MODELING OF ECONOMIC PROCESSES OF THE COMPANY'S OPERATION IN MODERN CONDITIONS

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Abstract: *The present economic conditions are characterized by dynamism and a considerable level of uncertainty. In these conditions, the efficiency of making administrative decisions comes to the foreground. One of the tendencies of improving the organization's management in the present conditions is a further application of advanced administrative technologies, innovative models and concepts which have proved efficient in other areas. The dynamics of the changing conditions of business activity is characterized by a high risk level which demands a search of methods to increase the effectiveness of economic system management. Ensuring the process of making management decisions on the basis of modeling is closely related to raising the quality, efficiency and technological effectiveness. The author of the article suggests that administrative influence should be based on the economic and mathematical model of the company's operation.*

Keywords: *complex of models, analytical model, imitation model.*

1. Introduction

The manager always has to make administrative decisions. The cost of failure depends on the scale of the decisions made and the business activity conditions. In such situations, the manager relies very often on his vision of the situation, his logic and experience. However the dynamism of the changing conditions of the company's operation, as well as some external and internal factors, may result in a considerable degree of risk and subjectivity in making such decisions (Druker 2003).

2. An integrated approach to modeling management decisions

In recent years there has been a trend towards greater use of models in decision making, driven in part by regulation but manifest in all areas of management (Management Solutions 2014).

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One of the ways of making objective administrative decisions is to analyze the situation and to take decisions based on modeling the process of the company's operation.

Undoubtedly, every company "functions within an environment which both influences the risks faced and provides a context within which risk has to be managed" (The Orange Book 2004). The company's operation modeling is an effective means of finding the ways of optimizing, forecasting and minimizing the risks arising at its various stages.

The application of an optimization model in a company requires the construction of an optimization modeling system (Shapiro 2000). Modeling, with the maximum nearness to reality, makes it possible to choose and check business improvement options, without a need for carrying out experiments, thereby avoiding excess risks.

To analyze their current performance and to make managerial decisions, today the majority of companies apply – explicitly or implicitly – various approaches to modeling which characterize particular aspects of their operation.

A special interest is caused by an integrated approach to modeling. A complex of models is the effective instrument of making strategic and operational decisions. The development of the complex of models practiced in the current company's operation includes several stages:
- developing a business model of the company's operation;
- developing an analytical model;
- developing an imitation model.

At the same time it must be kept in mind that the process of modeling has to be based on the developed system of indices of the company's performance.

At the first stage, on the basis of the system analysis, the business model is to be developed to assess the current company's performance, including the requirements for its functioning, management, efficiency, the end results and the degree of the consumer's satisfaction with the end results.

To identify the "squeezes" in organizing its operation, the gaps in information and material flows, and the duplication and "deflection" of its functions, the business model has to integrate:

- the organizational-and-functional model;

- the detailed models of business processes;

- the information and document flow model;

- the resource flow model.

The organizational-and-functional model helps to make the analysis of sufficiency/relevance of the functions, organizational links and the analysis of responsibility delegation. The development of this model on the basis of a network diagram and a process approach to the organization's operation arouse a particular interest.

The model of business processes shows interrelations between the functions, the order of their performance, and also the material and information flows existing in the company. The developed business model helps: to detect inefficient business processes; to

work out recommendations how to optimize the order of performing production tasks; to create the organizational structure of the changed business processes; to order document flow, and also to form a basis for the implementation of the process approach in the company's operation.

The second stage of modeling is the development of the analytical model of the company's operation. The development of this model is based on the factor analysis and the correlation-and-regression analysis of the company's operation statistics. The factor analysis defines the factors exerting influence on the company's operation. The number and degree of the factors having a significant effect on the company's operation are to be defined (Figure 1.).
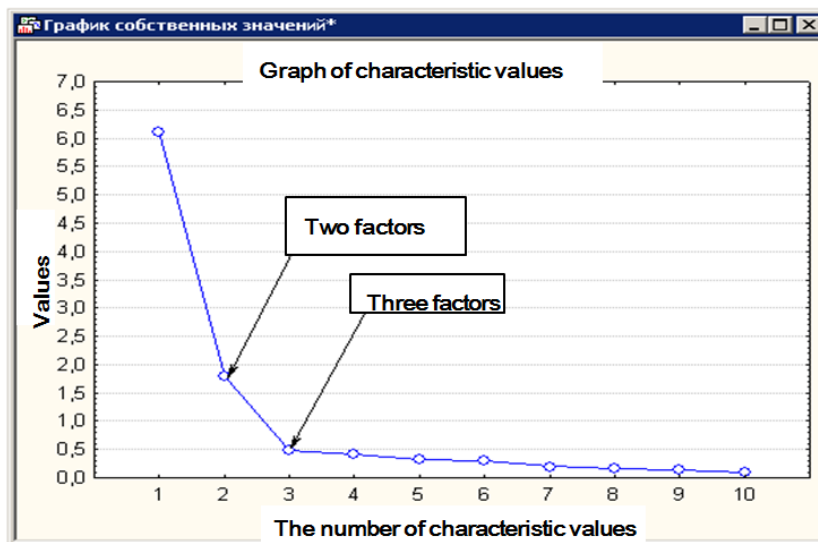
The identification of these factors (Figure 2.) is made on the basis of distribution of these factors.

Figure 2. Factor loadings

Перемен.	Фактор 1	Фактор 2
	Фактор.нагрузки (Варим. исх.) (Factor) Выделение: Главные компоненты (Отмечены нагрузки > ,700000)	
WORK_1	0,830623	-0,019320
WORK_2	0,902408	0,058905
WORK_3	0,870524	0,082595
HOBBY_1	0,739857	0,582885
HOBBY_2	0,731191	0,484489
HOME_1	0,097371	0,829676
HOME_2	0,165722	0,897242
HOME_3	0,168370	0,844159
MISCEL_1	0,768988	0,560555
MISCEL_2	0,748861	0,502121
Общ.дис.	4,561544	3,357507
Доля общ	0,456154	0,335751

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Before making the correlation analysis, it is necessary to define the dependent (Y) and the independent indices (Xi) in the system of the company's performance indices. The outcomes of the correlation analysis include (Figure 3.):

− defining the degree of mutual influence of the activity indices (Y, Xi);
− singling out, according to the Cheddock's scale criterion, the variables exercising a significant influence on the dependent index (Y).

Figure 3. The correlation matrix

Correlations (Analysis)
Marked correlations are significant at p < ,05000
N=12 (Casewise deletion of missing data)

	Y	X1	X2	X3	X4	X5	X6
Y	1,00	0,90	-0,94	-0,09	0,99	0,04	-0,59
X1	0,90	1,00	-0,92	-0,20	0,93	0,14	-0,56
X2	-0,94	-0,92	1,00	0,26	-0,94	0,00	0,68
X3	-0,09	-0,20	0,26	1,00	-0,11	0,27	0,52
X4	0,99	0,93	-0,94	-0,11	1,00	0,00	-0,60
X5	0,04	0,14	0,00	0,27	0,00	1,00	0,26
X6	-0,59	-0,56	0,68	0,52	-0,60	0,26	1,00

The correlation analysis considers among all the indices only those which make an essential influence on the resultant – dependent index (Y).

The development of the model as it is should be based on the regression analysis (Zerkin 2014) that helps:

− to develop the regression model of the company's operation for the period under study;
− to make the analysis of the model's adequacy in accordance with the specified criteria;
− to analyze the model coefficients and to define the degree of their influence on the dependent variable;
− to define the degree and nature of the control action on the dependent indices to achieve (forecast) the required result.

The regression model gives a true understanding of what operation is, but it is applicable only under stationary conditions. In this case, the functional is the dependence between the dependent index of the result and the characteristics of the system and its operating environment:

$$Y(t) = \max (\min) f\{k_i(t) \bullet x_{ij}(t), g_j(t) \bullet x_{ij}(t), Q_\phi(t)\} \qquad (1)$$

with the following restrictions: $Qf(t) \leq Qtr(t)$, where:

$Y(t)$ is the result index, the dependent characteristic of operation;
$x_{ij}(t)$ are the independent characteristics (indices) of the system's operation;

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$k_i(t)$ are the coefficients characterizing the degree of impact of the dependent factor, which is subject to a management system influence, on the system indices in the process of result achievement;

$g_j(t)$ are the coefficients characterizing the degree of the permanent factor impact which the control system cannot affect;

$Q_f(t)$ is the actual supply of resources needed for operation.

If we consider possible dynamic changes of the operation conditions, the model under consideration will be risky and it will lose its ability to adequately reflect the reality. Very often, the assessment of the model error is such that it is not possible to use the estimated dependences in practice, especially in case of multiregression. Therefore the estimated dependences reflect only the anticipated tendencies of development and have a low reliability under dynamically changeable conditions of the company's operation. Owing to it, there is a need to develop the imitation model of the company's operation on the base of the developed analytical model.

The imitation model is to be elaborated at the third stage. The imitation (dynamic) model is applied to the analysis of the company's operation, the analysis of the dynamics of changing operational conditions and the temporal change of material and information flows. The imitation model is an economic-and-mathematical model of the company's operation whose study is conducted by using experimental methods. The experiment includes the observation of the results of calculations made at various set values of the influencing factors. The imitation model is dynamic because it includes the time parameter.

The imitation model has to be developed on the base of the business model, the regression model and the outcomes of the factor analysis of the operational statistics. In the process of imitational modeling, the functions, material and information flows of the business process under study are put in compliance with the time characteristics, the functions of probabilistic distribution, and the functions of flow transformation. The imitation model, as a rule, is a dynamic structure consisting of the levels interconnected with the help of operated data flows. Its purpose is to show how each process is transforming its input data into output ones, taking into account the dynamics of the factor influence change, and also to reveal the relations between these processes. In particular, the model makes it possible to investigate the interaction of the processes and factors which influence the company's operation.

The analysis of the company's operation with the help of the imitation model helps to detect the unstable, overloaded and non-optimal parts of business processes. Besides, the model makes it possible to bring some disturbances into the parameters to define the effects of the decision made.

The imitation model is an effective tool of analysis and research of flow-line and continuous production.

The final stage of integrated modeling is the working out of recommendations for the improvement of the company's operation. The developed complex of models of the current company's operation is a convenient tool of assessing the effects of management decisions by changing the structure of the business process, redistributing the resources and bringing disturbances into the key scenario parameters of the models.

The development of imitation models is based on the MatLab-Simulink software product (Figure 4.).

Figure 4. The imitation model of the company's operation
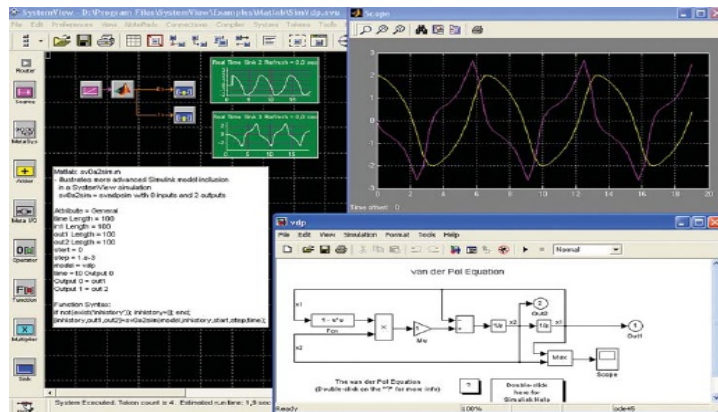
The imitation model developed in this operational environment enables:
- to assess the degree of the use of resources;
- to estimate the efficiency and capacity of the system;
- to define the dependence of variable costs on the capacity of the system;
- to carry out scenario modeling.

As a result of carrying out the general analysis the target model of the company is to be developed, with the optimum set of parameters, including time and cost characteristics.

3. Conclusion

The application of an integrated approach to modeling reduces the risk of inefficient reengineering of the existing business processes, as well as the introduction of new business processes and lines of business, as the developed complex of models helps to analyze and optimize business processes before they have been introduced into the company's operation (Zerkin 2015).

Besides, modeling of the company's operation, carried out in specially developed formats, represents the compact and easy-to-use database of how to organize the business processes of the company. The developed technique will make it possible to create, taking into account forecasting, a complex of models of the company's operation, and to concentrate the managers' attention directly on the development, validation, coordination and approval of administrative decisions. An integrated modeling of the company's operation is an effective instrument of continuous development and improvement of the company.

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MODELIRANJE EKONOMSKIH PROCESA RADA KOMPANIJE U SAVREMENIM USLOVIMA

Apstrakt: Sadašnji ekonomski uslovi se odlikuju dinamičnošću i značajanim nivoom neizvesnosti. U ovim uslovima, efikasnost donošenja administrativnih odluka dolazi u prvi plan. Jedna od tendencija poboljšanja upravljanja organizacije u sadašnjim uslovima je dalja primena naprednih administrativnih tehnologija, inovativnih modela i koncepata koji su se pokazali efikasnim u drugim oblastima. Dinamiku promenljivih uslova poslovanja karakteriše visok nivo rizika koji zahteva pretragu metoda za povećanje efikasnosti upravljanja ekonomskim sistemom. Obezbeđivanje procesa donošenja odluka menadžmenta na osnovu modeliranja je usko vezan za podizanje kvaliteta, efikasnosti i tehnološke efektivnosti. Autor članka sugeriše da administrativni uticaj treba da se zasniva na ekonomskom i matematičkom modelu rada kompanije.

Ključne reči: kompleks modela, analitički model, imitacije modela.