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Інформація про автора

Тарасова Тетяна Олексіївна – канд. екон. наук, докторант, доцент кафедри бухгалтерського обліку та аудиту Харківського державного університету харчування та торгівлі

(вул. Клочківська, 333, м. Харків, Україна, 61051, e-mail: tarasovatatina@mail.ru).

Інформація об авторе

Тарасова Татьяна Алексеевна – канд. екон. наук, докторант, доцент кафедри бухгалтерського учета и аудита Харьковского государственного университета питания и торговли (ул. Клочковская, 333, г. Харьков, Украина, 61051, e-mail: tarasovatatina@mail.ru).

Information about the author

T. Tarasova – PhD in Economics, doctoral student, Associate Professor of the Accounting and Auditing Department of Kharkiv State University of Food Technology and Trade (333 Klochkivska St., Kharkiv, Ukraine, 61051, e-mail: tarasovatatina@mail.ru).

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THE TERNARY ANALYTIC SYSTEM FOR DECISION-MAKING

O. Oleksiuk

The findings of the research on the new approach to decision-making in the current business environment have been presented. The study has been focused on the techniques of the business performance evaluation and developing a decision support analytical system. Nowadays the key factors of business success have changed and the management tools have to change with a view to taking into the account the intellectual part of the value of goods or information costs. Additionally, the investors and managers have to take into consideration new types of business organizations, shadow financial transfers and cross-industrial economic relations. The new approach bases on the non-categorical (ternary) analytical estimation of socio-economic results which makes it possible to tackle intangible corporate assets, time and traditional financial indicators as the equivalent components for decision-making. The study has contributed to the development of the economic calculation by introducing a socio-related analytic system. The research methods included the barycentric algebra, the data envelopment analysis (DEA), the cost benefit analysis, the econometric modelling and the traditional financial diagnostics. These quantitative methods were supported by qualitative techniques such as expert survey and benchmarking. The prospective research results will be useful for improving the decision-making, developing managerial applications and business performance management. The study aims to provide recommendations on the improvement of the business climate in Asia and CIS countries.

Keywords: performance, efficiency, decision-making, ternary analysis, economic results, barycentric estimation.

ТЕРНАРНА АНАЛІТИЧНА СИСТЕМА РОЗРОБЛЕННЯ УПРАВЛІНСЬКИХ РІШЕНЬ

Олексюк О. І.

Наведено результати дослідження підходів до розроблення управлінських рішень за сучасних умов ведення бізнесу. Центральним аспектом роботи є технології оцінювання результативності діяльності компаній та розвитку аналітичних систем підтримки управлінських рішень. Сьогодні вже змінилися ключові фактори досягнення успіху в бізнесі, що потребує модифікації аналітичних інструментів менеджменту для адекватного врахування інтелектуальної складової частини вартості товарів чи інформаційних витрат. Додатково інвестори та керівники мають брати до уваги нові форми організації бізнесу, тіньові фінансові трансферти та кросс-галузеві економічні зв'язки. Запропонований новий підхід ґрунтується на некатегоричному (тернарному) аналітичному оцінюванні соціально-економічних результатів, що дозволяє працювати з нематеріальними активами компаній, часовими параметрами та традиційними фінансовими індикаторами як із еквівалентними елементами процесу розроблення управлінських рішень. Дослідження вдосконалює методологію економічних розрахунків на основі започаткування соціально залежної аналітичної системи аналізу. Методи дослідження містять барицентричну алгебру, DEA-аналіз, функціонально-вартісний аналіз, економетричне моделювання та традиційну фінансову діагностику. Зазначені кількісні методи було доповнено якісними технологіями аналізу, а саме: опитуванням експертів та бенчмаркінгом. Перспективні наукові результати дослідження будуть корисні для вдосконалення процесу розроблення управлінських рішень у компаніях, розвитку управлінських застосувань і систем управління результативністю бізнесу. Дослідження орієнтоване на поліпшення умов ведення бізнесу у країнах СНД та Азії.

Ключові слова: результативність, ефективність, розроблення управлінських рішень, тернарний аналіз, економічні результати, барицентричне оцінювання.

ТЕРНАРНАЯ АНАЛИТИЧЕСКАЯ СИСТЕМА РАЗРАБОТКИ УПРАВЛЕНЧЕСКИХ РЕШЕНИЙ

Олексюк А. И.

Представлены результаты исследования нового подхода к разработке управленческих решений в современных бизнес-условиях. Центральным аспектом исследования являются технологии оценки результативности деятельности компаний и развитие аналитических систем поддержки управленческих решений. Сегодня уже изменились ключевые факторы достижения бизнес-успеха, что требует модификации аналитических инструментов менеджмента для адекватного учета интеллектуальной составляющей стоимости товаров или информационных затрат. Дополнительно инвесторы и менеджеры должны принимать во внимание новые формы организации бизнеса, теневые финансовые трансферты и кросс-отраслевые экономические связи. Предложенный подход базируется на некатегорической (тернарной) аналитической оценке социально-экономических результатов, что позволяет работать с нематериальными активами, временными параметрами и традиционными финансовыми индикаторами как с эквивалентными элементами процесса разработки управленческих решений. Исследование развивает методологию экономических расчетов на базе введения социально зависимой аналитической системы анализа. Методы исследования включают барицентрическую алгебру, DEA-анализ, функционально-стоимостный анализ, эконометрическое моделирование и традиционную финансовую диагностику. Указанные количественные методы были дополнены качественными технологиями анализа, а именно: опросом экспертов и бенчмаркингом. Перспективные результаты исследования будут полезны для усовершенствования процесса разработки управленческих решений в компаниях, развития управленческих приложений

и систем управления результативностью бизнеса. Исследование ориентировано на улучшение условий ведения бизнеса в странах СНГ и Азии.

Ключевые слова: результативность, эффективность, разработка управленческих решений, тернарный анализ, экономические результаты, барицентрическая оценка.

The current situation in the global economy stimulates scientific researches on the keys to the stabilization of socio-economic processes. The major factors of rapid global destructive changes are still under discussion. Obviously, basic (micro-level) economic systems (companies) have to do business now and deal with modern unpredictable environment. The unstable market environment, ecological changes, the high speed of technological development, the increasing ratio of information costs in product value cause the necessary progress in the methodology of the corporate management and economic analysis.

Reconsideration of scientific paradigms and conceptual principles of economic science are oriented to successful handling of economic contradictions between endless needs and limited resources, between production requirements and consumer tastes, between current financial results and strategic goals of the socio-economic development, between personified and public economic interests.

The main research problem is how to improve decision-making under knowledge-based economic conditions. The most important part of this scientific problem is the newest economic processes on local or global levels. It should be noticed that scientific recommendations are very important for investors: how to work with unstructured developing markets, how to deal with the non-economic competition, how to manage the financial flows according to the shadow (real or possible) transfers and operations. The analytical background for successful managerial decisions should base on the economic evaluation of business resources, information and time efficiency.

The general goal of the research is the evaluation of information and intellectual elements of the value added in the decision-making process under modern social and economic conditions. The study has several aims for further researching:

- improvement of the corporate accounting;
- development of the strategic management;
- creation of a better technique for analytical calculations of investment and financial management;
- direct involvement of consumers and partners into the decision-making process;
- taking into account the full range of possible economic and social effects within one analytic system.

Nowadays the biggest part of the value added in the global economy is created by intellectual, knowledge-based activities. Nevertheless, these crucial elements of corporate development cannot be easily taken into account in the strategic management and their evaluation is still quite subjective. As a result, the most important factors are out of the managerial control. The intensive and rapid integration expands over all levels of the world economy and brings many unusual managerial tasks. For instance, managers have to deal with developing markets, transnational capital flows, shadow economic processes, dynamic changes in behavioristic consuming models and others. Consequently, the question how to get success under global business models and cross-market economic strategies does not get an effective answer in practice.

The client-oriented business conception provides close connections between the quality of business processes, corporate financial results and the market value of companies. Despite the visible correlation between these parameters it is difficult to plan customer loyalty progress in financial indicators. That is the reason that stimulates the development of many alternative methods for customer efficiency evaluation. These methods are sometimes based on opposite backgrounds and lead to contradictive metrics and discursive conclusions.

Traditionally managers use a wide range of objective and subjective analytic techniques. Managers try to find optimum between conflicting goals by mathematical, statistical, sociological or other analytical tools but the majority of available approaches are based on the classical economic relations. The newest socio-economic problems need adoptive managerial algorithms that will allow ensuring a successful development in "the clever business environment".

From a practical viewpoint, the lack of adequate decision-making technologies at the macro and corporate levels leads to managerial mistakes. Definitely, the low efficiency of current corporate anti-crisis programs, cumulative industrial declines, a huge amount of business bankrupts and other factors are results of such mistakes.

Traditionally the decision-making tools ground on analytical algorithms and definitions. For instance, managers use such synonyms as "performance", "efficiency", "profitability", "productivity" and "competitiveness" for describing the commercial (economic) success of their companies. Undisputedly, these definitions have some differences not only in the morphological meaning but in the economic context.

Moreover they should be adopted to the modern economic reality and filled with a new socio-economic content. For this study the most convenient term is the "business performance management" that allows looking at the decision-making process as a goal-oriented, beneficial and systematic technology. Peter Druker explained in his books that effectiveness is "how to get aims in the best manner", but performance would be able to tell us which goals are appropriate at any stage of business development [1].

Nevertheless, the commercial success is a key point of all social, economic, technological, pharmaceutical and other researches. Some scientists support a position that there is no principal difference between "performance", "effectiveness", "profitability", "productivity" but others hold an opposite point of view. For instance, the differences in these definitions are illustrated in D. Skott Sink's publications [2]. The same position is applied to official recommendations for estimation performance of the Organisation for Economic Cooperation and Development [3]. M. Bourne, M. Franco, J. Wilkes made a survey of the corporate estimation practices in the European companies [4; 5]. According to their results, successful companies got the world level by managing two main business functions – the evaluation of business results and the business performance management.

The common approach to managing business performance orients to the reengineering and business model development. The positive correlation between process-oriented management and business performance was empirically proved by K. P. McCormack, W. C. Johnson [6]. Therefore, the aforementioned links allow us to make a hypothesis about an informative or intellectual nature of the modern business performance management. The same thesis follows from the value added structure of commodities and global market trends.

The next important part of the study is connected with HR management. It should be noticed that a lot of business performance researches were devoted to this issue, for instance, the study of A. A. De Waal [7]. The author wrote that the key to the performance management is the corporate human resource and he identified seven groups of factors for a business to succeed: the mechanisms of development (changes), the organizational context, the feedback channel with personnel and clients, controlling, the system of control, monitoring of internal and external environments.

The social approach also includes a cultural aspect. J. Graham wrote that the business performance management has to be built on a special corporate culture [8]. He thought that unique organizational climate allows discovering the full creative potential of employees, and underlined the integration of HR, business performance and strategic management.

Other famous scientists discovered three main aspects of the business performance system [9 – 14]: the system of aims, the estimation system and managerial mechanisms. According to these authors the corporate culture is an element that integrates all other blocks. Moreover, they thought that the key task for performance managing is the integration of performance estimation and corporate education. So there are several main activities for business performance management such as tutoring, controlling and diversification.

An interesting point of view was presented by the researchers E. Soltani, R. B. Van-der Meer, J. Williams [15]. They paid attention to the correlation between corporate performance and quality management (TQM). Their next conclusions concentrated on the integration of performance indicators with the quality management, the accurate account of the consumer preferences, the constant increasing the personnel efficiency and the project management.

D. N. Ammons tried to connect the business performance management to consumer surveys [16]. The main idea of his publication can be illustrated by one sentence "The economic performance is an understanding under strong influence of the goals". Z. Radnor and M. McGuire supported the same goal-oriented or managerial vision in their article "Performance management in the public sector: fact or fiction?" [9]. These authors proved that the business performance management is a technique of corporate education.

The survey of failures in the business performance management practices made by M. Bourne, A. Neely, J. Mills, K. Platts [5] is worth mentioning. The main conclusion in their work was about the uniqueness of corporate models resulting in a unique mode of business performance management. Some other well-known technologies for business performance management include:

- the AMBITE (Advanced Manufacturing Business Implementation Tool for Europe) [17];
- the ENAPS Performance Measurement Approach [18];
- the recommendations of the Canadian International Development Agency [19];
- the Balanced Scorecard technique by D. Norton and R. Kaplan [20];
- the International Society for Performance Improvement approach [21].

The theoretical review of the published sources makes it possible to state that the problem of business performance management has several aspects – logic and psychological, philosophical, economic and sociological. Undisputedly, modern conceptual socio-economic transformations lead to re-thinking of the key cost-pricing factors of goods and cause-effect relations in business.

The author's comparison of advantages and disadvantages of different methods for business performance analysis (by R. Petuhov, S. Eilon, B. Gold, J. Soesan, K. Kurosawa, A. Lowrall, S. Pokropivnyi etc.) has identified restrictions on their use under modern business conditions. For instance, managers should make decisions on the spot but financial and market information provided for them is based on the past facts. That is the main reason why managers have to deal with some level of uncertainty and the lack of a clear informative background causes managerial mistakes.

In a nutshell, managers should take into account the key factors of success in the modern environment (innovations, consumer preferences, psychological stimulus for business activity and others) but they don't have proper analytic tools. They cannot often get information about the quality of business processes. It is possible in expert grades but it will be impossible to convert these estimations into value indicators.

So, it will be difficult to integrate the corporate financial results with intellectual, innovative, time and other indicators. All corporate strategies are developed for getting social, economic, marketing, ecological or other results. However, it is still unclear how to estimate the full range of economic results under modern business reality. The calculation of economic results is complicated by intangible costs, shadow transfers, contradictory human capital evaluations and business processes quality estimations.

The theoretical and methodological basis of the research is a set of epistemological approaches, non-categorical logic for decision-making and other methods which are directly related to the performance estimation. New aspects are generated by technologies of problem-oriented analysis and synthesis, classification and systematization of cross-industrial cases. The most essential theoretical results have been got by reviewing the newest scientific publications, exploring the best practice of economic processes of different industries. The empirical part of the research bases on the statistical and mathematical programming, the correlation and regression analysis and also using special packages of data processing (DEA application).

The following methods have been used in the research:

- the ternary logic of economic calculation which is a core method applied to both the performance estimation and the non-categorical validity of decision-making;
- the barycentric mathematical tool used for assessing the enterprise performance according to the added value criterion;
- the efficiency-ratio methods which form the basis for the author's system of developing and improving the performance indicators.

The research framework combines national and international scientific publications (monographs, articles, collections of scientific papers and results of researches), official statistic materials of the State Statistic Committee of Ukraine, documents of other executive authorities, periodicals and annuals of international organizations, corporate financial reports and business associations.

The first result of the study is the method of business performance evaluation. It is based on the negentropic approach and quantitative estimations of business information. So it takes into account informative, innovative and intellectual components as a natural part of modern business activities. The next result is the technology of the business diagnostic. The main idea is the calculation of the value added flows and development of these computations on a hierarchy of economic indicators. On the one hand, our analytic model uses the DEA and a situation-related mathematical approach. According to the author's vision, an information-centered ternary model of the economic performance evaluation has been developed. This technique is based on the barycentric math and software tools.

On the other hand, nowadays it is very important to analyze the ownership and cross-industry relations. The correct and complete analysis of these matters allows re-evaluating the market situations and improving the analytic background of partnerships. All the author's achievements are oriented to the industrial practices. The author offers some improvements of BPM software applications available on the European and global IT markets. Many European IT platforms are developed by powerful IT companies such as Hyperion, SAP, IFS and others.

The traditional business calculus uses the Boolean algebra and classical logic constructs. Nowadays there are many different sciences avoiding the special object-related techniques of conclusion-making and Economics is not an exception to the rule. The social nature of economic processes should be described by the relevant analytic tools. The background of this logic was formed by J. Lukasiewicz, L. Carroll, N. Vasiliev, C. Lewis, D. Bochvar, A. Tarski and others. The research grounds on the soft ternary implication that is more natural for the human behavior and socio-economic processes (Fig. 1).

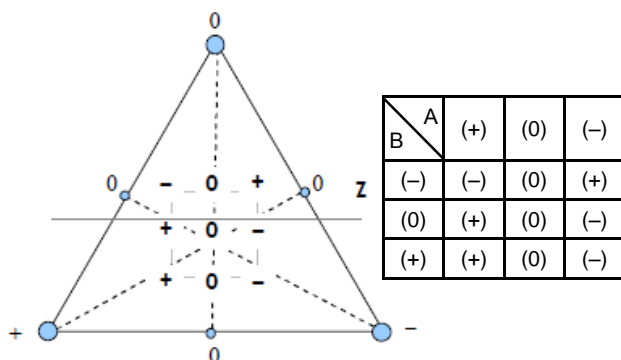


Fig. 1. The soft ternary implication

This ternary approach allows identifying the economic results by a triangular analytic construct – resource-time, information-resource and time-information ratios (Fig. 2).

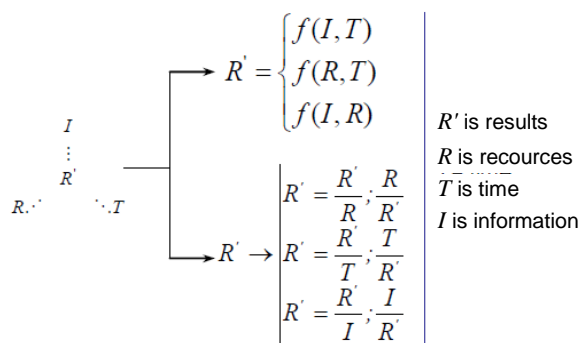


Fig. 2. Identification of economic results

The barycentric mathematical tools are able to convert the logical construct of the economic result into an analytic function and a proportion. The following equations will help to identify a position or a place in the ternary analytic system of performance evaluation which means that the results of business activity should be only estimated by resources, time and information:

$$R' = \begin{cases} x = [(I, i), (T, t)] \\ y = [(T, t), (R, r)] \\ z = [(R, r), (I, i)] \end{cases} \quad (1)$$

where i, t, r mean information, time and resources;

$$\frac{Ib}{bT} \times \frac{Ta}{aR} \times \frac{Rc}{cI} = I, \quad (2)$$

where a, b, c are values of different angles of the ternary system.

On this analytic base six managerial indicators have been built and integrated in one BPM-model (Fig. 3).

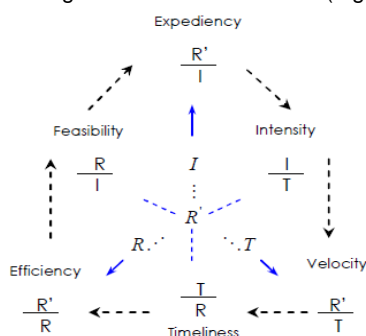


Fig. 3. The model of performance indicators for decision-making

It should be noticed that one of the possible approaches to the estimation of the information on the markets uses the probability theory. The author solves this task by using the Shannon method and traditional market indicators:

$$inf = \sum_{i=1}^n p_i \times \log_2 p_i. \quad (3)$$

After creating the analytic system for supporting decisions the author has developed a set of relevant comparative matrices. Value added flows have been used as the main criteria for building these matrices. The Data Envelopment Analysis provides a necessary application for analyzing value added flows. The author tried to approbate this approach and build a ternary graph for Ukrainian companies' performance evaluation (Fig. 4).

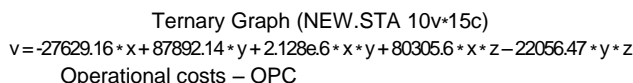
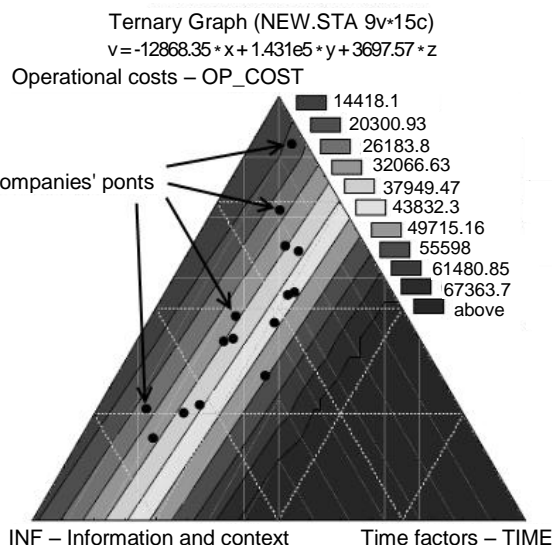


Fig. 4 Two types of Ukrainian companies' performance evaluation

Finally, the author offers to use this approach to improving decision-making to take into account the informative context of business activities. Thus, a research proposal has been outlined that will investigate the decision-making under modern conditions, particularly, the influence of social and intellectual factors on the business performance. The key subject of the study is companies and their managerial practices. The expected results will improve the decision-making methodology and business performance applications. For the practical prospects, the author expects to develop a special "business intelligence" software application with a hope to get the authorship certificate and offer it to IT companies.

Although it is rather difficult to make a clear prediction about the future practical implementation of the scientific results, the following conclusions can be drawn:

- the proposed ternary system of performance estimation and decision-making will provide an advanced theoretical understanding

and an econometric model of business activities; estimation of new forms of resource relocations under the knowledge-based economic paradigm; estimation of an "appropriate" level of company performance and disaggregation of its impact at the corporate level etc;

- the recommendations (suggestions) of this study will be useful for better decision-making and more precise economic calculations. The author also hopes that the study will help to identify more or less efficient strategies for Ukrainian companies;

- the proposed approach and analytic tools for business performance management aim to support Ukrainian managers and develop national corporate management standards. The author hopes that Ukrainian companies will be able to build transparent mechanisms for EU-Ukrainian cooperation in the near future.

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Information about the author

O. Oleksiuk – Doctor of Sciences in Economics, Professor of Enterprise Economy Department of Kyiv National Economic University named after Vadym Hetman (54/1 Peremohy Ave., Kyiv, Ukraine, 03680, e-mail: alexolexuk@gmail.com).

Інформація про автора

Олексюк Олексій Іванович – докт. екон. наук, професор кафедри економіки підприємств Київського національного економічного університету імені Вадима Гетьмана (просп. Перемоги, 54/1, м. Київ, Україна, 03680, e-mail: alexolexuk@gmail.com).

Информация об авторе

Олексюк Алексей Иванович – докт. экон. наук, профессор кафедры экономики предприятий Киевского национального экономического университета имени Вадима Гетьмана (просп. Победы, 54/1, г. Киев, Украина, 03680, e-mail: alexolexuk@gmail.com).

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