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SIMULATION OF PROCESSING FINANCIAL AND ECONOMIC INFORMATION IN THE INTEGRATED INFORMATION SYSTEMS OF THE TREASURY.

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Intoduction. At the formation of the treasury structures within some enterprises and holding companies on the basis of the systematic approach it is supposed to conduct activities in two stages. Thus, if the first one supposes creation of the model of the treasury that enables to identify and formalize key structural and functional characteristics of the units, which main purpose is the efficient management of financial flows, the second stage assumes transformation of the model into the form of organizational documents and automated procedures to create a complete management system.

This process is completed by implementing the system into production and its further interactive improvement through performing analysis of operating practices.

The most appropriate modeling tool for the rapid achievement of practical results is the application of structural-functional simulation. Within the framework of the general systematic approach two major tasksare solved: the structure of the governing body is created and the key functional areas of the activity are determined.

Two types of the treasury are structurally determined– centralized and decentralized, which is very typical for geographically-spread holding structures. Meanwhile, in recent years, many holdings have experienced significant organizational changes, including restructuring and centra-

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lization of their basic functions.Concentration of assets and centralized management are the main tools of transformation of the organizational-economic model of restructuring which was applied in most companies regardless of industry and scope of activities. Thus, their intention to take overall control over cash flows has made the treasurythe most important object of centralization regardless of the objective reasons of the modernization of the financial management of the enterprises.

It should be noted that it is not always recommended to conduct sophisticated and expensive process of the treasury centralization. Thus, the following factors justifying the need for centralization and clearly defined roles of the treasurycan be determinedbetween the head office of the holding company and its subsidiaries:

- unification of the diversified assets with different structures under a single holding company, sources of working capital as well as the structure of operating costs;
- geographical remoteness of the assets;
- numerous subsidiaries;
- high probability and significance of financial risks (e.g., significant share of export operationsin the income structure, the concentration of operations in a single geographical center, the value of debt and the availability of funds in the total assets of the holding).

A considerable number of experts believe that it is inefficient to create a centralized treasury. They suppose, regardless to the businesses' location, enterprises must work with a single settlement center. If, for example, some companies earn, and the others spend, however, to have an idea about what they are doing, they should possess operational information about the state of their cash flows.

Thus, the general nature of the benefits that the company receives at the centralization of the treasury functions, unlike the situation where the treasury functions are distributed between members of the holding companies basically is to strengthen the control over financial risks, reduce the probability of their occurrence and the severity of the consequences.Meanwhile under the centralized planning of financial flows the liquidity of the companyis increasing because without attraction of external financing it can centrally plan its financial needs, to redistribute cash flows within the holding company and to consolidate financial resources.

At the same time for the designed information system it is important to clearly define the aim of its creation, main requirements, and the mechanisms needed to control the system. Below we reveal the methods of organizing distributed processing of financial and economic information in conditions of functioning of corporate information system (CIS), the basis of which is represented by the scientific methodcalled “systematic approach” which is widely used in the research.In this case a larger apparatus to identify patterns of information system in close relationship of its constituent elements is represented. The following key stages implement this systematic approach: defining the aims of the system creation, its analysis, identification of elements, hierarchical levels and relationships between them; synthesis of the integrated information system.

Analysis. To improve the efficiency of functioning of the financial-economic units through the use of ICT and systematization of the functions of the treasury management the system of multi-level divided processing of financial and economic information aimed at operation in conditions of the CIS is created. Basing on this reason, the aim of this research can be demonstrated by the following equation:

$$DSI(FS(d), TB(p)) \Rightarrow PSI(FS(d), TB(p)), \quad (1)$$

where*DSI*(decentralized system) – existing system of processing financial-economic information in the treasury;

PSI(distributingsystem) – system of multi-level distributed processing of financial-economic information;

TB(p) (technical system) – technical base characterized by the set of the information-communication technologies;

FS(d) (functionalsystem) – a setofinterrelatedfunctions, expertiseandmethods thatensurethesolutionoffinancialandeconomicproblems.

DSI *(FS(d),* *TB(p)),* *PSI* *(FS(d),* *TB(p))* –systemof processingeconomicinformationconsideredintwoaspects: functionalandtechnical;

=> – process of designing *PSI*on the basis of *DSI*analysis.

Analysis of the created information system is implemented by decomposing it into two dimensions - functional and technical on the basis of the data tables of the survey.

Regarding the structure of the functional system of PSI, it is set on the basis of the analysis of the DSI to determine the processing technology, the composition of the functional tasks of the PSI, algorithmsof theirsolutions and assess information flows. To conduct comprehensive analysis of DSI, it is advisable to use a multilevel decomposition where the first level represents the subsystems and the relationships between them; the second level illustrates tasks, and the third one – information provision.

Since all levels are closely interconnected, of course, the result of the analysis of the higher level directly impacts the result of the analysis of the lower level. The result is represented by the information model of processing financial-economic information with the allocation of the automated and non-automated parts. Carrying out analysis of the technical system for designing the PSI, it is expected to determine possible types of personal computers (PC) used for servers and stations, the auxiliary devices, equipment, methods of connection and cooperation in a corporate network. Moreover, it is important to distinguish three levels: the *first* one – type of the PC; the *second*one - software for processing financial and economic information and service of computing process; and the *third* part represents the network and auxiliary equipment.

Thus, carried out analysis enabled to establish a list of functional subsystems of the functional system; the number of automated and non-automated tasks, their characteristics; the scheme of information flows; the types and number of documents; the size of arrays; the composition of the ICT.

The main aim of the synthesis of this system is the generation of its original structure. In this regard, a multi-level systematic approach to the synthesis of the information system is implemented by the iterative solution of complex of interrelated tasks: defining the network topology, distribution of tasks across levels and sites of information processing, data distribution on the nodes of the network, and determining the number of PCs in the CIS.

In turn, the network topology is detected by forming a network of relationships, workstations, servers and network equipment. The most important factor influencing the configuration of the network is the availability of information links between its nodes. Its topological structure can be represented as a graph whichpeak is the server and workstations, and the edge is represented by communication channels and information flows.It should be noted that the peak of the graph is a kind of network nodes, characterized by computing works. On the basis of the analysis the list and the number of nodes and links between them are determined. As a result there is developed a formal network with nodes in which the number and relative positions of the PC used as server and workstation are unknown. Such data are installed during the last stage – on the basis of the synthesis of the information system.

Herein, the task of distributing the computational work over the nodes of the network consists of distribution of works by levels of information processing, and within the level -by level nodes. As at the analysis phase, all works are classified according to their belonging to the processing area, and the nodes in the network correspond to the stations, so this problem is supposed to be solved. If only the works of each area is distributed among the processing levels, in other words, if a lot of work A is distributed among incessant subsets of[1] And[2],...,A[K] corresponding to the levels of information processing.

For example, extensive computational network of K=6 is under consideration. So, the lower level VI, which includes areas of cash-in-transit, warehouses and officesfocuses on the task of primary data collection, its accumulation and generalization in the context of structural units of the lower level of the treasury. These tasks require daily, every ten days and monthly solutions. In particular, the level of V characterizes the production accounting in the context of the entire enterprise.

Metodology and model. Time of accounting solution within each group accounts for over 20 minutes. These problems must be solved daily, monthly and yearly. At the same time, levels IV, III and II define financial accounting in the context of the entire enterprise. It is known that at level IVthe information on costs is formed, the state of the settlement, currency and other accounts is determined, and accounting of records of capital investments is carried out.Inturn, level III summarizesthedataonallareasoffinancialandoperating accounting, formulatestheconsolidatedregistersofanalyticalandsyntheticaccountingas well as outputreportingforms. In addition, thislevelassumes cameral control of reporting. Hereover 20 minutesare spent on solvingtakes, which solutioniscarriedoutmonthly, quarterlyandannually. Meanwhile, level II isdifferentfromothers by functioning of the internalaudit group. The tasks of a daily and annually nature are solved within 20 minutes. The upper level I is associated with the formation of information which is very important for decision-making and is characterized by the tasks of economic analysis, planning and forecasting. Time solution is over 20 minutes and the tasks are of the daily, monthly, quarterly and annually nature. Restrictions have been obtained through expertise.

$$\bigcup_k A_k = A, \qquad (2)$$

$$A_\mu \bigcap A_k = \emptyset; \qquad (\mu \neq k; \mu = \overline{1, K}). \qquad (3)$$

To develop the objective function we will put in correspondence the vector of signs $X_n = (X_1^n, \dots X_2^n, \dots, X_m^n)$.For$k$-level of processing also the vector of signs – etalon – will be determined

$$X_k^{эT} = \left(\overline{X}_1^k, \dots \overline{X}_2^k, \dots, \overline{X}_n^k\right); n = [1, \dots, N], k = [1, \dots, K],$$

where *N*–number of works;

n–number of the component of the vector of signs;

K–number of network levels.

The coefficient of comparison Q_{nk}, is calculated as the scalar product of vectors (X_n) *and* $(X_k^{эT})$:

$Q_{nk} = (X_n, X_k^{эT})$.(4)

In relation to the coefficient of comparison the following definition can be determined: nonnegative function $(X_n, X_k^{эT}) = Q_{nk}$ is called as the coefficient of comparison of objects *n*and*k*, ifи $0 \leq Q_{nk} \leq M; \quad Q_{nk} = Q_{kn}; X_m^n, \overline{X}_m^k = \{0,1\}, m = [1, \dots, M]$.

From the third condition it is obvious that the value of the component of vectors equals to 0 or 1 as optional. So, to enhance the weight of a particular characteristic or its attenuation, the increase or decrease of the values of the components is possible. This implies that the characteristics are primarily divided into groups of symptoms, and then their possible values are identified.

It should be noted that the bigger the value of the coefficient of comparison, the more matching signs have multiplied vectors. This condition enabled to determine the type of the target function:

$$L = \sum_{n=1}^{N} \sum_{k=1}^{K} Q_{nk} \cdot h_{nk} \text{ ,} \rightarrow \text{ max ,} \qquad (5)$$

where h_{nk} –indicator of executing the works n at the level k; h_{nk} = {0,1}.

If the work n is executed at the level k, then $h_{nk} = 1$; h_{nk} = 0– otherwise. To calculate the values of coefficients of comparison, the structure of the components of vectors of signs must be determined. Table 1 providesfunctionalcharacteristicsof computing works.

Table 1.

Functional characteristics of computing works

№ of group of	Name of group of signs	№ p/p	Характеристика *X*(вектора признаков)
I	Automatization level	1 2	automated manually
II	Location of information processing	3 4 5 6 7	analysis and forecasting group internal audit group finance audit group cost accounting groups
III	Frequency of execution	8 9 10 11	daily each decade monthly
IV	Time for solution (in case of automatization)	13 14	till *i* minutes *i*=20 over *i* minutes
V	Algorithm of calculations	15 16 17 18 19 20 21	input of primary data; data accumulation by subdivisions; data generalization by subdivisions; data accumulation by the company; data generalization by the company;
VI	Number of data sheets	22 23	up to *j* lists *j*=25 over *j* lists

Thus, the developed algorithm of the task solution represents the set of such actions as:

- Valuesofcomponentsofvectorofsignsare determined for each type of work;
- Valuesofcomponentsofvectorsofetalonsigns are determined for each level;
- WiththeetalonofeachlevelthecoefficientofcomparisonQ_{nk} *of n*- work is calculated and as a result *k*of values Q_{nk} is received;
- AmongreceivedvaluesQ_{nk} maximaloneischosen, noticingtowhichprocessinglevelthe vector of signs of etalon corresponds. ThisvectorisusedtocalculateQ_{nk}.

Hence, the determined level is the optimal location of *n* - work. For example, if we receive an equal value of the coefficients of comparison, the location of work is determined by the place of the compliance. As a result we get the distribution of the computing works among the nodes of the network.

This data is used to solve the following tasks: distribution of information files among nodes of the CIS network, which belongs to the class of problems of integer linear programming. As optimization criterion we take the minimization of the total operating costs determined by the cost of creating, storing and updating of the databases on the host and access to them from other points of the CIS of the treasury:

$$L = \sum_{i=1}^{I} \sum_{j=1}^{J} \sum_{k=1}^{K} \left(C_{ijk} + C_{ijk}^{obr}\right) y_{ijk} \rightarrow \min \qquad (6)$$

at limitations:

$$i, l = \overline{1, I}, \quad j, p = \overline{1, J}, \; k = \overline{1, K}, \qquad (7)$$

$$Y_{ijk} = \{0,1\}, \qquad (8)$$

whereil– level number;

jp– node number at the level;

k— array number;

C_{ijk} (C_{ipk}) – summarized costs on the creation, storing and renewal of *k*-array in node*ij (lp)*;

C_{ijk}^{obr} –expenses on the use of *k*-array, located in the node *ij*of the CIS*;*

C_{ijklp}^{obr} – expensesontheuseofof*k*-array, located in the node *ij*from the *lp*node*;*

$Y_{ijk} = \{0,1\}$,1 – if *k*- array is stored in the node *ij*, 0 – otherwise.

The information about the distribution of computational work by the levels and nodes of the network, as well as belonging of arrays to the relevant works enable to get a primary plan of the task solution: The algorithm of bringing the initial plan to the optimal one is the complete enumeration of the following options:

- for*k*arraythenumberofduplicates *Z*is determined (duplicate represents the number of array repetitions in different nodes of the network);
- ifZ=1, then location of the array corresponds to the location of computing works;
- ifZ>1, thensummarizedexpensesoncreation, storage, renewalofthearrayandaccesstoitfromothernodesaredeterminedforeachduplicateofarray;
- fromconsideredoptionsofallocating*k*-array, the option with minimal summarized expenses is selected.

With the account of the task solution, according to this algorithm, we are getting distribution of arrays among the network nodes.

TosolvethetaskofdeterminganumberofPCintheCISnode, thebasicdataisconsideredtobethefollowing: the volume of core (short-term) memory required for processing the information arrays of the node and the accurate operation of the system and applied software unit; the capacity of the hard drive that stores information files; system and applied programs; the classification of tasks along functional lines; PC configuration.

Thus, the volume of the necessary information for functioning of the node *(ij)* of the core memory is determined in the following way:

$$V_{ij} = \sum_{z=1}^{Z} V_{ijz} + \sum_{a=1}^{A} V_{ija}, \qquad (9)$$

where $\sum_{z=1}^{Z} V_{ijz}$ – volume of the core memory necessary to process the arrays of the node;

Z – number of arrays;

$\sum_{a=1}^{A} V_{ija}$ – volume of the core memory necessary for the activity of the applied programs o the node;

A- number of programs.

here – number of PC in the node*(K_{ij}):*

$$K_{ij}^{pc} = \frac{V_{ij}}{V_o - V_{ij}^{syst}}, \qquad (10)$$

whereV_o– total volume of the core memory installed in the PC;

V_{ij}^{syst} – volume of the core memory occupied by constantly operating software.

In case, if multi-station complexes are used in cooperation with the PC, calculation of the required number of input devices-output the nodes will be efficient for the lower level tasks which are characterized by the input of large amounts of information.

Conclusion. In conclusion, it should be noted that the organization of distributed processing is a time-consuming process of analyzing the current state of processing financial and economic information of the treasury, the synthesis of the system requiring the use of economic-mathematical methods and models.