Information System Of Optimal Allocation Of Enterprise Development Resources

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Abstract

The research relevance is induced by the rapid growth of the share of information technology in management processes at all levels. This state of matters requires the development and implementation of automation systems for both tactical and strategic decisions. On the other hand, the research relevance is induced by the accelerated competition and turbulence of operating conditions in the modern domestic market, creating the preconditions for the development of automated decision support systems in determining the enterprise development strategy.

Such a strategy should include long-term decisions to increase market share, as well as short-term tactical decisions to manage development finance. These arguments cause the involvement of mathematical apparatus and object-oriented methods of information systems development for the effectiveness of these management decisions. The task of this research is to develop an information system for the optimal allocation of financial resources for enterprise development.

The work offers an approach to solving the optimal allocation of development tools problem involves finding a row-vector plan for the allocation of a limited amount of resources in a two-level hierarchical system between lower-level aggregates. According to the found allocation plan, the effect of the entire aggregate system is maximum. The information system developed in the work has to meet the following requirements: to ensure the interactivity of the system functional problems solving process; provide the ability to enter the output data by various means; provide a presentation of source information both in text and in graphic form; support multitasking, i.e. the simultaneous performance of calculations and output of different nature information. This information system can be implemented in the workplaces of upper and middle management managers.

Keywords 1

Automated system, optimal allocation, managerial decisions, mathematical model.

1. Introduction

Due to the expansion of the lower-level government powers, competition increase and the instability of the external environment due to the changing legislative sphere, the requirements for the governance process have increased significantly.

Management is broadly defined as leadership, ie purposeful influence on a particular object (or subject) to achieve a specific result.

For an enterprise to be able to exist in the economic conditions prevailing in our country, its management has to execute optimal management. The optimality of management is determined by the completeness of the analysis of the production system states, the optimality, and timely decisions. Optimal management is possible only if the processes of analysis and decision-making is implemented based on reliable information.

This condition fulfillment is the most complex and important part of the management process, especially when the object of management is a complex production system of large size. You can increase the level of

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information reliability only through the use of computer technology and information technology as a tool for automating the management process.

This work is devoted to the development of an information system for the optimal allocation of financial resources for enterprise development, which main function is to automate the process of rational decisions making in the field of social-economic systems management.

2. Associated works

To determine the model development directions and information system of optimal allocation of enterprise financial resources development, world periodical sources have been analyzed.

From the decision-making processes research point of view, works [1, 2] have scientific value, but the models described in these works do not take into account issues related to the competitive operating environment and are difficult for further automation.

Analysis and risk evaluation in the scenarios of the behavior of the dynamic system with the complex interaction of hardware and software is described in [3]. The authors [4] put forward the results of testing probabilistic optimization models of failure scenarios for decision-making in emergency situations. The research is built upon the dynamic modeling of complex systems considering risks. The offered approaches [3, 4] require some refinement for use in the field of enterprise resource management.

The authors [5] analyze the essence of sources of financial resources and their importance for the development of the infrastructure of the logistics system of the enterprise, but the work has a purely scientific direction and does not address the use of these resources.

In [6, 7] macroeconomic models are presented, studying the financial flows impact and the international drivers' impact on economic growth, so they can not be used for decision-making at the enterprise level. The issue of making rational management decisions at the enterprise level is devoted to works [8-11], but there are no studies of optimization models. The authors of [8] provide a comparative analysis of different approaches to the process of enterprise financial management and a description of the stages of decision-making. In [9] the construction of a conceptual model of organizational system efficiency through the study of rational management decision-making processes is presented. The subject of research in [10, 11] is the process of creating automated systems to support decision-making, but the study covers only some organizational systems of specific operational areas.

3. Research Methodology

Based on the world information sources analysis, the novelty of the work is determined, which consists in modeling the application of the dynamic programming method to solve the allocation of enterprise development funds problem increasing its competitiveness in the limited capacity market with subsequent automation of the model.

The relevance of research topics is based on the urgent need to create typical software and hardware complexes problem-oriented to solve a set of problems related to the optimization of the management process on an industrial basis. The stochastic conditions of enterprises in the market are based on three factors: the lack of complete and reliable information about the environment, the presence of chance in the course of events, the opposition of the market [12, 13].

The purpose of the work is to analyze the process of designing an information system for the optimal allocation of resources for enterprise development using the method of dynamic programming. The purpose of the information system is to determine the optimal plan for the allocation of financial resources of the enterprise amid measures to increase its competitiveness. The information system being developed can be implemented in automated workplaces of middle managers: investor, planner, marketer, production organization manager, administrator, etc. The object is an information system of optimal resources allocation. The subject of the work is the technology of designing and developing an information system for calculating the optimal allocation of a limited amount of development resources by the method of dynamic programming. The information system of enterprise development resources optimal allocation is a client-server application in the form of a web application (site), implemented in PHP programming language using related web development technologies (Open Server web server, MySQL database, Twitter Bootstrap adaptive layout framework).

A meaningful description of the optimal resources allocation problem is to determine the strategy of financial resources allocated for enterprise development. In this case, the resource allocation is the size of the enterprise development fund, ie a certain amount of free funds, which remains at the disposal of the governing body of the enterprise after making all the necessary payments. Measures to develop and increase the competitiveness of the enterprise are taken as aggregates, such as:

- introduction of new technologies to improve product quality;
- employee training and education to improve the quality of services;
- expansion of the trade network;
- introduction of product delivery services, etc.

With this goal-setting, the aggregates do not have their own goals and are inactive, and the rule of development resources allocation is determined exclusively by the center of the system, i.e. the governing body. The task of the governing body is to distribute the development resource between the aggregates to maximize the effect of the entire system.

In the process of solving the problem of optimal allocation of development resources, the enterprise is considered as a complex social-economic system that is characterized by dynamism, integrity, the relative autonomy of functioning, homeostatic, stability, uncertainty in functioning. According to the organizational structure, such systems have a hierarchical structure, which can be represented by several two-level hierarchical structures [14].

Thus, a hierarchical control system of any degree of complexity can be represented as a set of interconnected modules, which are two-level hierarchical control systems - the simplest subsystems that have all the characteristics of such systems (fig. 1).

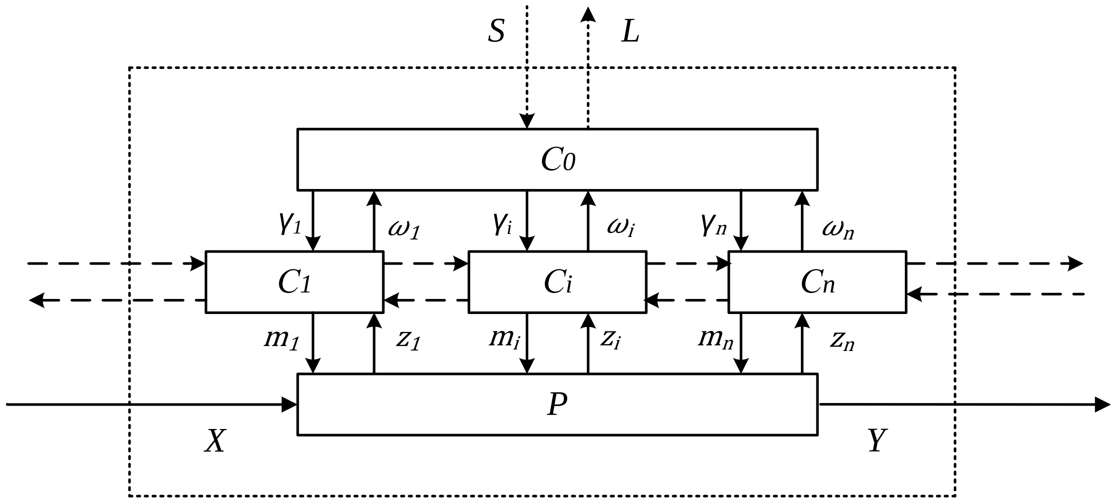


Figure 1: Two-level hierarchical management system

The two-level hierarchical control system is formed (n+2) by the main subsystems:

Superior control subsystem, or coordinator C_0, which generates coordinating signals γ_i (i=1,…,n), addressed to n subordinate control subsystems C_i (i=1,…,n), producing feedback signals ω_i (i=1,…,n), which are coming to the input of the coordinator, as well as control effects m_i, intended for management.

The process P, which is connected to the environment through the input X and output Y, and the exchange of information about the results of activities are executed through feedback channels z_i.

Interactions between the subsystems of the hierarchical control system are dynamic, change over time and create a closed-loop, and by definition the upper level has priority.

To formalize the matter of optimal allocation of resources further, we present the enterprise as a two-tier system center – a set of aggregates $A = \{A_i\}$, $i = 1, \dots, N$. Center is the governing body that decides on the allocation of the development fund, aggregates - measures to increase competitiveness by N. The system has a limited amount of resources that should be distributed among the aggregates to obtain maximum effect from the entire aggregate system.

When solving this problem, you can consider different models for determining the relationship between the amount of resource and its allocation plan and the size of the effect of the entire system. To determine the effect of the entire aggregation system, an additive convolution of local functions of aggregate effects was used in this paper, for which the normalized dependencies on the number of development resources provided to this aggregate are accepted. The solution of the problem can be considered with varying degrees of information completeness about the local functions of the aggregate effects. Since the aim of the work is to automate the process of optimal development resources allocation, i.e. the situation of intense centralization is considered, in the future, we will assume that the center has complete information about the type and values of local functions of aggregates parameters.

One of the possible ways to solve the problem in such a setting is the method of dynamic programming (or dynamic planning), which is a special method of optimizing multi-step solutions and belongs to the methods of operations research. The allocation of resources by dynamic programming is based on Bellman's recurrent formula. The multi-step decision, in this case, is the formation of the optimal allocation plan, a separate step of which is the allocation of a certain amount of resource to one of the aggregates of the system and consists of *m* stages [15].

Let the efficiency of the whole system be characterized by a certain indicator *W* – gain, determined by the additive convolution of gains at each stage:

$$W = \sum_{i=1}^{m} w_i , \quad (1)$$

where w_i – gain on level *i*.

The solution is selected at each stage, the gain at this stage depends on this solution along with the operation as a whole, ie the stage controls $x_1, x_2, \ldots x_m$, determining the amount of development resource of the given *i* aggregate. The total of controls at all stages is the management of the operation as a whole:

$$x = \left(x_1, x_2, \ldots, x_m \right) , \quad (2)$$

The problem is to find a control *x*, with the help of which the gain *W* is converted to a maximum:

$$W = \sum_{i=1}^{m} w_i \xrightarrow[x]{} \max . \quad (3)$$

The control x^*, at which such maximum is achieved is the optimal control. It consists of a set of optimal controls at each stage:

$$x^* = \left(x_1^*, x_2^*, \ldots x_m^* \right) . \quad (4)$$

The maximum gain achieved under this control is denoted by W^*:

$$W^* = \{ W(x) \} . \quad (5)$$

Each aggregate A_i where it is given a resource in the amount of x_i brings an income that can be calculated by the function $\varphi(x_i)$. All functions $\varphi(x_i)$ ($i=1,\ldots,m$) are given and unbreakable. The task is to find such allocation of *K* units resource between aggregates where they bring the greatest income.

The control system *S* in this case is a resource that is distributed, the total amount of resource in the system is denoted by *K*. The state of the system *S* before each step is characterized by one *S* number – the initial stock of funds not yet invested. In this problem, the stage control are the resources $x_1, x_2, \ldots x_m$, allocated to the aggregates. It is necessary to find the optimal control, ie the set of numbers $x_1, x_2, \ldots x_m$, where the total income will be maximum:

$$W = \sum_{i=1}^{m} \varphi_i(x_i) \xrightarrow[x]{} \max . \quad (6)$$

The problem is solved by the method of dynamic programming in two steps. Notional optimal gains are defined on the first step, it happens from the last aggregate to the first one. In the general case for any *i* step, we define notional optimal gain for all steps, beginning from the given and till the end of the operation by the formula:

$$W_i(S) = max\{ \varphi_i(x) + W_{i+1}(S-x) \}, \quad (7)$$

and the corresponding notional control $x_i(S)$ – where the value is x_i, this maximum is reached with. Thus, the maximum gain (income) from all aggregates is found. It remains to determine the optimal allocation strategy by looking at the notionally optimal gains from the first aggregate to the last, this is the second step of the solution process. The x value, at which the maximum is reached, is the optimal control x_1* in the first step. After the funds in x_1*amount are invested in the first aggregate K-x_1* remains. We take the notionally optimal gain for S=K-x_1*, the second aggregate is given the optimal number of funds: x_2*=x_2-(K-x_1*), etc. up to the last aggregate.

Under conditions of intense centralization and full awareness of the center about the internal operating conditions, all functions of local effects of aggregates $\varphi(x_i)$ (i=1,…,m) are considered to be given. In the general case (under the condition x_i=[0, ∞]) the dependence of the aggregate local effect on the amount of resource given to it is a monotonically increasing S-shaped curve. To solve practical problems, the limits $x_{i\,min} \le x_i \le x_{i\,max}$ are accepted, where $x_{i\,min}$ is the amount of resource required by the aggregate for normal operation, $x_{i\,max}$ is the amount of resource required for extreme operation. The condition x_i=[$x_{i\,min}$, $x_{i\,max}$] separates a convex, linear, or concave segment from the whole curve. Realization of such dependences is possible through the function of a kind:

$$\varphi_i\left(x_i\right)=\left(\frac{x_i-x_{i\,\min}}{x_{i\,\max}-x_{i\,\min}}\right)^{\alpha_i}. \qquad (8)$$

where α_i – nonlinearity parameter, for $0 < \alpha_i < 1$ convex dependences are realized, $\alpha_i = 1$ is for linear, $\alpha_i > 1$ is for curved ones.

4. Research results

To build an automated system that implements the above model for solving the problem of optimal resource allocation, it is necessary to determine the input and output data. The input data for the automated system of optimal resource allocation are:

– number of lower-level m aggregates;
– functions parameters of local effects of aggregates – vectors $x_{min} = \{x_{i\,min}\}_m$, $x_{max} = \{x_{i\,max}\}_m$, $\alpha = \{\alpha_i\}_m$;
– amount of development resource K.

The last indicator can be changed for each computer experiment with the model, all the previous ones are model parameters that determine the conditions for solving optimization problems. According to the logic of the problem and the accepted method of its solution, the given parameters have to be non-negative integers, except for α_i, which can accept small values. Figure 2 provides a graphical and tabular presentation of the dependences of local effects of aggregates.

Output data					
x	f1	f2	f3	f4	f5
0	0	0	0	0	0
1	0,24	0,01	0,09	0,07	0,00
2	0,28	0,01	0,13	0,09	0,00
3	0,30	0,02	0,16	0,10	0,00
4	0,32	0,03	0,18	0,11	0,01
5	0,34	0,04	0,19	0,12	0,01
6	0,35	0,05	0,20	0,13	0,02
7	0,36	0,05	0,22	0,13	0,03
8	0,37	0,06	0,23	0,14	0,03
9	0,38	0,07	0,24	0,14	0,04
10	0,39	0,08	0,24	0,14	0,05

	Model parameters				
	1	2	3	4	5
dmin	0,20	0,30	0,55	0,35	0,45
dmax	11,50	12,95	10,65	11,60	13,85
α	0,20	1,00	0,33	0,25	1,85
b	0,40	0,10	0,25	0,15	0,10

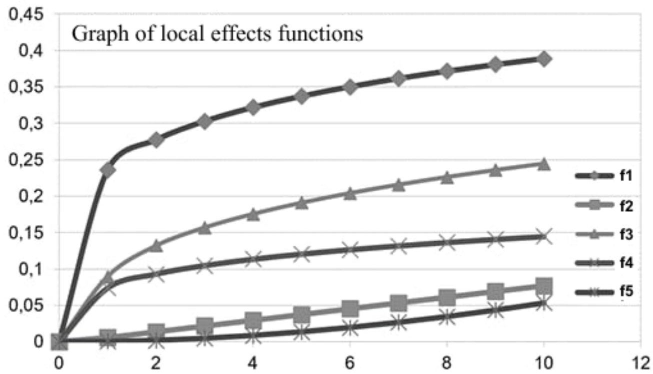


Figure 2: Dependences of local effects of aggregates

The output data of the automated system is the vector $x_i^*=(x_1^*, x_2^*,..., x_m^*)$ – a plan for the development resources allocation, in which the entire system effect is maximum. The image of the output data is presented in Figure 3.

The goals of the automated system of optimal resources allocation to the user are to provide the following features: the use of a trial version of the system (without registration), which involves entering task parameters in a convenient dialog mode, solving the problem, and presenting results in the graphical and tabular display; registration in the system; use of the full version, which in addition to the previously mentioned features provides saving of the previously entered tasks parameters and the results of their solution for further use when working with the system.

	A1	A2	A3	A4	A5
Optimal strategy	4	0	4	2	0

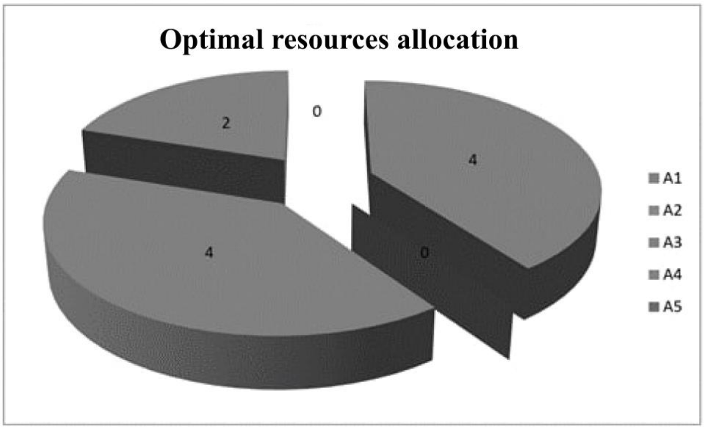


Figure 3: Output data

The task of optimal resources allocation is versatility for the object of management. The versatility of the problem is as follows:

- production systems of various dimensions and complexity operating in any field of human activity can be the management objects;
- the problem is solved for objects with different management strategies and levels of centralization;
- the type of resources allocated may vary.

Taking into account a wide range of systems in which the considered problem can be applied, for allocation of its basic properties, purposes, and principles of action it is necessary to apply the system approach methodology.

The most important characteristics of the system are:

1. Versatility.
2. The ability to expand the functionality with changes in the subject area.
3. Problem nonlinearity, which complicates the algorithm of its solving, and hence the requirements for the design environment.

The main purpose of the information system developed in this work is to determine the optimal strategy for the allocation of funds in different production systems at various degrees of certainty.

The functioning of the information system of optimal resources begins with the introduction of production system data and the amount of development resources. To do this, the initial input data and parameters of the task have to be entered into the data entry mode requests of the screen.

In addition, the table of the same screen should include the following information about each of the lower level aggregates:

- the resource amount required for normal operation of the aggregate;
- the resource amount required for the extreme operation of the aggregate;
- the value of the nonlinearity coefficient.

When subsequent operation with the information system, the user can select one of the previously entered options of the production system description and calculation conditions by entering the aggregate number in the corresponding request field.

The source and recipient of the information is a specialist, with the information system of optimal resources allocation implemented in his automated workplace. Requirements for the information collection and transmission, as well as control over the accuracy of the information entered are determined by the situation in a particular production system from these operating conditions. The information system control aggregate is designed to check the correctness while data entry into the information system.

Since this given information system is intended for specialists in various fields use, the start of work start is provided by initiating the pressing the appropriate button, selecting an appropriate menu item, or otherwise provided by the specific system in which the information system will be implemented. The user has to enter the above data about the production system and the parameters of the calculation process to perform calculations. After performing the calculations, you can proceed to view and save the results.

The completion of the information system operation, as well as the performance of other operations, including service ones, is initiated by the user in an interactive mode. The previous material contains a general mathematical formulation of the problem and the method of its solution. We consider a mathematical model of computer modules of the information system further.

The first module of the information system is a module for calculating the values of aggregates production functions. This module uses the following variables:

1. i – aggregate index;
2. dmin [i], dmax [i], α [i] (nonlinearity coefficient) – parameters of aggregates production functions;
3. F [i] – value of the production function;
4. d^0 [i] – the number issued to the *i* aggregate resource.

Mathematical formulas reflecting the relationship between these variables are given in the previous paragraph. In addition, the considered module uses constants:

1. D – the maximum amount of resources distributed in the system;
2. n – the number of aggregates in the system.

The listed parameters are used by all modules and cannot be changed during one run of the computing mode of the information system.

The second module calculates the optimal strategies for the allocation of different amounts of resources, ie such sets of values of variables d^0 [i], for which the effect of the entire aggregate system is maximum. This module implements the solution of the optimal resource allocation problem by the method of dynamic programming.

The third module is designed to determine and distribute the profits of the production system. This module implements a built mathematical model based on the following assumptions:

- the first assumption is that at the initial stage of modeling the system has a certain amount of resource - the initial capital;
- the second assumption is that the resources of the aggregate accumulate, ie at each step the aggregate is given more resources than the previous one (this assumption is based on the fact that some types of resources are not used directly for production, such as raw materials or electricity, and can accumulate in the aggregates, providing expansion of production, such as machines, production area, etc.).

In addition to the mentioned above common variables, this module uses the variable D – the size of the system profit. The profit of the system is determined by the values of the local functions of the effects of the aggregates and is calculated by the additive formula. At the beginning of the simulation process, this variable is equal to the amount of initial capital entered by the user.

The development tools of an information system for optimal resources allocation of development are based on a standard set of web application development technologies that are supported by a large number of hosting providers, namely: the system is implemented in PHP programming language, MySQL is chosen as the database management system.

The tools for developing the user interface of the information system are the following technologies:

- software access to web application objects, interactivity, and system dynamics is provided by using the object-oriented programming language JavaScript (.js) using the jQuery library, which belongs to the software that is freely distributed;
- the layout and style of the web application pages are developed using the formal language of page style - cascading style sheets (.css)
- the layout of the web application is carried out using the hypertext markup language (.html).

It is possible to use the optimal resource allocation information system on the client's computer with the following technical characteristics:

- single-core CPU clocked at 1 GHz;
- 512 MB of RAM;
- free space of the hard drive;
- USB or PS / 2 compatible mouse (or touchpad) and keyboard or touch screen;
- Internet connection with 1 Mbps speed.

The work of the developed information system is possible under the control of any operating system that supports modern browsers and has a graphical interface.

5. Analysis of simulation results

To determine the degree of compliance of the developed information system with the goals that were formulated as a result of the analysis of the subject area and the object of study, we analyze the operation of the system on a test case.

To analyze the test case, select the following initial data:

a) the number of development resources is 10 units;

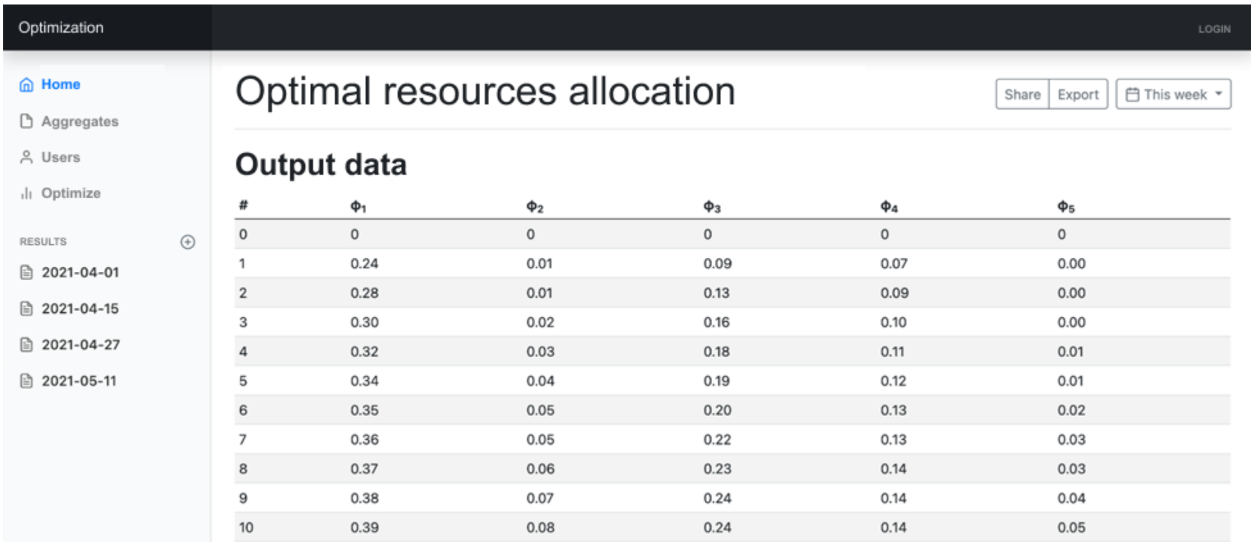
b) the number of lower-level aggregates is 5;

c) the parameters of the function of the local aggregates effects are selected to realize the convex up and down dependencies.

The analysis results obtained while the information system operation has shown the compliance of the data of the optimal resource distribution vector with the accepted hypotheses and research methodology. The analysis of the information system correlation to the formulated requirements and functions is provided below.

6. Description of the system interface

Login involves user registration in a standard form. The main page of the application (Fig. 4) contains menu items (on the left), which allows the user to perform calculations and edit the composition of the aggregates that make up the lower level of the hierarchical organizational and production system.



#	Φ_1	Φ_2	Φ_3	Φ_4	Φ_5
0	0	0	0	0	0
1	0.24	0.01	0.09	0.07	0.00
2	0.28	0.01	0.13	0.09	0.00
3	0.30	0.02	0.16	0.10	0.00
4	0.32	0.03	0.18	0.11	0.01
5	0.34	0.04	0.19	0.12	0.01
6	0.35	0.05	0.20	0.13	0.02
7	0.36	0.05	0.22	0.13	0.03
8	0.37	0.06	0.23	0.14	0.03
9	0.38	0.07	0.24	0.14	0.04
10	0.39	0.08	0.24	0.14	0.05

Figure 4: Information system main page screen

In addition to these menu items, the main page contains input data - the values of local functions of the aggregates effects, in tabular form (Fig. 4), graphical (Fig. 5), and in the form of parameters of local functions of effects (Fig. 6).

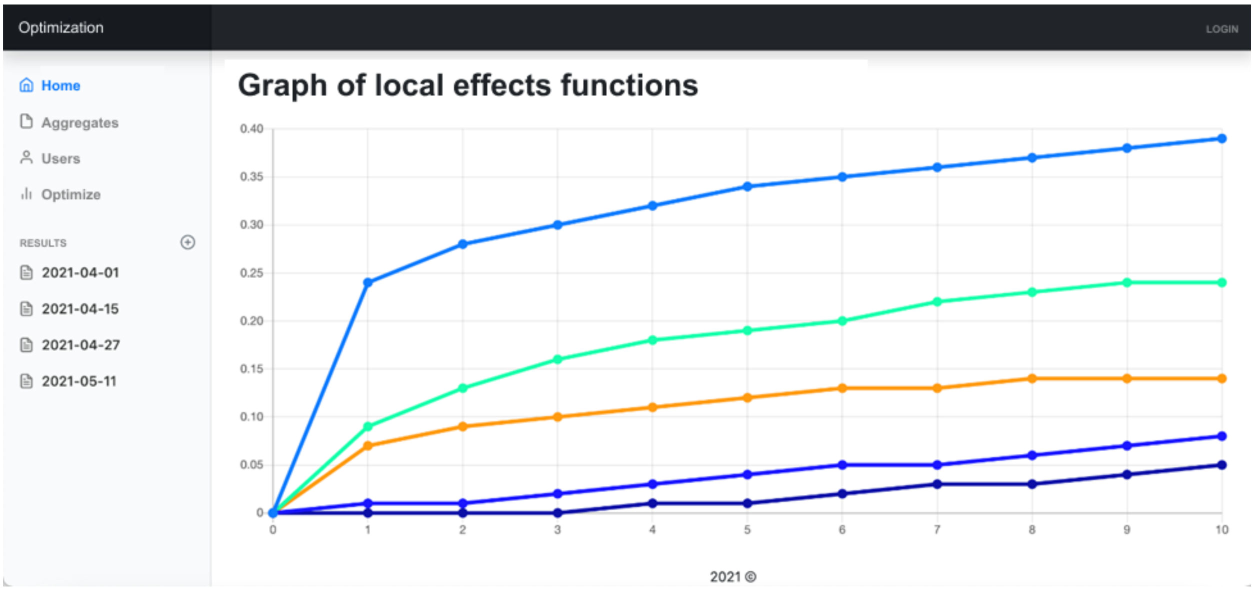


Figure 5: Input data in graphical form, screen

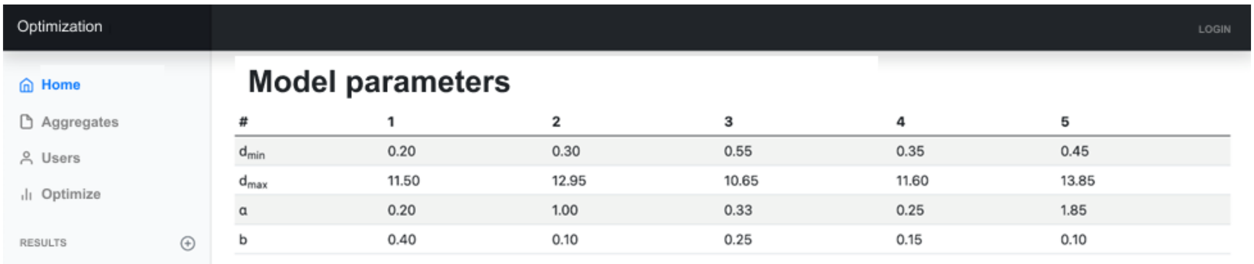


Figure 6: Input data as parameters of local effects functions screen

Optimization is carried out after entering the data by selecting the appropriate menu item, the screen of calculating the optimal strategy is given in Figure 7.

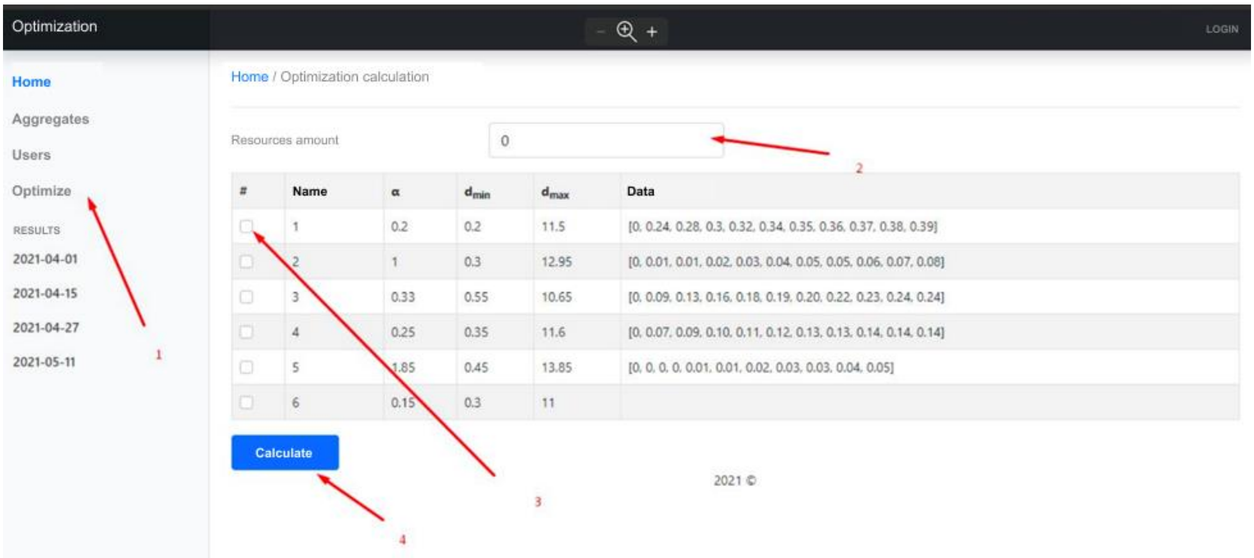
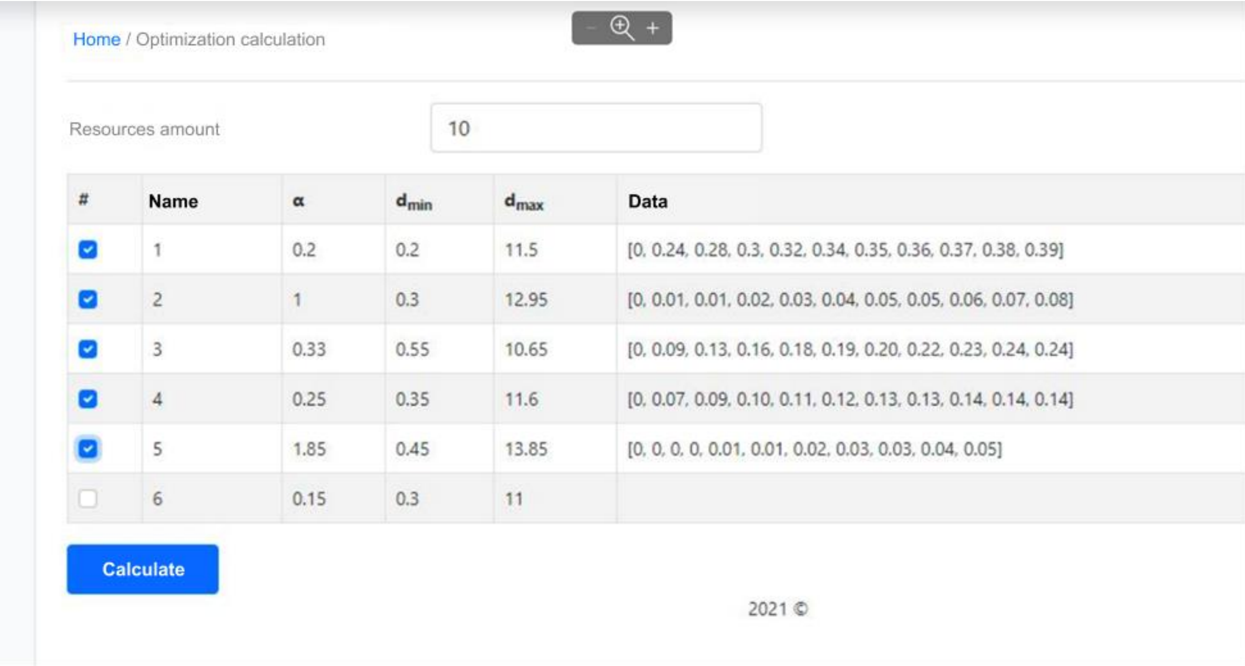


Figure 7: Calculation of the optimal distribution strategy screen

The arrows on the form show the following functional elements:
1 – menu item to calculate the optimal allocation strategy;
2 – input field to determine the number of development resources available in the system;
3 – flags to determine the composition of the aggregates of the lower level of the organizational system;

4 – button for calculations.
The screen in Figure 8 contains the results of the data entry.

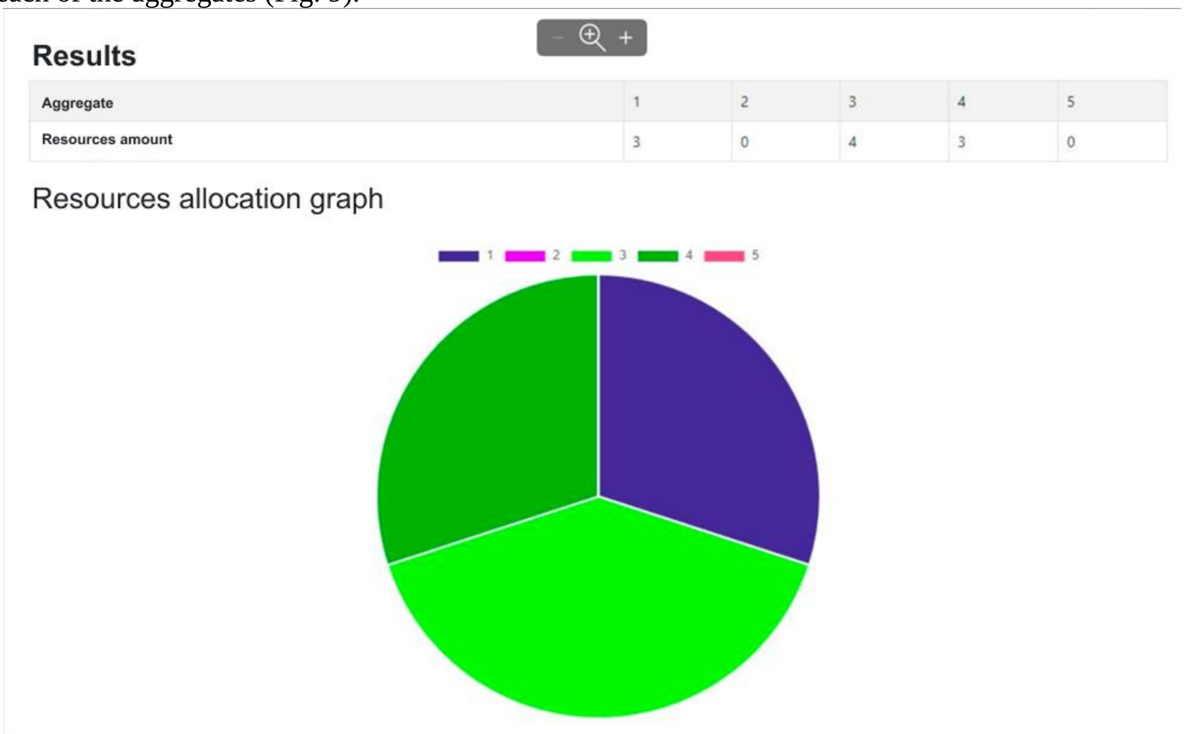

Home / Optimization calculation

Resources amount: 10

#	Name	α	d_{min}	d_{max}	Data
☑	1	0.2	0.2	11.5	[0, 0.24, 0.28, 0.3, 0.32, 0.34, 0.35, 0.36, 0.37, 0.38, 0.39]
☑	2	1	0.3	12.95	[0, 0.01, 0.01, 0.02, 0.03, 0.04, 0.05, 0.05, 0.06, 0.07, 0.08]
☑	3	0.33	0.55	10.65	[0, 0.09, 0.13, 0.16, 0.18, 0.19, 0.20, 0.22, 0.23, 0.24, 0.24]
☑	4	0.25	0.35	11.6	[0, 0.07, 0.09, 0.10, 0.11, 0.12, 0.13, 0.13, 0.14, 0.14, 0.14]
☑	5	1.85	0.45	13.85	[0, 0, 0, 0, 0.01, 0.01, 0.02, 0.03, 0.03, 0.04, 0.05]
☐	6	0.15	0.3	11	

Figure 8: Filled in form for calculating the optimal allocation strategy screen

After the calculations are made, the information system provides the optimal allocation vector and the corresponding pie chart, the sectors of which correspond to the quantities of development resources provided to each of the aggregates (Fig. 9).


Results

Aggregate	1	2	3	4	5
Resources amount	3	0	4	3	0

Figure 9: Output of calculation results screen

For the given initial data the optimal allocation is the following: to allocate 3 units of a resource to the first aggregate, 0 - to the second aggregate, 4 - to the third aggregate, 3 – to the fourth aggregate, 0- to the firth aggregate. That is d^0={3, 0, 4, 3, 0}.

7. Evaluation

The functionality of the information system of optimal resources allocation is designed to solve large-scale computational problems associated with the definition of strategies for the allocation of funds in complex production systems. Therefore, the information system being developed is a powerful tool that reduces the complexity and time spent in solving this problem. In addition, an information system can be implemented to predict the effect of the object of management on different strategies of financial management, which allows the entity to compare results and choose the most effective strategy, thereby improving the quality and soundness of management decisions.

The information system of optimal allocation resources development can be implemented as part of the decision support system "Development of the object of management", the block diagram of which is presented in Figure 10.

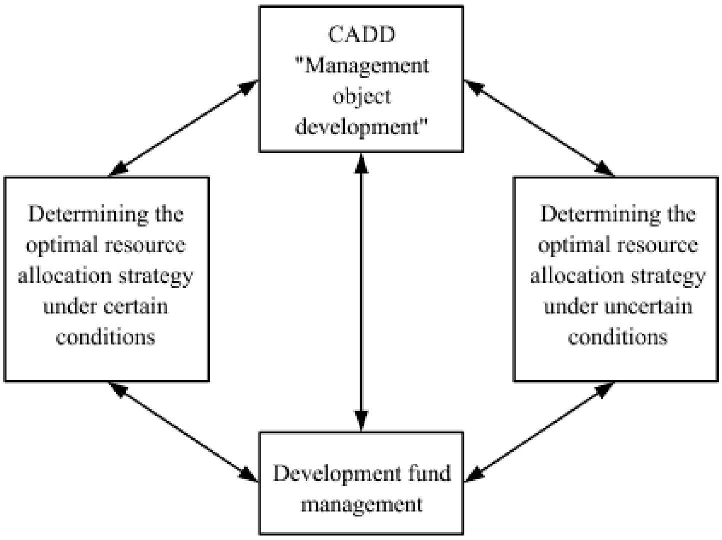


Figure 10: Block diagram of the "Development of the management object" system

There are the following information links between the subsystems: part of the input information needed to determine the optimal investment plans by different strategies, implemented by the subsystems "Optimal allocation under certain conditions", "Optimal allocation under uncertain conditions", is formed during the subsystem "Development Fund Management". In addition, the initial information (graphs of profits from the implementation of investment projects in the development of the enterprise, the optimal plans for the allocation of profits between projects) subsystems of optimal allocation are needed to solve problems of optimal allocation of development funds.

A modification of this automated system is to provide an opportunity to alternatively set the values of local effects of aggregates in tabular form. This task can be performed upon request during a dialogue between the system and the user or by exporting data from a text-type file or spreadsheet.

Another improvement of the automated system may be the introduction of the coefficient of the aggregate importance, which reflects the attitude of the management subject to a measure to increase the competitiveness of the enterprise.

Development prospects of the created information system "Development of the management object" are the improvement of subsystems of optimal distribution, in particular:

a) expansion of calculation capabilities;

b) increase of the number of factors that are taken into account when formalizing the description of the object of management;

c) taking into account external factors that affect the operation of the object of management and profit.

8. Conclusion

During the research, the results of solving the problem of modeling and automation of the decision-making process management in the field of financial resources optimal allocation which was obtained by domestic and foreign scientists were analyzed. Based on this analysis and analysis of the subject area, the relevance and purpose of the work were formulated. Mathematical tools for solving the problem of optimal allocation of a limited amount of resources and tools for software implementation of the solution process are determined. The analysis of input and output data of the automated system is carried out, and also the purposes of its creation concerning the user are defined.

Based on the analysis of possible methods for optimal resource allocation for problem-solving, the method of dynamic programming has been chosen as the solution. This approach provides versatility towards resource type, a number of aggregates, and the type of local effects functions

The information system operation has been tested with a test case. The analysis of the results calculations and the functionality of the system has shown the compliance of the system with the tasks defined on the basis of the subject area study and scientific publications.

The further area of research is to take into account the uncertainty due to the presence of the aggregate's goals.

The automated system of optimal allocation of a limited amount of resources can be used on enterprises that operate in a high level of competitiveness and stochastic environment. The effect of the system is to increase the scientific validity of management decisions on the allocation of internal financial resources of the enterprise.

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