The object of research are the peculiarities of formation, use and improvement of the economic-mathematical model of the enterprise's development. It is determined that the development of enterprise is evaluated through economic growth (result) taking into account quantitative and qualitative changes (in certain space-time environments), where the potential, quality of management, innovation and orientation to the processes of continuous improvement (through the development of staff, improvement of the system of interaction, opportunities, etc. based on the use of modern technologies and management systems, support and expansion of the marketing business network and ensuring the reliability of partnerships to achieve economic goals) provide economic growth (result) of the enterprise. A graphic interpretation (model) of the enterprise development is presented according to the theory of cyclical development and taking into account the influence of innovation in the system of kind of innovation as kind of development. It is determined that the level of scale and quality of the enterprise development depends on its potential and reserves for growth. It is identified that in practice there are problems related to the formation (build-up) and use of a system of indicators to determine the level of development of enterprise. Upon the results of the study and discussion, an improved economic-mathematical model of the enterprise development is presented, which, unlike the existing ones, not only takes into account the theoretical and applied aspects of the use of independent partial models of the enterprise development for management of development (namely, content, characteristics and values of the model of the enterprise's ability to develop, the model of selecting the enterprise's development strategy, the model of selecting the enterprise development vector, the model of selecting the basis of the enterprise development, the model of efficient management of the enterprise based on the introduction of the marketing mechanism and the model of the enterprise development result), but also provides for a simultaneous multi-vector target assessment of many spheres of the enterprise's operations (based on the use of a system of parameters, indicators and criteria of the system-oriented economic diagnostics) in order to determine its prospects. In particular, it includes the main directions and the basic instrumentarium for diagnosing competitiveness, investment attractiveness and enterprise development, taking into account the relationship of modern management and marketing.

Keywords: enterprise, enterprise development, enterprise development model, development result, management and marketing relationship, economic diagnostics, managerial decisions and innovations, economic goals.

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Skrynkovskyy Ruslan M. – PhD (Economics), Associate Professor, Professor, Department of Business Economy and Information Technology, Lviv University of Business and Law (99 Kulparkivska Str., Lviv, 79021, Ukraine)
E-mail: uan_lviv@ukr.net
ORCID: http://orcid.org/0000-0002-2180-8055

Sopilnyk Lyubomyr I. – D. Sc. (Engineering), D. Sc. (Law), Professor, Professor, Department of Administrative Law and Process, Financial and Information Law, Lviv University of Business and Law (99 Kulparkivska Str., Lviv, 79021, Ukraine)
E-mail: sopilnyk01@gmail.com
ORCID: http://orcid.org/0000-0001-6881-7255


Tsuyh Svyatoslav I. – Marketing Specialist, Yadro LLC (7 Shchyretska Str., Lviv, 79071, Ukraine)
E-mail: svyatoslavtsuyh@gmail.com

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Ключевые слова: предприятие, развитие предприятия, модель развития предприятия, результат развития, взаимосвязь менеджмента и маркетинга.

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Скрыньковский Р. Н., Сопильник Л. И., Цюх С. И. Совершенствование модели развития предприятия: новые решения на основе менеджмента, маркетинга и экономической диагностики

Объектом исследования являются особенности формирования, использования и совершенствования экономико-математической модели развития предприятия. Установлено, что развитие предприятия оценивается через экономический рост (результат) с учетом количественных и качественных изменений (в определенных пространственно-временных условиях), где потенциал, качество управления, инновации и ориентация на процессы постоянного совершенствования (через развитие персонала, улучшение системы взаимодействия, возможностей и т. п. на основе использования современных технологий и систем менеджмента, поддержки и расширения маркетинговой деловой сети и обеспечения надежности партнерских отношений для достижения экономических целей) обеспечивают экономический рост (результат) предприятия. Представлена графическая интерпретация (модель) развития предприятия согласно теории циклического развития и с учетом влияния инноваций в системе "вид инноваций – вид развития". Установлено, что уровень масштабности и качества развития предприятия зависит от его потенциала и резервов роста. Выявлена и на практике существуют проблемы, связанные с формированием (построением) и использованием системы показателей для определения уровня развития предприятия. По результатам исследования и обсуждения представлено усовершенствованная экономико-математическая модель развития предприятия, которая, в отличие от существующих, не только учитывает теоретические и прикладные аспекты использования независимых частных моделей развития предприятия для управления развитием (в том числе содержание, характеристики и значения модели способности предприятия к развитию, модели выбора стратегии развития предприятия, модели выбора вектора развития предприятия, модели выбора базиса развития предприятия, модели эффективного управления предприятием) на основе внедрения маркетингового механизма модели результатов развития предприятия), но и предусматривает одновременное многовекторное целевое оценивание многих сфер функционирования предприятия (на основе использования системы параметров, показателей и критериев системно-ориентированной экономической диагностики) с целью определения его перспективы. В частности, включает основные направления и базовый инструментарий диагностики конкурентоспособности, инвестиционной привлекательности и развития предприятия с учетом взаимосвязи современного менеджмента и маркетинга.

Ключевые слова: предприятие, развитие предприятия, модель развития предприятия, результат развития, взаимосвязь менеджмента и маркетинга, экономическая диагностика, управленческие решения инновации, экономические цели.

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Скрыньковский Руслан Николаевич – кандидат экономических наук, доцент, профессор кафедры экономики предприятий и информационных технологий, Львовский университет бизнеса и права (ул. Кульпарковская, 99, Львов, 79021, Украина)

Электронная почта: uan_lviv@ukr.net

Сопильник Любомир Иванович – доктор технических наук, доктор юридических наук, профессор, профессор кафедры административного права и процесса, финансового и информационного права, Львовский университет бизнеса и права (ул. Кульпарковская, 99, Львов, 79021, Украина)

Электронная почта: sopilnyk01@gmail.com

Цюх Святослав Игоревич – маркетолог, ООО «Ядро» (ул. Щирецкая, 7, Львов, 79071, Украина)

Электронная почта: svyatoslavtsyuh@gmail.com

УДК 65.01

JEL: C59; M00
A
s practice shows, in recent years, business conditions are characterized by the financial and economic crisis, permanent political instability, corruption risks, increase in the degree of dynamism, complexity and uncertainty of the external environment, significant increase in competition in the market, as well as the inability of the market mechanism to ensure stability and efficiency of enterprises in general, etc. [1–4]. In these circumstances, activities of an enterprise should be aimed not only at identifying and eliminating its problem points and weaknesses in a competitive environment but also at the development process and its effective management with the use of the best world practices and technologies.

The analysis of literary sources [1; 3; 5–8] and business practices has allowed to reveal that the interpretation of the concept “enterprise development”, the key features of enterprise development, as well as its types (defined based on certain characteristics, criteria) and kinds (sustainable development, managed development, organizational development, etc. [9; 10]) are closely related to other concepts and economic categories, in particular – enterprise potential, competitiveness, investment attractiveness, internal variables, economic interests (targets), and strategic management and innovation.

In economic theory and practice, development of an enterprise: 1) is reflected, as a rule, with the help of the business (economic) cycle; 2) is estimated through economic growth (result), taking into account changes (under certain spatial and temporal conditions).

At the same time, in [9], it is noted that development of an enterprise is conceptually characterized by an increase in its potential and the following interrelated components: 1) quantitative, qualitative and structural changes; 2) improvement; 3) its process character; 4) duration; 5) a set of processes; 6) adaptation to the external environment; 7) internal integration of the enterprise; 8) the ability to counteract the negative effects of the external environment; 9) increase in the enterprise’s viability.

However, within the framework of scientific researches on the problem [3; 11; 12], it is established that the higher the level of potential of a business entity is, the more development opportunities it has. Here, potential of an enterprise should be understood as its capabilities, resources (financial, labor, material, energy, etc. [13]), reserves, funds that are used or can be used to achieve the strategic or tactical goals of the enterprise [3].

Given this, it is found that the above components of an enterprise’s development, including increase in its potential, form a systems model for determining its level. At the same time, taking into account the opinion of top executives (managers), it is determined that insufficient attention is paid to the task of constructing a comprehensive model of enterprise development. This should be done with due consideration for combination and coordination of the experience and knowledge about this process, including theoretical and applied bases of management, marketing, economic diagnosis (target assessment) of an enterprise (based on the system of parameters, indicators and criteria), their interrelations, and economic and mathematical modeling on the problem. Along with this, it is worth noting that out of a large number of models and methods for determining the level of enterprise development the model presented in [5] deserves special attention. However, certain aspects of the presented model require additional studying, certain improvement, and corresponding refinement. All this has justified the relevance of the study, its theoretical importance and practical significance and determined the choice of the research object – features of the formation, use, and improvement of the economic and mathematical model of enterprise development.

Therefore, the aim of the study is to formulate theoretical principles and develop practical recommendations for improving the economic and mathematical model of enterprise development based on management, marketing and economic diagnosis.

To achieve the set goal, the research employs the following methods [12; 14; 15]:

- methods of systems analysis, systematization, complex generalization and concretization, the graphical method and the method of comparison (of processes, indicators) – to clarify the essence and structure of the concept (category) “enterprise development” (in terms of management and content), improve the graphic model of enterprise development according to the theory of cyclic development (taking into account the influence of innovation in the system “type of innovation – type of development”), as well as to present the method for determining growth rate;

- economic and mathematical methods for modeling systems based on expert assessments (judgments of enterprise managers expressed in the form of a descriptive, qualitative and quantitative assessment of objects on the problem) – to improve the economic and mathematical model of enterprise development based on management, marketing, and economic diagnosis.

According to the results of studies [12; 14; 16], we can conclude that the process of constructing the economic and mathematical model for a real economic object in the context of constantly changing external influences, uncertainty and complexity of economic processes consists of the following six interrelated stages:

1) formulating a real economic problem and carrying out its qualitative analysis;
2) formalizing the economic problem and constructing an applied model (based on theory and
analitics) in the form of specific economic and mathematical dependencies and relations (functions, equations, inequalities, etc.);
3) carrying out economic and mathematical analysis of the model (in order to identify its general properties and assessing its suitability for studying a real object, process;
4) preparing initial information (economic, tax, statistical, scientific and technical, sociological, legal, and other types of information) with consideration for assessment of the time factor and cost of obtaining information and / or data;
5) clarifying the issue (main aspects) as concerns practical numerical solutions, taking into account the peculiarities of using information systems and technologies in certain areas as well as management standards and evaluation criteria;
6) carrying out comprehensive analysis of numerical results and their application.

Thus, with regard to the process of constructing economic and mathematical models (theoretical, analytical, applied ones) for a real economic object (based on analysis, systematization, generalization, and explanation of key factors affecting management of economic systems and business processes) [12; 14; 17–21], we recommend expressing the improved economic and mathematical model of enterprise development (based on management, marketing and economic diagnosis) as the system of relations (1) – (2) [3; 5; 22]:

\[
D = \{A, S, V, B, R\} = \{M, Q, I_a, I_d\};
\]

\[
D^* = \{A \rightarrow V \rightarrow R\} = \{C, I_a, I_d\};
\]

\[
T_p > T_o > T_a > 100%;
\]

\[
A = f_1(\{\alpha_A\});
\]

\[
S = f_2(\{\alpha_S\});
\]

\[
V = f_3(\{A, S, \{\alpha_V\}\});
\]

\[
B = f_4(\{A, S, V, \{\alpha_B\}\});
\]

\[
R = f_5(\{A, S, V, B, \{\alpha_R\}\});
\]

\[
S \in \{S\};
\]

\[
V \in \{V\};
\]

\[
B \in \{B\};
\]

\[
\{S\}, \{V\}, \{B\} \neq \emptyset,
\]

where  

\[
D^* \text{ is the enterprise's development in terms of content, which comprehensively (using multi-faceted approach) characterizes the development (as a phenomenon, law and principle [5]). It is advisable to consider enterprise development from several perspectives, namely [3; 23]:}
\]

1) development as a process (in the system "goal – conditions – opportunities – efficiency – result");
2) development as a result (in the system "information – resource – time", using the basic determination of enterprise performance with the help of seven coefficient systems of analytical relationships for evaluating performance: efficiency, feasibility, safety, technological level, intensity, speed and timeliness);
3) development as an immanent property;
4) development as a pattern;
5) development as a dynamic characteristic.

\[
A \text{ is assessment of the enterprise's development potential;}
\]

\[
S \text{ is the enterprise's development vector, the choice of which is based on assessment of the following factors [17; 18; 21]:}
\]

1) risk level;
2) impact of past strategies;
3) influence of factors of the enterprise's external environment, which include economic, market, political, natural, scientific, technical, demographic and other factors;
4) dependence on time and cost factors;
5) influence of factors of the internal environment, which is determined, according to the theory and practice of management, by such main internal variables of the enterprise as goals, structure, tasks, technology, and employees, which are interconnected and form a system model.

\[
\{S\} \text{ is a set (list) of possible strategies for the enterprise's development (based on hierarchy in the management system, functional criterion, stages of the life cycle, competitive position in the market, way to achieve competitive advantages, development directions, etc. [24]), which are aimed at ensuring its stable competitive position in the market and growth of its market value;}
\]

\[
V \text{ is the enterprise's development vector (Fig. 1);}
\]

\[
\{V\} \text{ is a set of possible vectors of the enterprise's development [5; 25; 27], with consideration for the results of the analysis and assessment of circumstances, specific situations and opportunities, taking into account the time factor, development conditions, reasons, etc.}
\]
\[ B \] is the basis for development of the enterprise (a set of theoretical principles, provisions, and practical tools used to explain the circumstances of the course and characteristics of the enterprise’s development in the system “enterprise – external environment” taking into account its internal changes) [5; 21; 28];

\[ \{ B \} \] is a set of possible bases for the enterprise’s development, with consideration for its content, structure and condition of the elements;

\[ R \] is the enterprise’s development as a result;

\[ M \] is the scale of the enterprise’s development (reflects the behavior of its internal variables, volumes of activity, results, taking into account factors of influence, capital, turnover, performance, etc.);

\[ Q \] is the level of quality of the enterprise’s development (depends on two key indicators [3; 29]: the level of regularity of the pace of production processes and defect-free production (in the production management system), and the level of satisfaction of consumer needs with finished products (in the system of marketing goals). The presented indicators should be considered as one of the main management tasks since, with regard to the analysis of the concepts “extensive development” and “intensive development” and taking into account the relationship between the concepts “development” and “potential” [3; 11; 30], they characterize the level of the enterprise’s ability to operate continuously and are aimed at maximizing profits due to improving production quality, design quality, and quality of marketing and services).

\[ C \] is the level of the enterprise’s competitiveness (characterized by the following three components [3; 31–33]:

1) competitiveness of the enterprise’s products;

2) the enterprise’s performance (based on assessment of its components – financial, economic, industrial and commercial effectiveness) including legal aspects of management (e.g., results of the analysis and evaluation of legal information on the level of legality of managers’ actions in achieving the economic goals of the enterprise, its structural units, or functional services)

3) concentration of the market in which the enterprise operates);

\[ I_a \] is the level of investment attractiveness of the enterprise (it is advisable to determine the key criteria for the investor, which together reflect such aspects as level of reliability, business reputation and information openness of the enterprise to its external environment; level of investment transparency of the enterprise; and level of development of the educational and professional potential of the staff) [3; 34; 35];

\[ I_d \] is the level of innovative development of the enterprise (depends on the parameters of its innovative potential, the source of which is innovation (new achievements in the field of technology and management) as a factor in promoting the enterprise’s development in the system “type of innovation – type of development”) [7; 26; 36–38];

\[ T_p \] is the profit growth rate;

\[ T_s \] is the sales growth rate;

\[ T_a \] is the asset growth rate;

\[ f_1, f_2, f_3, f_4, f_5 \] are functions that are used to determine the elements of a tuple for \( D \);

\( \{ \alpha \} \) is a set of components (criteria, parameters, factors, etc.) that are used for the function of determining an element of the tuple for \( D \) (e.g., \( \{ \alpha \} \) is a set of factors whose influence is necessarily taken into account at \( S \), i.e., when choosing the enterprise’s development strategy).

---

**Fig. 1. Graphical interpretation of enterprise development according to the theory of cyclic development, taking into account the influence of new achievements in the field of technology and management**

The graph represents the development vector (V) over time intervals (periods). The development process is depicted with cycles labeled C1, C2, ..., Cn, indicating individual cycles of the enterprise’s development, its transition from one state to another. The time interval is indicated on the x-axis, and the development cycles are shown on the y-axis.

Source: [25] improved by the authors based on [23; 26].
At the same time, here (as concerns the values of \( T_p, T_o, T_s \)), it should be noted that the growth rate \((T)\) is the relative indicator of dynamism of economic development (in the form of a coefficient or in %), which is the ratio of two levels of development. That is, the indicator \( T \) reflects how much a certain estimated level is relative to another level taken as the basis for comparison. Here, the comparison base, as a rule, is either the initial (constant) level of the time series or the level of the time series preceding this level \([11]\). Thus, the indicator \( T \) can be calculated with a constant or variable comparison base using formulas \((3) – (4)\). In the first case, it is called the base one \((T_b)\), in the second – the chain one \((T_c)\) \([11; 39; 40]\):

\[
T_b = \frac{Y_i}{Y_i} \times 100, \quad (3)
\]

\[
T_c = \frac{Y_i}{Y_{i-1}} \times 100, \quad (4)
\]

where \( Y_i \) is the studied level of the time series;
\( Y_i \) is the initial (constant) level of the time series;
\( Y_{i-1} \) is the preceding level of the time series.

The generalizing indicator of the \( T \) time series is the mean (or average) of its values, which is called the average growth rate \((\bar{T})\). It shows how (or how much) the average levels of time series changed over the study period and can be calculated by formulas \((5) – (6)\) \([11; 40]\):

\[
\bar{T} = \sqrt[\text{n}]{T_1 \times T_2 \times \cdots \times T_n}, \quad (5)
\]

\[
\bar{T} = \frac{\sqrt[n]{Y_n} - Y_1}{Y_1}, \quad (6)
\]

where \( T_1, T_2, T_n \) are the annual growth rates expressed in coefficients;
\( n \) is the number of years;
\( Y_n \) is the final level of the time series.

The results of the study can be applied in practical activities of enterprises, and will also be useful for training specialists in the field of management and administration.

The prospect for further research in this direction, taking into account the opinion of top executives (managers) of enterprises, is the construction of an applied economic and mathematical model to maximize profit of an enterprise based on information in works \([41-44]\).

**CONCLUSIONS**

According to the results of the study, it is found that enterprise development, with consideration for its content and structure of formation, is assessed through economic growth (result), taking into account quantitative and qualitative changes (under certain spatial and temporal conditions). Economic growth (result) of the enterprise is ensured due to increasing the level of potential, quality of management, innovation, and orientation towards continuous improvement processes (through staff development, improvement of the interaction system, capabilities, etc., based on using modern technologies and management systems, supporting and expanding marketing business network, and ensuring the reliability of partnerships to achieve economic goals).

The scale and quality of an enterprise’s development depends on its potential and growth reserves. The higher the level of potential of a business entity, the more opportunities for development it has. Here, potential of an enterprise should be understood as its capabilities, resources (financial, labor, material, energy, etc.), reserves and funds that are used or can be used to achieve the strategic or tactical goals of the enterprise.

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