

Halyna Us,

*D.Sc., Profesor, Vice-rector for Scientific Staff Training,
East University of Economics and Management,
Cherkasy, Ukraine*

Lyudmyla Malyarets,

*D.Sc., Professor,
Head of the Department of Higher Mathematics and Economic and Mathematical Methods,
Simon Kuznets Kharkiv National University of Economics,
Kharkiv, Ukraine*

lia Chudaieva,

*D.Sc., Associate Professor, Head of the Department of Management of Organizations,
East University of Economics and Management,
Cherkasy, Ukraine*

Olena Martynova,

*Ph.D., Senior Lecturer,
Department of Higher Mathematics and Economic and Mathematical Methods,
Simon Kuznets Kharkiv National University of Economics,
Kharkiv, Ukraine*

MULTI-CRITERIA OPTIMIZATION OF THE BALANCED SCORECARD FOR THE ENTERPRISE'S ACTIVITY EVALUATION: MANAGEMENT TOOL FOR BUSINESS-INNOVATIONS

The effectiveness of the managerial decisions regarding the enterprise's activity is determined by its evaluation objectivity, which in its turn is based on the mathematical model. The aim of the article is to solve the problem regarding the enterprise's activity evaluation based on the multi-criteria optimization models of the balanced scorecard. The object of the study is a process to investigate multi-criteria optimization models of the balanced scorecard to evaluate the enterprise's activity. In order to solve the multi-criteria optimization tasks in the enterprises' activity evaluation, it is recommended to use the fminimax procedure, which minas to be implemented in the software environment MatLab. Four optimization tasks are recommended to be solved for four constituents of the balanced scorecard: financial, customer, internal business processes, training and advancing of the staff. The partial criteria in these tasks are levels of the financial constituent development, internal business processes, customer constituent, the staff training and advancing constituent, general level of the enterprise's active development. While forming the restrictions in changes of partial indicators values, it is recommended to calculate numerical features regarding the distribution laws of these indicators. The calculated optimal values of the enterprise's activity indicators should be used for comparison in the evaluation, and while investigating the functional strategies of the relevant enterprise's activity types. The comparison of optimal indicators values with achieved ones on the example of the concrete enterprise is an ability to reveal some negative tendencies of its economic processes development, related to the constituents of the balanced scorecard: financial, customer, internal business processes, staff training and advancing, and as a result, in order to increase its activity efficiency, the enterprise has to review its policy regarding reproduction of the basic productive assets, particularly, regarding the renovation of their active part. The optimal values of the balanced scorecard make the base to develop managerial measures regarding the evaluation of all enterprise's activities efficiency and require the relevant information provision, based on the constituents and results of the multi-criteria optimization of the balanced scorecard values as a tool of the enterprise's innovative development.

Keywords: activities, balanced scorecard, multi-criteria optimization, partial criteria, comparative evaluation.

Introduction and problem statement. The effectiveness of managerial decisions in the enterprise's economy under modern conditions totally depends on the objectivity and reliability of its activity. The activity evaluation is important and is carried out at all management levels. Demands for evaluation rise in the current difficult social, economic and political situation in Ukraine. Dynamics of the macroeconomic indicators in Ukraine shows that in 2017 the economy continued slowly to grow. According to the data of the official statistics, machine building sector had positive results among all industries, particularly, one can observe: increase by 7.3 % (in comparison with + 2 % in 2016, + 14.6 % in December 2017) by means of most subindustries under conditions of the domestic demand increase for the invested goods from related industries, and the external demand increase; in the group of machines and equipment production – increase by 5.1 % (in comparison with + 2.3 % in 2016, + 14 % in December 2017) through the investment demand from the industrial enterprises with purpose to reconstruct the productive capacities and constantly to evaluate the industrial efficiency and industrial policy implementation consequences. Thus, the complexity of the external and internal environmental conditions makes the enterprises to find and to use the effective management tools and methods. One of such methods is a balanced scorecard, which has been practically tested at the foreign enterprises and has demonstrated its reasonability in management. However, in Ukraine, it has not been implemented. One of the reasons is an absence of its analytical provision, its adaptation to the conditions of the native enterprises' activity.

Analysis of the recent research and publications. Works of such foreign scientists as R. Kaplan, D. Norton, [1-2], E. Nili [3], P. Nivan [3], B. Phelps N.-G. Olwe [3] and others [6-9], and of the Ukrainian scientists as V.V. Vitlinsky [10], O.V. Rayevnev [11], V.S. Ponomarenko [12], O.I. Chernyak [13] observe the theoretical and practical problems to evaluate and to analyze the enterprise's activity, their modelling, mathematic tools improvement. The performed analysis of works, written by the above scientists, proves the insufficient level of these models and tools investigation to evaluate activity, based on the balanced scorecard. We know that modern methods of management at the large domestic industrial enterprises are based on the conceptions and methodologies of the information systems, which have been widely used in the companies and firms of the far-abroad countries. ERP-systems, which automate the most management functions, became popular at the large and medium-sized domestic enterprises. One considers them to give the most reliable information about the enterprise, but at the same time they have great disadvantages, particularly: the complexity of implementation; followings of the ERP-systems, incomplete comprising of all divisions at the enterprise; insufficient analytical tools for simultaneous information processing; the relation of the processed information only with internal management processes. The modern informational management systems are mainly based on the general conception regarding the information storage, such as OLAP and means of the intellectual data analysis (Data Mining) [19, p. 154-185]. Today, together with ERP-systems, other systems are introduced at the enterprise, such as SCM, CRM, automated management systems of the technological processes (AMSTP), the automated projecting system (APS), Product Data Management – PDM etc. However, the ERP-system is a core, since it realizes the main management functions: planning, economic operations accounting, evaluation and analysis of all enterprise's activities, organization, control and controlling etc. The above conceptions have general drawbacks: it is impossible to comprise all activities of the enterprise and to describe their peculiarities by means of features in the informational systems of the enterprise; a human, but not a computer develops and makes the managerial decision.

It is possible to solve this problem, by adopting the informational and analytical conceptions and management methods, such as the balanced scorecard, which does not require great costs for an introduction. The advantage of this management method is an ability to carry out the objective evaluation of the enterprise's activity.

We know that the general disadvantage of the classical economic management methods is their focusing only on the financial indicators. It causes the strategic management weakening at the enterprises

and consideration of them as integral systems, development of which is provided by the enterprise's various activity spheres. The current problems of the effective management and its measuring include non-consideration of the enterprise's definite wishes and needs, the satisfaction of which depends on the interesting parties, particularly on: investors, customers, mediators, the enterprise's staff, suppliers, regulatory bodies, influential groups and different partner alliances. The problems also include inconsistency of the efficiency criteria with the enterprise's strategies, processes and abilities, oriented to satisfy the needs and wishes of parts. The drawback of the existed system for the efficiency measurement is a random selection of the internal efficiency criterion, abstracting of the fact that it is only the part of one integral system. In order to eliminate the drawbacks of the old economic management methods, new management methods have appeared in recent decades.

Peter Drucker says about the role of analytical management methods, that they provide the enterprise's administration with information, which is necessary for the director [20, p. 11–31]. There are four types of such diagnostic information: basic information, information about productivity, information in the sphere of specialization and information about resources distribution. Such information is necessary to develop the management conception at the enterprise and its effective instruments.

The results of the study. BSC takes into account almost all main enterprise's activities in the complex of the interrelated balanced indicators, which evaluate significant factors of not only current but future enterprise's development, quantitative and qualitative aspects of its activity. The main advantage of this balanced scorecard is a synthesis of financial and nonfinancial indicators, internal and external view on the enterprise's work, provision of the relationship between indicators and aims and complex evaluation of perspectives.

For the effective implementation of the BSC in the evaluation of the enterprise's activity, it should be presented in the following way:

$$AIE = \langle F, P, M, S, II \rangle \quad (1)$$

where *AIE* – the activity of the industrial enterprise;

F – financial activity;

P – production activity;

M – marketing activity,

S – staff activity;

II – innovative and investment activity.

The enterprise's activity evaluation model based on the BSC is a formalized representation through the mathematical symbols and correlations and is a mathematical representation of features, phenomena, processes, which define the activity on the basis of the multi-criteria scorecard, systematized by activities.

Objectivity of the industrial enterprise's activity evaluation is defined by the consideration of its several criteria. The managerial decisions are more often made taking into account the several criteria in the management of the enterprise's activities. We know that BSC classically consists of four constituents: financial, customer, internal business processes, training and advancing of the staff. Sometimes in addition to the BSC constituents, other ones are taken, firstly, to emphasize the importance of the relevant feature evaluation in the enterprise's activity, and secondly, to take into account the peculiarity of the concrete enterprise's activity. That is why, as partial criteria, it is reasonable to observe efficiency functions, such as the efficiency of the financial, marketing activity, of internal business processes, training and advancing of the staff. The enterprise can achieve maximum efficiency in its whole activity taking into account partial efficiency criteria. The optimal partial indicators of the enterprise's activity are obtained while solving the multi-criteria optimization task.

The well-known specialists' works analysis on the problems of evaluation and economic analysis and management shows that in order to represent proper activities one should include the following indicators by constituents to the BSC: the financial constituent – the return of the invested funds (x_{11}); net return of sales (x_{12}); receivable turnover (x_{13}); return on equity (x_{14}); absolute liquidity ratio (x_{15}); financing coefficient (x_{16}); equity to total assets ratio (x_{17}); internal business processes constituent – growth rate of the labour productivity (x_{21}); increase/decrease rates of costs per UAH of the commodity products (x_{22}); coefficient of the average production capacity utilization (x_{23}); return on assets (x_{24}); coefficient of the main fixed assets depreciation (x_{25}); share of costs for production modernization in the overall costs structure (x_{26}); capital-labour ratio (x_{27}); the share of own equipment in the total quantity of main funds (x_{28}); the share of new goods in the total production amount (x_{29}); coefficient of the products updating (x_{30}); customer constituent – the relation of the product price to the fixed price for current goods (x_{31}); the share of costs to promote goods in the structure of product prime cost (x_{32}); compliance of the planned resources with needs for them (x_{33}); share of costs for guarantee service (x_{34}); production share, which is subjected to the guarantee service in the structure of the total amount of the produced goods (x_{35}); the economic efficiency of export (x_{36}); the share of supplies by direct agreements in the total number of supplies (x_{37}); the share of supplies agreements violations in the total number of agreements (x_{38}); the constituent regarding training and advancing of the staff – rates of workers' number increase (x_{41}); the share of workers, who improved skills in the reported year in their total number (x_{42}); the share of workers under the age of 50 in their total number (x_{43}); the share of workers, who carry out the scientific and technical work in their total number (x_{44}) [21].

The optimization tasks essence and their practical implementation in the MatLab environment is represented in more detail in works [14-18, 22-24]. In these works, authors do not only describe possibilities of the MatLab environment to solve optimization tasks, but also demonstrate examples to solve various optimization tasks, especially the multi-criteria tasks.

The activity evaluation objectivity based on the BSC is defined by consideration of four criteria according to four constituents and by solving four optimization tasks.

At first one should define optimal values of the financial constituent's partial indicators. It makes the first optimization task. The first criterion of this task is the criterion of the financial constituent development level, which is defined by the integral indicator and can be calculated as taxonomic development indicator. This criterion is maximized. Factors, which are expressed by the partial indicators influence the financial constituent development level. This impact is defined by the person, who makes decisions and can establish them depending on the current activity state, strategic tasks and goals of the enterprise. Thus, the first partial criterion is recommended to form scalarly taking into consideration dependencies of the financial constituent development level on its factors during the investigated period. The criterion is represented as scalar considering the significant coefficients, depending on the rating of the indicators' impact, e.g., $\alpha = (0.2; 0.15; 0.1; 0.15; 0.1; 0.3)$. Thus, it is necessary to solve four tasks. Having used data of the economic indicators from PJSC "Turboatom", we have such four tasks.

The first task is to define the optimal values of the financial constituent indicators:

1-st criterion: level of the financial constituent development (max):

$$F_1^1 = 0.2 \cdot \frac{1}{0.8995 - 0.2131 \ln x_{11}} + 0.15 \cdot \sqrt{0.623 - \frac{0.0451}{x_{12}}} + 0.1 \cdot \sqrt{1.231 + \frac{0.04}{x_{13}}} + 0.15 \cdot (0.9869 + 0.623 \ln x_{14})^2 + 0.1 \cdot \sqrt{1.0433 + \frac{0.5157}{x_{15}}} + 0.3 \cdot \sqrt{0.3168 + 0.1861x_{17}^2} \quad (2)$$

2-d criterion: level of the internal business processes development (max):

$$F_2^1 = 0.920927 - 1.6448x_{12} - 10.952x_{13} + 5.056x_{14} \quad (3)$$

3-d criterion: the general level of the enterprise's activity development (*max*):

$$F_3^1 = 0.7154 - 0.602x_{12} - 3.065x_{13} + 2.4558x_{14}. \quad (4)$$

Thus, restrictions in this task include:

$$0.4504 + 1.0232x_{11} + 0.2282x_{12} + 3.3615x_{13} + 0.2867x_{14} + 0.0131x_{15} + 0.0145x_{17} \leq 0.7222;$$

$$0.019 \leq x_{11} \leq 0.092; 0.158 \leq x_{12} \leq 0.35; 0.011 \leq x_{13} \leq 0.02;$$

$$0.025 \leq x_{14} \leq 0.099; 0.81 \leq x_{15} \leq 1.012; 0.8 \leq x_{17} \leq 0.859.$$

Level of the customer constituent development and constituent regarding training and advancing of the staff does not depend on the financial indicators. One should solve this complicated multi-criteria task in the software environment MatLab, using the procedure *fminimax*. Having used this procedure, we obtain the following optimal solution:

$$x_{11} = 0.019, x_{12} = 0.158, x_{13} = 0.02, x_{14} = 0.025, x_{15} = 1.012, x_{17} = 0.8.$$

Values of the partial criteria are: $F_1^1 = 0.7301, F_2^1 = 0.5833, F_3^1 = 0.6204$.

The second task is to define optimal values of indicators for production strategies, which consider internal business processes:

1-t criterion: level of the internal business processes development (*max*):

$$F_1^2 = 0.1 \cdot \sqrt{0.4655 - 0.0153x_{22}} + 0.1 \cdot \sqrt{1.8986 - \frac{2.1207}{x_{24}}} + 0.1 \cdot \sqrt{1.2587 + 1.2895x_{25}^2} + 0.15 \cdot \frac{1}{1.3356 + \frac{0.0251}{x_{26}}} + 0.1 \cdot \sqrt{0.06 + 0.0026\sqrt{x_{27}}} + 0.1 \cdot \sqrt{0.6097 - \frac{0.0317}{x_{28}}} + 0.2 \cdot \sqrt{0.3846 + 19.2674x_{29}^2} + 0.15 \cdot \frac{e^{0.1173+8.7288x_{30}}}{1+e^{0.1173+8.7288x_{30}}} \quad (5)$$

2-d criterion: level of the customer constituent development (*max*):

$$F_2^2 = 0.5566 - 0.0515x_{22} + 1.393x_{29}. \quad (6)$$

3-d criterion: the general level of the enterprise's activity development (*max*):

$$F_3^2 = 0.0843 + 0.406x_{24}. \quad (7)$$

with restrictions:

$$1.71077 + 0.0252x_{22} - 1.0566x_{24} + 0.168x_{25} + 0.3112x_{24} + 0.000009x_{27} + 0.454x_{28} + 1.1527x_{29} \leq 0.72,$$

$$1.005 \leq x_{22} \leq 1.6; 1.42 \leq x_{24} \leq 1.533; 0.374 \leq x_{25} \leq 0.5;$$

$$0.1 \leq x_{26} \leq 0.28; 16541 \leq x_{27} \leq 30061.4; 0.15 \leq x_{28} \leq 0.32;$$

$$0.04 \leq x_{29} \leq 0.07; 0.05 \leq x_{30} \leq 0.08.$$

The level of the financial constituent and the constituent regarding training and advancing of the staff does not depend on the indicators of the internal business processes.

The optimal solution is:

$$x_{22} = 1.005, x_{24} = 1.42, x_{25} = 0.374, x_{26} = 0.1, x_{27} = 16541.0, \\ x_{28} = 0.15, x_{29} = 0.04, x_{30} = 0.05.$$

The optimal values of the partial criteria are:

$$F_1^2 = 0.6449, F_2^2 = 0.6641, F_3^2 = 0.1046 \quad (8)$$

The third task is to define the optimal values of indicators for marketing (customer) strategies:

1-st criterion: the level of the customer constituent development (*max*):

$$F_1^3 = 0.2 \cdot \frac{1}{1.2621 + \frac{0.0215}{x_{32}}} + 0.1 \cdot \frac{1}{1.4561 - 0.0161x_{33}^2} + 0.1 \cdot \sqrt{0.4568 + 9.6445x_{35}^2} + 0.3 \cdot \\ \sqrt{0.2772 + \frac{0.2318}{x_{36}}} + 0.3 \cdot \sqrt{0.4076 + 0.1081x_{37}^2}, \quad (9)$$

2-d criterion: the level of the internal business processes development (*max*):

$$F_2^3 = 0.459 + 1.1916x_{32} - 0.0835x_{33} + 2.762x_{35} \quad (10)$$

3-d criterion: the general level of the enterprise's activity development (*max*):

$$F_3^3 = 0.5706 + 0.8841x_{32} \quad (11)$$

With limitations:

$$0.4457 + 0.812x_{32} + 0.0033x_{33} + 0.9963x_{35} + 0.0402x_{36} + 0.0637x_{37} \leq 0.6976, \\ 0.1 \leq x_{32} \leq 0.14; 0.5 \leq x_{33} \leq 1.0; 0.04 \leq x_{35} \leq 0.06; 0.855 \leq x_{36} \leq 1.173; \\ 0.8 \leq x_{37} \leq 0.854.$$

Level of the financial constituent development and constituent regarding training and advancing of the staff does not depend on the customer indicators.

The optimal solution is:

$$x_{32} = 0.1, x_{33} = 0.5, x_{35} = 0.04, x_{36} = 1.173, x_{37} = 0.8$$

The optimal values of partial criteria:

$$F_1^3 = 0.6869, F_2^3 = 0.2711, F_3^3 = 0.659 \quad (12)$$

The fourth task is to define optimal values of the indicators for staff management strategies (training and advancing of the staff):

1-st criterion: development level of the constituent regarding training and advancing of the staff (*max*):

$$F_1^4 = 0.25 \cdot \sqrt{-0.00014 + 0.012x_{41}^2} + 0.2 \cdot \frac{1}{10.5739 - 9327.11x_{42}^2} + 0.2 \cdot \frac{1}{17.7137 - \frac{4.5514}{x_{43}}} + 0.35 \cdot \sqrt{-0.0084 + 0.1369\sqrt{x_{44}}}, \quad (13)$$

2-d criterion: level of the financial constituent development (*max*):

$$F_2^4 = -4.9499 + 2.1472x_{41} + 6.4884x_{43} \quad (14)$$

3-d criterion: the general level of the enterprise's activity development (*max*):

$$F_3^4 = -1.4243 + 0.5637x_{41} + 2.8724x_{43}. \quad (15)$$

With restrictions:

$$\begin{aligned} 0.4644 + 0.057x_{41} + 5.5097x_{42} + 0.0957x_{43} + 2.5917x_{44} &\leq 0.6902, \\ 0.972 \leq x_{41} \leq 1.023; 0.01 \leq x_{42} \leq 0.013; 0.53 \leq x_{43} \leq 0.553; \\ 0.021 \leq x_{44} \leq 0.022 \end{aligned}$$

The development level of internal business processes constituent and customer constituent does not depend on the constituent of training and advancing of staff.

The optimal solution is:

$$x_{41} = 0.972, x_{42} = 0.01, x_{43} = 0.53, x_{44} = 0.021$$

The optimal values of partial criteria are:

$$F_1^4 = 0.1065, F_2^4 = 0.586, F_3^4 = 0.646 \quad (16)$$

Almost all defined optimal values of the BSC indicators, except the constituent of the internal business processes, provide the sufficient level of the enterprise's work.

The optimal indicators of the enterprise's activity, which are recommended to be used for comparison in the evaluation, and while developing the functional strategies of the relevant enterprise's activities are calculated.

Comparison of the optimal indicators with those, achieved at the enterprise PJSC "Turboatom", reveals some negative tendencies of its economic processes development. For example, in order to implement financial strategies successfully, it is necessary to increase the profitability of the invested funds, receivable turnover, the return on equity. It is obvious that enterprise has to activate its work regarding funds return in time and to follow clear policy regarding the commodity credits for customers and to introduce measures of the beforehand payment for those customers, who do not pay for shipped products in time. The constituent of internal business processes requires the development of a wide range of the managerial measures. Although the enterprise takes leading positions at some foreign markets thanks to its target orientation to reduce costs for production, rates of the production prime cost reduction have a falling tendency.

The enterprise should analyze rates of the salary increase in comparison with rates of the workers' labour productivity growth. Since the main enterprise's production consists of hydraulic and steam turbines, and also energy equipment that is extremely material-intensive production, an increase of orders for goods production can cause the slower of the production prime cost decrease rates.

In order to increase the efficiency of its activity, the enterprise has to review its policy regarding

reproduction of the basic production assets. Many large domestic industrial enterprises have an old park of machines and equipment. The low share of costs for the equipment modernization proves the fact that enterprise does not deal with the renovation of its basic assets. It is well-known that when real value ratio of the basic production assets reaches the critical mark (0.2–0.3) in the enterprise's property, the real production potential of the enterprise is low and the enterprise should find funds to improve the situation.

Of course, it is difficult to carry out technical re-equipment of production for such giant enterprise as PJSC "Turboatom", since it requires large amounts of money, but it is necessary to develop and gradually to perform this policy immediately.

Fig.1 demonstrates the costs dynamics for technical re-equipment and major repair at the enterprise.

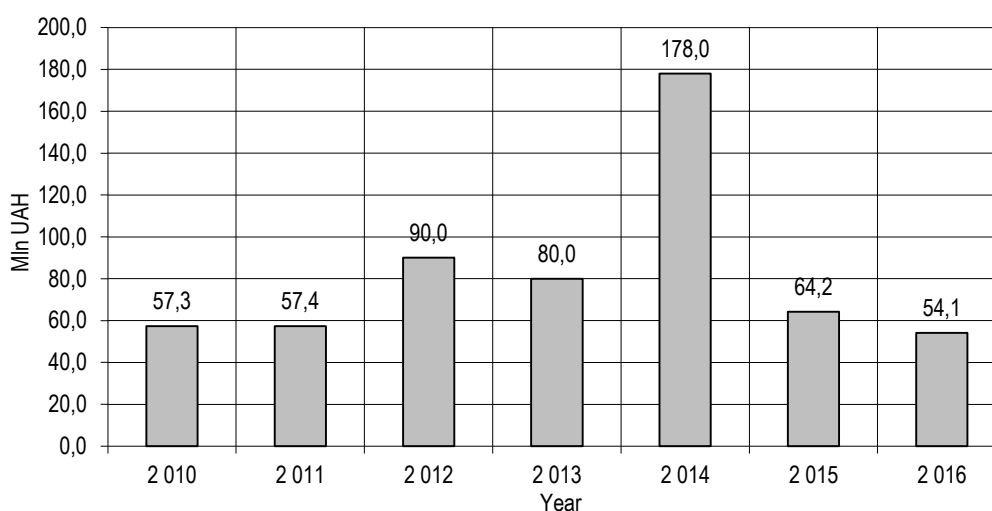


Figure 1 – Costs for technical re-equipment and major repair at the enterprise PJSC "Turboatom"

The enterprise has to deal more with the renovation of the active part than with other main funds since it will positively influence the indicator of the return on assets. The enterprise needs to care about the commodity range renovation of its products. However, one should carefully make managerial decisions.

The enterprise has to increase the marketing activity efficiency, mainly the organization of the production material and technical provision. It is necessary to develop managerial measures regarding the resources amount compliance with needs in them, particularly, the organization of timely receipt of the material resources in the right amount, quality and assortment, on which the linear and rhythmic output of the final goods, its competitiveness and enterprise's activity efficiency depend. It is obvious that marketing department at the enterprise should ground the plan of measures regarding determination of the perspective and current need in materials, raw material and equipment; check and improve development of the material balances, place orders and carry out operative measures for their implementation; make detailed analysis of the material resources quality level, according to the standards, select suppliers and support relations with them. The marketing department should pay attention and reduce the production share, that is covered by the guarantee service.

The general scheme of managerial measures regarding the increase of the activity efficiency at PJSC "Turboatom", obtained on the basis of comparison of the achieved results with optimal values of the BSC, is shown in fig. 2.

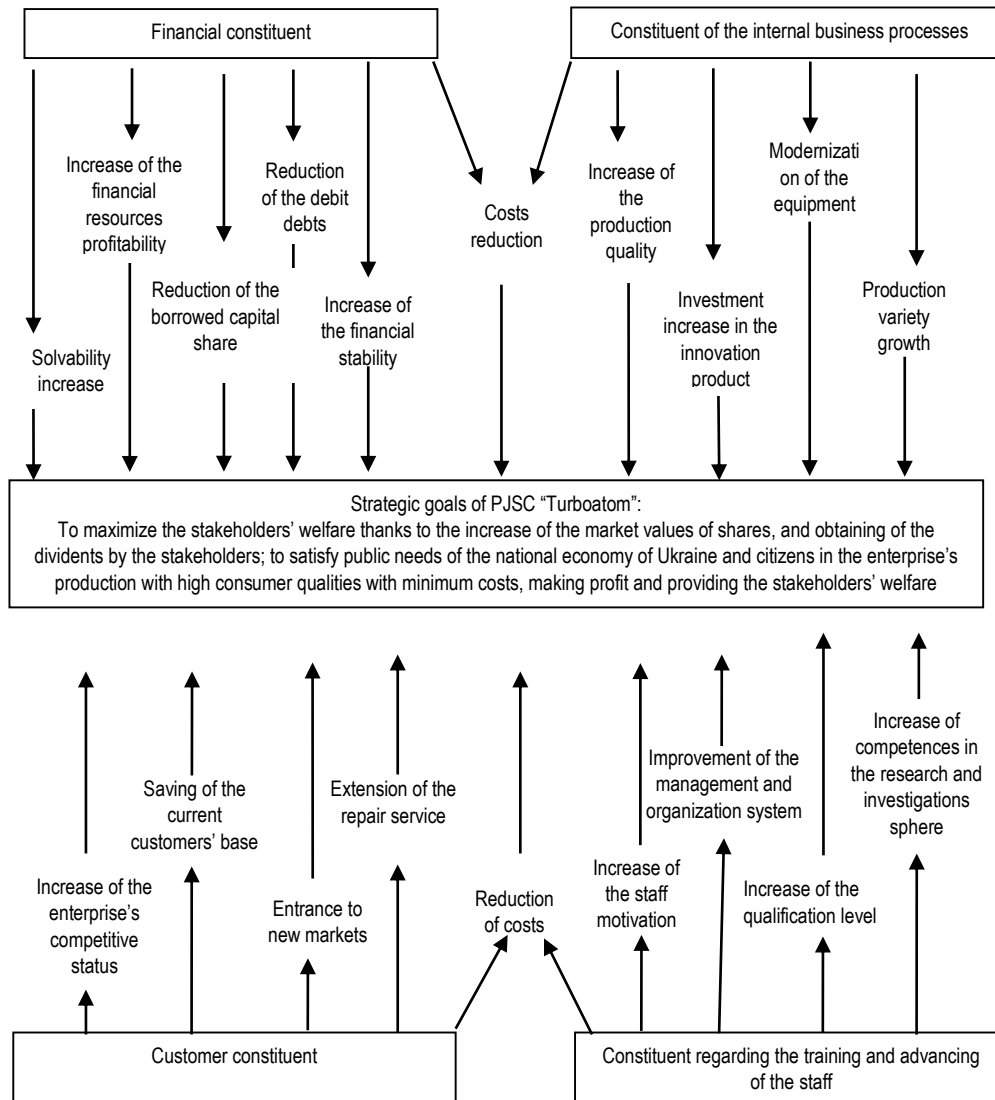


Figure 2 – The general scheme of managerial measures regarding the efficiency increase of PJSC "Turboatom" activity"

Conclusions. The modelling process will be finished if it is possible to ground and to make an effective managerial decision thanks to the calculated mathematical model. Given this, the activity evaluation modelling on the basis of the balanced scorecard multi-criteria optimization defines the final stage as a stage to develop the managerial decisions regarding the increase of the enterprise's activity and improvement of management by it. The modelling results of the enterprise's activity evaluation are reasonable to use in practice at all stages of the managerial decision development regarding the

enterprise's activity efficiency increase based on its evaluation, mainly at stages where information about situation is obtained, the goal is set, the evaluating system is investigated, the situation is analyzed and diagnosed, the situation prediction is investigated, the alternative decisions are generated, main variants of the managerial actions are chosen, the situation development scenarios are developed, main managerial actions are evaluated by experts, at stages of the collective expert evaluation, decision making by a person, who makes decision, plan of actions is developed, the plan implementation is controlled, the results of the situation development after managerial actions are analyzed. All the above stages of managerial decisions development regarding the enterprise's activity efficiency increase through its evaluation require the relevant provision with information, based on the constituents and results of the multi-criteria optimization of the balanced scorecard.

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Г. О. Ус, д.е.н., професор, Східноєвропейський університет економіки і менеджменту (Черкаси, Україна);
Л. М. Малярець, д.е.н., професор, Харківський національний економічний університет імені Семена Кузнеця (Харків, Україна);

І. Б. Чудасва, д.е.н., доцент, Східноєвропейський університет економіки і менеджменту (Черкаси, Україна);
О. В. Мартинова, к.е.н., Харківський національний економічний університет імені Семена Кузнеця (Харків, Україна).

Багатокритеріальна оптимізація значень збалансованої системи показників для оцінки діяльності підприємства: інструмент менеджменту для бізнес-інновацій

Метою статті є розробка методичного підходу до оцінювання діяльності підприємства на основі збалансованої системи показників за допомогою моделей багатокритеріальної оптимізації. Обґрунтовано, що для розв'язання багатокритеріальних оптимізаційних задач, спрямованих на оцінювання діяльності підприємства, необхідно використовувати процедуру fminimax з реалізацією у програмному середовищі MatLab. У відповідності до чотирьох складових збалансованої системи показників (фінансової, клієнтської, внутрішніх бізнес-процесів, навчання та розвитку персоналу) сформовано чотири оптимізаційні задачі, критеріями оптимізації в яких є рівні розвитку відповідних складових розвитку досліджуваного підприємства (фінанси, бізнес-процеси, клієнти, персонал), а також загальний його рівень. При формуванні системи обмежень розробленої моделі враховано числові характеристики законів розподілу значень індикаторів кожної зі складових збалансованої системи показників. Обчислені оптимальні значення складових збалансованої системи показників є базою для порівняння з реально досягнутими на конкретному підприємстві, що може бути використано при розробленні функціональних стратегій відповідних видів діяльності підприємства, стратегії інноваційного розвитку, виявленні слабких місць та негативних тенденцій у розвитку окремих бізнес-процесів, при перегляді підприємством політики щодо відтворення основних виробничих засобів, особливо оновлення їх активної частини, при розробленні управлінських заходів щодо запровадження бізнес-інновацій та підвищення ефективності видів діяльності підприємства.

Ключові слова: види діяльності, збалансована система показників, багатокритеріальна оптимізація, частинні критерії, порівняльна оцінка.