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ISSN: 1992-8645

www.jatit.org



E-ISSN: 1817-3195

# BUSINESS PROCESS VERIFICATION WITH INTEGRATED SIMULATION METHODS: FOCUS ON "CUSTOMER ENGAGEMENT»

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#### ABSTRACT

Many business process-modeling techniques cover and address various aspects of the business process. A limited number of these process models allows further quantitative analysis, and only a few allow structuring the process. This article discusses and classifies the main methods of modeling business processes from the view of their analysis and the possibilities of optimizing the business process taking into account the client's attracting. There are three types of methods, on the basis of which the choice of representative methods of business process modeling is classified. A similar classification is presented for the approaches of analysis and optimization of business processes identified in the relevant literature. The main contribution of the article is that it determines which business process methods are suitable for analysis and optimization, and also it highlights the disadvantages of such approaches. This article presents a modern review in the field of modeling, analysis and optimization of business processes with the emphasis on the ways to attract customers, which have not received sufficient coverage and support in the literature of post-Soviet countries. Organizations can make a big profit for themselves by having a documented business process model available. This gives it's activities greater transparency, which in turn is an additional stimulating factor of investment attractiveness for the organization. For developing companies seeking to ensure competition in the market, it is especially important to have a clear understanding of the role of business process modeling and its necessity, and its place in the organization. Today, most organizations are actively trying to create their own models business processes or use existing models, and there is a reason for this their reasons, which can be easily explained by various factors.

Keywords: Business-Process (BP), BP Analysis, Petri Nets, BP Modeling, BP Optimization, Simulation Methods.

#### 1. INTRODUCTION

One of the most advanced methods of managing an organization that allows achieving the greatest efficiency is the so-called process approach to management, which consists of selecting business process chains in the organization and managing these processes to achieve maximum efficiency of activity [1]. The process approach allows management to take a comprehensive look at the problems of managing an organization and suggests ways to solve these problems [2]. To simulate the company's behavior over time and analyze the implementation of business processes in terms of resource adequacy and efficiency of their using, simulation models are developed. Simulation modeling methods allow you to generate specific business cases of business processes at a given time interval and analyze the indicators obtained from the simulation results. Analysis of simulation results allows you to identify bottlenecks in the implementation of business processes, identify the most time-consuming functions, cost centers and organizational units with a low utilization rate, conduct a functional and cost analysis and develop recommendations for optimizing and improving defective processes.

In terms of computer implementation, simulation modeling is a comprehensive method of studying complex systems on the computer, including the construction of conceptual, mathematical and software models, as well as performing a wide



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communication in the country. Burukhina O. S., Serbin S. A., Vartanyan S. V., Maltceva I. N. have developed a modern doctrine of introducing business processes into the PR activities of several firms, in particular the Institute competition MultiComfort House", conducted by Sen-Goben ISOVER [9]. Kinash I. P., Arkhypova L. M., Polyanska A.S., Dzoba O. G., Andrusiv U. Y., Iuras I. I. proposed a method of economic characteristics of the development of tourist enterprises, which confirms that business processes should be tested at all levels of management systems [10]. The researchers presented a methodology for assessing the profitability of the enterprise, there they proved

implemented using the tools of mathematical methods, special software and programming tools [3]. The simulation obtained in this way is an

independent software and computational complex, which allows evaluating the effectiveness of existing business processes and analyzing the possibilities of their optimization, associated with the elimination of problem areas or with engineering of new processes.

range of purposeful simulation experiments,

processing and interpretation of the results of these

A simulation model is a type of model, which is

The use of methods of mathematical, including' simulation; modeling; and making informed decisions on the management of the organization on their basis is a competitive advantage and allows you to reduce the risk of failure when restructuring business processes.

Usually researchers in this field focus on certain aspects of business processes, offering methods and models specific to a particular industry. There are also a number of universal tool environments on the market, which have broad capabilities, but at the same time are characterized by excessive complexity, a fairly high price, and significant costs of implementation.

Due to the multitude of studies in the field of automation of analysis and optimization of business processes, the main issue remains the creation of a universal methodology

The structure of indicators for evaluating the effectiveness of business processes includes the following targets:

- the total value of the costs on employees while performing functions;

- the total value of other expenses incurred in performing functions;

- the total value of the total costs on performing the functions;

- number of functions performed;

- total time for function execution ;

- total working hours of employees;

- number of functions, accoplished by

employees;

- coefficients of the use of organizational units.

These indicators, obtained after simulation, allow us to understand the degree of efficiency of the business process. The other, not quantifiable indicators are equally important, for instance bottlenecks in business processes, excess approvals, employees performing useless work, and many others [3]. If quantitative performance indicators can be obtained as a result of a simple run of the model, then qualitative indicators [4]: - only after a thorough and comprehensive study of the model by the analyst. This article discusses the optimization of the business process with a focus on" Customer attraction " as one of the most difficult to manage business processes in a small trading company, both in terms of the number, cost and time of performing functions, and in terms of the number of people involved.

Various tools and methodologies can be used for modeling. This article uses the ARIS methodology implemented in the ARIS Toolset. The models were built, debugged, and run using the ARIS Toolset 6.2 software package [4].

Abdelkafi and Teusher proposed a business model of sustainable development aimed at creating value for various stakeholders and the natural environment [5]. This model is based on creating an extended feedback loop between the value for the consumer, the value of the company and the value for the environment. Chapman R. L., Soosay C., Kandampully, J. in their work, they argued that business processes play an important role in innovative service-based logistics services, transformed from a business concept of transportation into a service for all the logistics needs of customers [6]. In the work of Fomina I. G., Makolski M. S., innovative cooperation between universities and high-tech enterprises of Russia is analyzed [7]. It is established that the level of innovative development of Russia was one of the lowest in the world and the new model of business partnership between educational institutions and high-tech companies is based on the introduction of effective business process management.

Scientists from Estonia Bikse V., Lusena-Ezera

I., Rivza B. we conducted research on the creation

of high-tech enterprises and the reform of business

processes in their activities [8]. They reviewed the

implementation of businesses and linked the startup doctrine with the business incubator, which shows

the prospects for the formation of innovative

he profitabili

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E-ISSN: 1817-3195

the relevance of introducing the latest business processes into the marketing system.

Compared to other studies, this paper simulates the model for its further scaling, which indicates its versatility. The purpose of business process analysis is to identify new information to solve problems and optimize customer engagement to create important competencies in the company.

# 2. METHODS

ARIS includes a set of tools that can analyze and model enterprise performance. Modeling in ARIS begins with a description of the organizational structure of the company and business processes.

The main advantage of ARIS over other tools is the availability of well-developed graphical tools to present the generated models.

In the process of modeling business processes, first consider any moment of the company individually. Then a merged model is created that reflects the relationship.

The leading business model of ARIS system can be considered eEPC, which is an extended eventdriven chain of business processes. It can be said, that it extends the capabilities of IDEF0, IDEF3 and DFD, has its advantages and disadvantages. It uses a sufficient number of objects, which are connected to each other by different types of links. In eEPC a business process is a flow of sequentially organized procedures, arranged in chronological order [1].

In ARIS templates are schemes consisting of various objects, such as events, functions, organizational units, documents, etc.

The objects are linked by different types of relations. Each object has a set of attributes, assigned to it to enter additional information.

ARIS is a modern approach to the structured description and presentation of organizational activities in interrelated and complementary graphs that are easy to understand and analyze. ARIS methodology applies the principles of structural analysis.

Structural methodology is aimed at a complete representation of the structure of material, information, financial and managerial flows, as well as the display of the organizational structure of the enterprise [2].

A meta-analysis was conducted to analyze the research questions. The structured literature review was adapted in accordance with the guidelines for systematic literature review presented by Checez-Kecmanovich [11]. The literature review was based on research papers that were available through Scopus, Academic search databases. The initial criteria for selecting the article for inclusion in the review were based on the object of presented research. The business process was chosen as the object of scientific research. Keywords for the search were built as a combination of words: business process, analysis, productivity, evaluation. For the literature review, scientific papers related to the above keywords were selected. For the analysis of the literature, full-text articles written in Russian and English and published in journals that apply peer review were included[12].

Process-oriented management depends as one of the most effective tools for conducting a stateowned enterprise in the works of great scientists, but video information and the sociological prerequisites for conducting business processes are sufficiently reformulated in them. The long-term modification of this work projects a set of information-analytical, theoretical and theoretical factors to refute the gradual method for selfidentification and management of businessprocesses at a state-owned enterprise and to recreate the flywheel of the performance characteristics of the process, a method that assumes the formation of subjective coefficients of business-processes of a state-owned enterprise [13].

One of the first stages of the analysis business processes and functions are the application of the Pareto principle of 20 to 80 [14], according to which it is necessary to select priority ones from all business processes, the analysis and optimization of which should be done first, for which it is necessary to determine the priority criteria:

1) the importance of the business process;

2) the problematic nature of the business process;

3) the possibility of making changes to the business process from the point of view of the cost side of improvement. For more successful analysis at this stage, it is necessary to create business processes at this enterprise a group of more competent managers in this area [15,16].

# 3. RESULTS

Description of the "Customer Attraction" business process let us consider the route map of the business process "Customer Attraction" (Figure 1). New customers appear in the company in one of two ways: they appeal independently or by sales representatives. After the presentation is made and the "Commercial Offer" is prepared, the client refuses, agrees, or demands a high discount. The

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ISSN: 1992-8645

www.jatit.org

E-ISSN: 1817-3195

approval of non-standard discounts is under the control of the head of the sales department [17].

The main service blocks of any business process model are functions, events, and positions. A function is a task, operation, or action, performed on an object to achieve one or more goals. A position is a type of organizational unit that performs functions. A business process is a chain of functions performed sequentially by employees holding various positions [18,19]. As a result, of each function, one or more events are generated according to the priority of their occurrence and the logical operators that connect them. One of the start events can carry out the start of a business process with a predetermined frequency.

One of the characteristics of each non-starter object of type "event" is the priority for this event. Thus, the moments of occurrence of all events, except the starting ones, will obey the route map of the business process and the priority of the occurrence of events at the branching points. The priority each of them is the same. The only characteristic of an object of the "position" type is the number of employees who hold this position. In total, 11 employees are involved in the business process, occupying 5 positions. Employees are assigned to positions as follows [20,21]:

secretary – 1; sales manager – 6; sales representative-2; TV marketer-1; head of sales department - 1.



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Figure 1. Route Map Of The Business Process "Attracting A Client»

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ISSN: 1992-8645

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E-ISSN: 1817-3195

Function	Min. execution time, h:m:s	Max. execution time, h:m:s	Personnel execution costs, USD	Other expenses, USD
Accepting an application	00:07:00	00:13:00	1,50	2,00
Finding out the client's needs	00:10:00	00:25:00	4,00	1,00
Offer a meeting to the client	00:20:00	00:30:00	2,00	2,00
Customer Search	02:30:00	05:30:00	3,00	9,00
Checking the completion of the questionnaire	00:30:00	01:30:00	6,00	0,00
Departure for a meeting with a client	01:00:00	01:30:00	6,00	6,00
Preparation of a commercial offer	00:50:00	01:40:00	4,00	3,00
Preparation of the buyer's order	00:20:00	00:30:00	3,00	1,00
Finding out the reason for the refusal	00:05:00	00:10:00	1,00	0,50
Approval of the discount	00:20:00	00:30:00	5,00	1,50
Invoicing for payment	00:10:00	00:20:00	2,00	3,00

#### Table 1. Characteristics Of Service Blocks Of The "Function" Type

Table 2. Differences In The Characteristics Of The Models For Initiating The Process Of "Attracting A Client" – "A
Request Was Received From A Client" And "Visiting The Object»

Model	Received a request from the client	Departure to the object
Start of the working day, h:m	09:00	09:00
The duration of the working day, hour	9	9
Number of working days per week	5	5
Frequency, days	7	7
Average number of processes per day	14	10

For each specific function, an estimate of the minimum and maximum time for its implementation was obtained, as well as the cost of paying for the work time of the employee performing this function, as well as the cost of making phone calls, using the Internet, the cost of gasoline, metro travel, and so on [10,22]. A list of the cost of performing each function is given in Table 2.

The execution of each business process is initiated by one or more start events. Thus, the input flows for each business process are events, the frequency of which is determined by a certain distribution law. To generate events with a certain frequency, each of the starting events has a nested model of the "process initiation model" type, which determines the order and cyclicity of event generation [23]. In the "attracting a client" model, two events are the starting ones: "a request was received from a client" and "departure to the object" [24]. Both of these events have the same algorithm for the initiation process, characterized by several characteristics. The differences in the characteristics of the initiation models of the process "attracting a client" – "a request was received from a client" and "visiting the object" are shown in Table 3.

Thus, in the "customer acquisition" business process, a certain number of instances of business processes are created during business hours of each day. This process is repeated the number of times corresponding to the number of working days in the week.

The results of the simulation of the business process "attracting a client". The model run involves setting the simulation interval (in this case, the interval corresponds to a week) and setting the composition of the analyzed parameters [25].



ISSN: 1992-8645

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E-ISSN: 1817-3195

Table 3. Statist	ics Of Time, I	Number And Cost	Of Functions In	n The Business	Process	"Attracting A Client»
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Function	Number of processed functions	Processing time, d:h:m:s	Personnel costs, USD	Other expenses, USD	Total costs, USD
Accepting an application	70	0000:11:55:58	105,00	140,00	245,00
Finding out the client's needs	70	0000:21:18:38	280,00	70,00	350,00
Offer a meeting to the client	179	0003:02:58:31	358,00	358,00	716,00
Customer Search	50	0008:03:29:45	150,00	450,00	600,00
Checking the completion of the questionnaire	50	0001:15:00:05	300,00	0,00	300,00
Departure for a meeting with a client	147	0014:12:21:58	882,00	882,00	1 764,00
Preparation of a commercial offer	277	0014:08:19:40	1 108,00	831,00	1 939,00
Preparation of the buyer's order	277	0004:20:27:33	831,00	277,00	1 108,00
Finding out the reason for the refusal	94	0000:11:40:28	94,00	47,00	141,00
Approval of the discount	95	0001:15:29:55	475,00	142,50	617,50
Invoicing for payment	140	0001:11:10:13	280,00	420,00	700,00
Total	1 449	0045:07:03:43	4 863,00	3 617,50	8 480,50

Table 4. Statistics On The Use Of Employee Resources In The Business Process "Attracting A Client»

Post	Number of processed functions	Working hours, d:h:m:s	Usage rate	Number of people
Secretary	70	0000:11:55:58	0,07	1
Sales Representative	50	0008:03:29:45	0,58	2
A telemarketer	157	0002:17:42:45	0,39	1
Sales Manager	1 027	0030:02:38:09	0,72	6
Head of Sales Department	145	0003:19:17:07	0,54	1

As a result of the analysis of the statistical data from Table 4 obtained after running the model in batch mode, it became obvious that the function "preparation of a commercial offer" is not only the bottleneck in the implementation of the business process, but also the most expensive center. The total cost of performing this function has reached 1,939 USD, which is the maximum value compared to the other functions [26].

The analysis of the statistics on the use of employees ' resources, shown in Table 5, allows us to talk about high workload rates for sales managers and sales representatives and a very low workload rate for the secretary.

Methods of optimization of the business process "customer acquisition". Improving the efficiency of the business process can be done in several waysgradual (engineering) and cardinal (re-engineering) methods of improving business processes [27].

Engineering and reengineering as methods of improving business processes. In order to

constantly monitor the business processes of companies, the concept of business process engineering is applied for their subsequent management. Business process engineering (or business engineering) is the creation of an "as is" model of business processes that reflects the current state of the company's functioning, and its constant updating, which means maintaining the model in a form that corresponds to the changing circumstances of the company's actual activities. In accordance with the Deming P-D-C-A cycle [20], the engineering process, being a management process, is iterative, successively passing through four stages: planning, implementation, control and analysis. This process, reflecting the current state of affairs in the company or supply chain, in terms of innovation/creativity or rationality, is a its reflection of current business practices. However, the fact that business process engineering is constantly used as a tool shows a certain level of innovation in the management of a given enterprise or supply chain.

15<sup>th</sup> November 2021. Vol.99. No 21 © 2021 Little Lion Scientific



www.iatit.org

E-ISSN: 1817-3195

Business process improvement began as part of an effort to redesign and / or reengineer business processes that promised exceptional results. Gunasekaran and Kobu [28] argue that the business process must undergo fundamental changes to achieve significant performance improvements. According to Soliman [29], the goals of business process reengineering are to improve business processes and reduce costs. However, while most attempts at business process reengineering (or redesign) in the literature claim to support business process improvement, there are few cases that describe in sufficient detail the actual improvement steps that need to be taken. According to some authors, this is a typical case when improving business processes is limited to a broad description of the steps that need to be taken. The steps, according to these authors, are as follows [30]:

1) Specify the system.

2) Identify the performance bottleneck(s).

3) Choose one of the possible modifications to eliminate performance bottlenecks.

When improving the business process, one of the following techniques or a combination of them can be used:

automating the execution of a function;

of changing the areas functional responsibility;

decrease in the share of inspection and control activities;

minimization of approvals.

Automating the execution of a function involves increasing the degree of informatization of the function and leads to a reduction in the time of its execution and to the standardization of the output. According to the degree of informatization, there are automated, interactive, expert and nonautomated functions. Automatic functions are performed by a computer without human intervention, such as making standard reports or performing mathematical calculations. Interactive functions are performed by a computer and a person in an interactive mode, for example, the implementation of non-standard requests. Expert functions are performed by a person on the basis of recommendations (commands) prepared by a computer. Non-automated functions are performed by a person without using a computer [31].

Changing the areas of functional responsibility is the assignment of responsibilities for the performance of a particular function to another organizational unit. In a flawed process, some functions may be too expensive because they are unreasonably performed by highly paid employees. Such functions are called cost centers. The validity

of the costs of performing such functions is determined by the minimum necessary level of competence of the responsible employee. If the performance of a function does not require the professional knowledge of the employee performing it, then such a function should be included in the area of responsibility of a lowerpaid employee [32].

Reducing the share of work on verification and control allows you to increase the speed of the business process. Traditional business processes are replete with verification and control operations, which are a kind of useless work, because they do not create any values, but, nevertheless, are necessary in order to ensure that there are no violations. All these checks take time and effort in some cases, even more than the business process itself. Minimizing approvals ensures consistency of operational data, as well as increases the speed of the business process. Reconciliation is another kind of useless work that a redesigned business process should minimize. This is achieved by reducing the number of external contact points available in the business process, which reduces the likelihood of obtaining conflicting data, which, in fact, requires coordination [33].

Let's consider the application of these methods for the business process "attracting a customer". Analysis of the results of simulation modeling, which are shown in Table 4 and 5, allows you to understand how much each employee is busy with work, how much money and time is spent on performing each of the functions. Sales representatives and sales managers have the highest workload ratio [18, 34].

One way to reduce the workload of sales representatives is to hire additional employees. The work of a sales representative is one of the lowest paid, so hiring additional employees will increase the efficiency of the process without significant financial costs. It should be borne in mind that hiring one additional employee will reduce the workload of sales representatives and increase the number of customers found, which in turn will increase the low utilization rate of the telemarketer.

In this case, you can only give a probabilistic estimate of the increase in the efficiency of the process. Accurate calculations of the workload indicators of sales representatives after hiring an additional employee are not possible, since hiring an additional employee will lead to an increase in the number of orders, and an increase in the number of orders will force you to re-model the process with other sets of input data. You can remove the workload of managers in a similar way, but it is

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#### ISSN: 1992-8645

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unlikely that it will be economically feasible. In addition, when analyzing the functions performed by a sales manager, bottlenecks were identified that slowly down the business process [19, 35]. To relieve the workload of sales managers and optimize the business process of "attracting a customer", methods of automating the performance of the function and changing the areas of functional responsibility can be applied. Analysis of the simulation results suggests that the sales manager performs many functions that do not require his knowledge, which can be transferred to the secretary who has a too low workload factor. These functions include "finding out the reason for refusal" and "invoicing for payment" [36]. Such a step is quite reasonable, since the cost of performing the functions of a secretary will be significantly lower than that of a sales manager, in addition, it will allow you to load the secretary's working time in full.

One of the most expensive and time – consuming functions that require professional knowledge of the manager is "preparing a commercial offer". The average time of its execution is 1 hour 15 minutes, the cost is 7 USD. This function involves the step-by-step execution of standard operations – opening the template of the commercial offer, correcting the client's details, calculating the parameters of the system being sold, saving the received file and sending it by mail to the client. Currently, this function is performed manually by employees, so it can be classified as non-automated [37].

The development or purchase of special software that allows you to generate a commercial offer automatically, based on standard templates and perform the calculation of system parameters using a computer, will reduce the time and cost of performing this function and translate it into the category of expert, which implies interactive performance of the function by a person based on recommendations and commands prepared by a computer. Reducing the execution time of the function will lead to an increase in the speed of customer service in general, which should have a positive impact on customer loyalty.

Further analysis showed that a number of functions performed by a sales manager do not require their professional knowledge. These include "finding out the reason for the refusal" and "invoicing for payment". The function of "finding out the reason for refusal" is to call the client and fix the reason for refusing to work with the company. The "invoice for payment" function consists of filling in a standard invoice form with the customer's details and sending this form by email or fax. None of these functions requires professional knowledge of the sales manager, which means that they are performed unreasonably. Analysis of the statistics of employee workload factors will allow to include these functions in the area of responsibility of the secretary who has a too low workload factor of 0.07 [38].

Such a modification of the areas of functional responsibility will be quite reasonable, since the cost of performing the functions of a secretary will be significantly lower than that of a sales manager. The salary of a secretary is on average 4 times less than that of a sales manager.

Formal/Mathematical Models. The need for formal semantics in business process modeling has led to the second generation of formal models. Formal models are those in which the concepts of processes are defined strictly and precisely, so that mathematics can be used to analyze a group of clients, extract knowledge from them, and reason about them. The advantage of formal models is that they can be checked mathematically, and can also be checked for consistency and other properties [39]. These models are consistent with the assumption of van der Aalst et al. [40] that business process models "should have a formal basis", since formal models leave no room for ambiguity and increase the potential for analysis. However, formal methods of supporting process design are not sufficient [1], since the elements and constraints of the business process are mostly qualitative in nature, and they are difficult to characterize in a formal way that lends itself to analytical methods [21]. This explains the complexity of developing "parametric" business process models and the fact that only a few practical examples are found in the relevant literature [42].

The Petri net is an example of a business process modeling technology that combines a visual representation using standard notation with a basic mathematical representation. Petri net is a graphical language that is suitable for modeling systems with parallelism [20]. A Petri net graph is a directed bipartite graph consisting of two kinds of nodes called places and junctions. Petri nets have been modified and extended by various researchers to provide more powerful business process modeling capabilities. Some of their variations include temporal Petri nets, stochastic Petri nets, color Petri nets, and hierarchical Petri nets [36].

The Petri network, in the process of modeling, allows you to detect network properties such as potential liveliness, safety and limitation. Taken together, these properties provides reachability of



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E-ISSN: 1817-3195

some network state. If the Petri network simulates some business process, then the state of the network should be understood as a set of executed.

The business requirements of the process during the achievement of the specified result. Liveliness Property the network explains the ability to perform any transition (process operation), including number and absence of dead end branches in the process model. The Petri network's "security" property explains the truth of the minimum conditions under which a transition can be performed (process operation). The "constraints" property explains no closed process cycles with an infinite increase in the number of preconditions required to perform process operations.

The complexity of analyzing the behavior of Petri nets is that you have to simultaneously monitor the position of several points and remember these situations. The behavior of the Petri net is explicitly described using a graph of achievable markings, which is in some sense analogous to an equivalent parallel-serial scheme (P-scheme) constructed to a given bridge scheme. The main advantage of P-schemes, which determined their wide application, is that for each of them the structure and behavior can be described the same Boolean formula, which allows you to perform its formal transformations in order to simplify the structure without changing the behavior.

# 4. DISCUSSION

In this article business processes are considered by introducing a new classification scheme for business process models and presenting current trends in analysis and optimization. We present the most representative approaches to business process modeling and classifies them into three groups based on their characteristics, and defines the different types of business process analysis methods and classifies them in a similar way, and justifies the need to move from improving business processes to structural optimization and identifies approaches to optimization that are deficient in the literature. Also, an overview of all the presented classifications and highlights the current situation, the gap in research and the directions for further development of methods of modeling, analysis and optimization of business processes.

Business process optimization can be based on the methods of the relevant disciplines. Researchers Gunasekaran [10] and Kobu [11] argue that in the context of business processes, there is a need for greater use of decision support systems, based on artificial intelligence and expert systems. They also support the need to develop queuing systems, linear programming, and simulation models to represent business processes and select the optimal design. In this question, they identified two other disciplines with business processes: planning and evolutionary computing. Planning has a number of common themes with business processes, and evolutionary computing is already a successful approach to optimization in other areas [12].

Other scientists in this field, Zhou and Chen [13], suggest that business process optimization should be aimed at reducing time and costs, improving product quality, and increasing customer and staff satisfaction in order to maintain the competitive advantage of the organization. Another researcher, Ragers [14], suggests that the goals of optimizing business processes are often to reduce costs and flow time. However, Hofacker and Vetshera [15] emphasize that the concept of "optimality" of technological structures is not trivial, and the quality of processes is determined by many, often contradictory criteria. Both in applied and theoretical terms, great importance is given to the optimization of business processes, mainly without explaining the criteria and alternatives considered for optimization [1]. But Zhou and Chen [13] note that there is still no systematic methodology for optimizing business processes. Currently, there is a fairly large number of universal and specialized modeling technologies, which have broad capabilities, but at the same time are characterized by excessive complexity and significant cost of study. As a rule, researchers in the field of business process management solve specific problems by offering technologies and tools that are well suited for solving one highly specialized problem. Researchers have developed various sets of criteria to assess the feasibility of using modeling technologies to solve business process management problems. In particular, one such relatively successful set was proposed by A. Popovich and M. Stemberger [20]. However, these and similar criteria [10] are rather general and are not correlated with the stages of the life cycle of improvement of the efficiency of business processes, which makes their application difficult.

Many researchers focus on finding bottlenecks in business processes. In particular, the author of the theory of constraints E. Goldratt [12,13,14], and supporters of this theory W. Detmer and E. Schragenheim [19] showed that the effectiveness of each organization is limited to a very small number of variables that can be called bottlenecks.



ISSN: 1992-8645

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However, they did not explore the possibility of using simulation modeling as a universal tool for identifying and eliminating bottlenecks in a variety of business processes.

# 5. CONCLUSION

Comprehensive simulation modeling of the business process "customer engagement" allowed to identify cost centers, bottlenecks in the implementation of business processes and uneven workload of employees. Simulation indicators such as redistribution of load factors, function automation and change of functional responsibility zones allowed to define methodological approach for further optimization of "customer engagement" business process. Changing areas of functional responsibility proved to be one of the most effective ways to reduce the cost of the business process. Moreover, reducing the cost of the process in this way allows you to leave the quality of execution. As a result, with the help of computer simulation we obtained an algorithm for further development of the software platform.

# 6. LIMITATION AND FUTURE WORK

The conducted research has given unambiguously positive results. Therefore, we plan to further analyze all typical business processes of enterprises in the field of services. At the same time we will simultaneously verify the business processes with the help of a colored Petri net. Certainly, verification at the initial level of company functions allows to avoid unnecessary expenses for erroneous business processes. In turn, increase economic effect from the transition of the enterprise to process management using BPM-systems. The simulation modeling methodology described in the article will be taken as the basis of the software platform for analysis and optimization of the business process "customer engagement".

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