and ending with the interaction with the external environment; processes starting in the external environment and ending in the organization; processes starting in the organization and ending in the external environment; processes starting and ending within the organization).

V. CONCLUSION

It is obvious that the digitalization of the economy is not only an economic issue, but also a matter of national security in the context of sanctions against the Russian Federation. Digitalization of business processes is in fact the transformation of business in a digital reality based on data. Digitalization is first of all new business processes, organizational structures, regulations, new role models in business, and strategic data management becomes the most important process of digitalization. In the modern period of recovery from the crisis, urgent measures are needed in different planes of modernization, including in the field of digitalization and the introduction of modern methods of business process management. As a result of the formalization of business processes, it is possible to conduct their qualitative assessment and, based on the results obtained, to optimize the

activities of small and medium-sized enterprises and organizations, which will increase their competitiveness and sustainability. And in the end it will become an element of improvement of the entire economic system of the Russian Federation.

References

- [1] O. A. Evseeva, Formation of strategy of development of industrial enterprises of small and medium business based on the efficiency of its total potential. Business. Education. Law. Bulletin of the Volgograd Business Institute, 2011, 2(15), pp.68-72.
- [2] M. Hammer, J. Champy, Reengineering the Corporation: A Manifesto for Business Revolution. 3rd edn., 2001.
- [3] M. Hammer, J. Champy, The Corporation Reengineering: Manifesto of the revolution in business. Per. from English, SPb., 1997, pp. 332.
- [4] State standard of the Russian Federation GOST R ISO 9000-2008 "quality management System. Fundamentals and vocabulary" Gosstandart of Russia, M, 2009, 35 p.
- [5] E. A. Ivanov, Model end-to-end budgeting in multi-organizations holding type. Business. Education. Law. Bulletin of the Volgograd Business Institute, 2012, 2(19), pp. 207-214.
- [6] I. I. Kulagina, D. V. Semikin Approaches to sustainable economic development of the region. Business. Education. Law. Bulletin of the Volgograd Business Institute, 2013, №1 (22), pp. 191-195.
- [7] S.V. Orekhova, Doctor of Economics, Associate Professor, Ural State Economic University, Yekaterinburg, Russia TERRA ECONOMICUS, 2018, volume 16 (number 4), pp. 77-94.
DOI: 10.23683/2073-6606-2018-16-4-77-94
- [8] Passport of the national program "Digital economy of the Russian Federation" (app. by Presidium of Council at the President of the Russian Federation on strategic development and national projects, the Protocol of 24.12.2018 N 16).
- [9] August-Wilhelm Scheer, Business process modeling. Scientific edition, Moscow, 2000.
- [10] V.V. Zverev, R. A. Nabiev Development of information infrastructure to support entrepreneurship as an effective means of reducing transaction costs. Business. Education. Law. Bulletin of the Volgograd Business Institute, 2011, №1 (14), pp. 133-136.