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FEATURES OF FORECASTING STRATEGIC DEVELOPMENT OF ENTERPRISES IN THE CONDITIONS OF DIGITAL TRANSFORMATION

The article examines the features of forecasting the strategic development of an enterprise in the context of the digital transformation of the economy. The key factors influencing the process of strategic forecasting are identified, changes in approaches to forecasting are analysed, and modern forecasting methods based on digital technologies are systematized. The main stages of developing a forecast for the strategic development of an enterprise are formed, with the inclusion of tools for analysing the environment. To forecast the strategic development of an enterprise, its development directions and corresponding assessment indicators with an integral coefficient of the level of strategic development of the enterprise were determined. Recommendations are formulated for improving the strategic forecasting system using digital technologies, which provide for ensuring continuous integration of the forecasting system with strategic planning, the formed budget and operational management in order to instantly influence the forecast indicators on the tactical actions of the enterprise.

Keywords: *strategic forecasting, digital transformation, strategic development, forecasting methods, forecasting factors.*

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ОСОБЛИВОСТІ ПРОГНОЗУВАННЯ СТРАТЕГІЧНОГО РОЗВИТКУ ПІДПРИЄМСТВ В УМОВАХ ЦИФРОВОЇ ТРАНСФОРМАЦІЇ

У статті досліджено особливості прогнозування стратегічного розвитку підприємства в умовах цифрової трансформації економіки. Визначено ключові фактори, що впливають на процес стратегічного прогнозування, проаналізовано зміни у підходах до формування прогнозів, а також систематизовано сучасні методи прогнозування, засновані на цифрових технологіях. Визначено основні переваги та недоліки впливу цифровізації на систему прогнозування стратегічного розвитку підприємства. В роботі було систематизовано перелік традиційних методів прогнозування стратегічного розвитку підприємства, які використовуються до цифрової трансформації та залишаються актуальними як основа для сучасних цифрових методів. Обґрунтовано доцільність використання інтелектуальних аналітичних систем, великих даних (Big Data), штучного інтелекту (AI) та прогнозної аналітики для підвищення точності прогнозів. Сформовано основні етапи розробки прогнозу стратегічного розвитку підприємства з наведенням інструментів аналізу середовища. Для прогнозування стратегічного розвитку підприємства було визначено його напрями розвитку та відповідні індикатори оцінки з інтегральним коефіцієнтом рівня стратегічного розвитку підприємства. Визначено, що правильно побудований прогноз дає можливість не тільки оцінити перспективи розвитку, а й також розробити стратегію, яка буде дієвою щодо мінімізації ризиків і дозволить забезпечити стійке зростання в умовах цифрової трансформації. Визначено, що розвиток цифрових технологій створює передумови для формування антикрихких стратегій розвитку, які не лише витримують вплив кризових чинників, а й використовують їх як можливість для посилення конкурентоспроможності підприємства. Сформульовано рекомендації щодо удосконалення системи стратегічного прогнозування з використанням цифрових технологій, які передбачають забезпечення безперервної інтеграції системи прогнозування зі стратегічним плануванням, сформованим бюджетом та оперативним управлінням з метою миттєвого впливу прогнозних показників на тактичні дії підприємства.

Ключові слова: *стратегічне прогнозування, цифрова трансформація, стратегічних розвиток, методи прогнозування, фактори прогнозування.*

Problem statement. In the conditions of a dynamic business environment, which is transformed under the influence of digital technologies, the issue of forecasting the strategic development of the enterprise plays an important role. Digital transformation significantly changes the principles of formation of competitive advantages, consumer behavior and internal business processes. In such conditions, traditional approaches to forecasting the strategic development of the enterprise are not effective enough, as they are based on the stability of the external environment and the use of retrospective data that no longer reflect development trends. Making strategic decisions of enterprise development in conditions of uncertainty, digital risks, as well as the need to take into account a large number of factors related to digital innovation, requires reviewing existing methodological approaches to forecasting,

integrating digital analytics tools and building new models capable of taking into account nonlinearity and the speed of change. Thus, there is a need to determine the features of forecasting the strategic development of enterprises in the conditions of digital transformation, as well as improved methods and approaches that ensure increased accuracy of forecasts, adaptability of strategic decisions and the ability of enterprises to sustainable development in the digital environment.

Analysis of recent research and publications. In the scientific works of both domestic and foreign scientists, the issues of digitalization and strategic development were separately revealed to a sufficient extent. The works of such scientists as L.G. Donchak, O.B. Pogrishchuk, I.M. Sysoeva [2], M.O. Kravchenko, V.O. Salabay [9], L.V. Verbivska, T.V. Dziuba [3] O.G. Melnyk, M.V. Ruda [4], H.J. Duus [5] and others, were devoted to digital transformations and forecasting of strategic development. These scientists consider various aspects of forecasting strategic development in the conditions of digital transformation, such as the use of digital technologies for forecasting, research on artificial intelligence (AI), strategic development of the enterprise in the conditions of digitalization, and others. Despite the presence of a significant number of studies, a number of important aspects of forecasting the strategic development of the enterprise remain insufficiently researched and require clarifications and developments. Aspects related to the improvement of the strategic forecasting system using digital technologies and the updating of factors influencing the forecasting process remain insufficiently disclosed. Solving these issues will contribute to increasing the accuracy of forecasts and ensure the formation of effective strategies for the development of enterprises in the digital economy.

Formulating the purposes of the article. The purpose of the article is to study the peculiarities of forecasting the strategic development of enterprises in the conditions of digital transformation and to determine recommendations for improving the forecasting process in order to instantly influence forecast indicators on the tactical actions of the enterprise.

Presentation of the main research material. Forecasting the strategic development of the enterprise in the conditions of the digital transformation of the economy involves a systematic process of predicting future conditions and trends that may affect the long-term activity of the enterprise and using this knowledge to form its strategy, goals and priorities. This is not just a process of predicting the future, but a process of its formation with the possibility of preparation for various scenarios of the enterprise development.

Digital transformation in forecasting the strategic development of the enterprise requires a review of traditional methods and stages in forecasting with an emphasis on modern digital technologies (AI, IoT, Cloud, Big Data), which allows forecasts to be made more dynamic, based on large volumes of data and simulations.

However, in the context of rapid digitalization, which provides expanded opportunities to increase the accuracy and quality of forecasts of the strategic development of the enterprise, it is desirable to consider the understanding of what exactly is the strategic development of the enterprise.

In our opinion, strategic development of an enterprise should be understood as a process aimed at creating opportunities for full use of potential, efficiency of business processes improvement, competitiveness insurance via a usage of modern digital technologies to achieve strategic goals of enterprise development [1].

The process of forecasting strategic development is influenced by factors of the internal and external environment. Internal factors can be controlled and optimized by the enterprise to improve the quality of forecasting. Drawing on the in-house research and studies of domestic scientists [3, 4], the classification of internal and external environmental factors can be presented as follows.

Internal environmental factors include:

– information and analytical factors: data quality and availability (completeness, reliability, relevance of internal (ERP, CRM) and external data); level of digitalization (availability and efficiency of using modern Big Data, AI and ML tools in the forecasting process); integration of systems (relationship between the forecasting system, strategic planning and operational management);

– organisational and personnel factors: staff qualifications (availability of Data Science specialists, forecasting economists able to work with new methods); organisational structure (flexibility of structure and speed of response to changing forecasts); forecasting culture (degree of involvement of senior management and confidence in forecasting models);

– resource factors: financial resources (the amount of investments allocated for the development of prognostic tools and IT infrastructure); technological equipment (availability of powerful computing resources, cloud services, high-performance servers).

External environmental factors include:

– economic factors: macroeconomic stability (inflation rates, GDP dynamics, discount rate, exchange rates); state of financial markets (accessibility of loans, cost of capital, investment climate); global economic crises and cycles; technological factors (rates of scientific and technical progress (speed of emergence of new destructive technologies like AI, IoT, and quantum computing that can change the industry; technology life cycle (the moment of obsolescence of key production or product technologies of the enterprise;

– market and competitive factors: demand dynamics (change in consumer preferences, emergence of new market segments); competitive activity (strategies of the main competitors, emergence of new players); globalization (growth of international competition and integration of markets;

– socio-political and legal factors: changes in legislation (tax policy, trade barriers, environmental standards and digital data regulation); demographic changes (age structure of the population, migration, impact on the labor market and consumption); geopolitical situation (wars, conflicts, sanctions).

By systematizing traditional methods of strategic forecasting of enterprise development, which are presented in the scientific literature [5], the list of main approaches to strategic forecasting can be presented as follows:

1. Extrapolation – is based on the historical development trends continuation.

2. Expert-analytical – is based on the generalization of experts' opinions.

3. Scenario-simulation – involves modeling alternative scenarios of the future.

In the conditions of the digital transformation of the economy, all three approaches undergo significant changes, as they are complemented by digital analytical tools – systems of artificial intelligence, machine learning and cloud computing.

Digital transformation creates new opportunities for data management, scenario modeling and strategic decision-making. Its influence on the forecasting process is manifested in the following aspects [6]:

1. Changing sources of information. Enterprises receive data not only from internal reports, but also from digital platforms, sensors (IoT), social networks, and client systems.

2. Analytical processes automation. Using Power BI, Tableau, Google Data Studio, Python tools allows to automatically update forecasts.

3. Decision making speed. Forecasts are formed in real time, which ensures prompt response to environmental changecv.

4. Artificial intelligence integration. AI models are able to self-learn, increasing the accuracy of forecasts in the process of data accumulation.

5. Formation of an anti-fragile strategy. In the digital environment, the enterprise must not only adapt to change, but also use crises as opportunities for development.

Forecasting the strategic development of the enterprise requires consideration of modern forecasting methods based on digital technologies, which significantly increase the accuracy, speed and flexibility of the forecasting process itself, allowing companies not only to respond to changes, but also to anticipate them. These methods integrate big data, artificial intelligence and complex modeling. The main methods of forecasting the strategic development of the enterprise in the conditions of digital transformation include:

1. Predictive analytics. It involves the use of statistical methods, machine learning and intelligent data analysis to create probabilistic forecasts of future events. This group of methods can be used to determine accurate demand forecasting, customer outflow forecasting and financial risk assessment, commodity price forecasting, exchange rates and key macroeconomic indicators.

2. Big data analysis. Forecasting through big data analysis is used to identify patterns, correlations, and trends in data sets that are too large, complex, and rapidly growing for traditional methods. This group of methods allows not only to predict, but also to understand cause-and-effect relationships in a wide variety of areas. It involves forecasting demand and sales, prices, consumer behavior, etc.

3. Complex modeling and simulation. It involves the use of powerful computing resources for testing strategic decisions in a virtual environment. Forecasting the long-term, non-linear consequences of strategic decisions (for example, how a change in marketing strategy will affect competitors and then suppliers). Allows testing of new operational strategies, logistics schemes or production investments without risk to real assets.

4. Cloud platforms and data integration. Digital platforms provide the basis for continuous forecasting. Use of cloud data storage (Data Lake) and analytical tools (for example, Tableau, Power BI) for continuous monitoring and visualization of predictive models.

To predict the strategic development of the enterprise, it is necessary to decide on the main directions of development and the corresponding indicators for evaluating the development of these directions and on the determination of the integral coefficient of the level of strategic development of the enterprise. For an industrial enterprise, such components of development as: financial, personnel, technological, marketing and digital can be distinguished. Table 1 presents the components of strategic development and the indicators that determine them.

If the existing high level of strategic development is identified, the enterprise will understand its competitive advantage and will receive an impetus for further strategic

Table 1

System of indicators for assessing the level of strategic development of the enterprise

	Strategic development components	Name of the indicator	
1	Financial component	Return on equity	R_e
2		Return on assets	R_a
3		Coefficient of financial stability of the enterprise	C_{fst}
4		Coefficient of financial sustainability of the enterprise	C_{fsu}
5		Total liquidity ratio	R_{tl}
6		Autonomy coefficient	C_a
7		Average accounts payable repayment period	P_{apr}
8	Personnel component	Labor productivity	P_l
9		Personnel qualification level	L_{pq}
10		Personnel motivation level	L_{pm}
11		Personnel stability level	L_{ps}
12		Personnel retraining ratio	R_{pr}
13		Personnel turnover ratio	R_{pt}
14		Wage competitiveness index	I_{wc}
15	Technological component	Fixed asset turnover	T_{fa}
16		Intangible asset turnover	T_{ia}
17		Working capital turnover ratio	R_{wct}
18		Fixed assets depreciation ratio	R_{fad}
19		Production capacity utilization ratio	R_{pcu}
20		Share of energy costs in production cost	S_{ec}
21		Fixed asset renewal ratio	R_{far}
22	Marketing component	Sales growth rate	R_{sg}
23		Advertising cost payback	P_{ac}
24		Share of repeat customers	S_{rc}
25		Customer satisfaction ratio	R_{cs}
26		Exports in total sales	E
27	Digital component	Science intensity coefficient	C_{si}
28		Share of innovation costs	IC
29		Product assortment renewal ratio	R_{par}
30		Profitability coefficient of sold updated products	C_{pup}
31		Technology advancement coefficient	C_{ta}
32		Innovative capacity ratio of personnel potential	R_{ic}

Source: summarized and improved by the author based on [7;8]

development. A low level can activate the process of finding a way out of the current situation: changes in strategic forecasting and planning, introduction of innovative technologies, repurposing, diversification, etc.

Despite the presence of a wider range of indicators, the given list is sufficient for calculating the integral indicator. It takes into account all the key directions of the enterprise's development, at the same time, the digital component adds an important context for evaluating development precisely in the conditions of digital transformation.

Thus, the study of the process of forecasting the strategic development of the enterprise using artificial intelligence allows it to be presented in the form of six stages.

The first stage involves determining the main goals of the strategic development of the enterprise. It can be increasing profits, increasing market share, introducing modern techniques and technologies at the enterprise. At this stage, it is also important to determine the time horizons in which it is possible to achieve the set strategic development goals.

At the second stage, it is necessary to determine the sources of information about the external and internal environment.

The third stage – is the choice of method and software for forecasting strategic development. Such software should use improved mathematical algorithms for accurate determination of forecast indicators for business operations of the enterprise.

The fourth stage involves the use of artificial intelligence and Big Data to predict the strategic development of the enterprise. With the help of artificial intelligence, daily observations of updated data of the enterprise take place, statistical data for current periods and periods of retrospection are generated, additional factors that can also affect the development forecast are analyzed, and variable factors of enterprise environments are coordinated. Digital tools for analysing environments can be: Similar Web – analysis of competitor website traffic, user behaviour, market shares; SEMrush, Ahrefs – monitoring competitive strategies in digital channels, assessing demand by keywords; Statista, Euromonitor, IBISWorld – macro trends, industry forecasts, market analytics, and others.

At the fifth stage, a forecast of the future scenario of strategic development of the enterprise is developed.

The last sixth stage involves the selection and approval of one of the projected strategic development scenarios.

The process of forecasting the strategic development of the enterprise using digital technologies is presented in fig. 1.

A correctly constructed forecast makes it possible not only to assess development prospects, but also to develop a strategy that will be effective in minimizing risks and will ensure sustainable growth in the conditions of digital transformation.

Thus, the development of digital technologies creates prerequisites for the formation of anti-fragile development strategies that not only withstand the influence of crisis factors, but also use them as an opportunity to strengthen the competitiveness of the enterprise.

Improvement of the strategic development forecasting system using digital technologies results in the increase of the speed, accuracy, quality, flexibility and proactivity of the process. This is achieved through the integration of advanced analytics, modeling and automation tools.

The main areas for improvement of the strategic development forecasting system are:

1. Transition to predictive analytics. It is proposed to build forecasts using complex models, namely machine learning to analyze huge data sets (Big Data) – from internal operational data to external social networks and economic indicators. This allows to predict future demand, customer behavior and market trends with higher accuracy.

2. Advanced scenario modeling and simulation. Digital tools allow to create and test much more complex scenarios. Using simulation software and creating dynamic models. This allows forecasters to change key parameters (for example, changes in the price of raw materials, regulatory changes) and instantly see the impact on the long-term results of the enterprise.

3. Real-time visualization and data. This approach allows modern tools to turn complex forecasts into scenarios that are understandable for management.

4. Integration of artificial intelligence. The latest models can speed up the process of qualitative forecasting by creating strategic hypotheses regarding possible strategic directions and risks.

5. Flexible strategizing. Digital tools make the strategic cycle faster and more iterative. Thanks to automated data collection and modeling, strategic development forecasts can be revised not once a year, but quarterly or even monthly, quickly responding to digital and geopolitical changes.

Conclusions. According to the results of the study, it was determined that in the process of digital transformation, forecasting the strategic development of enterprises moves to a new qualitative level, based on the use of big data, artificial intelligence algorithms and real-time data analytics. The main features of this process are: dynamism and adaptability of models, combination of quantitative and qualitative methods, integration of forecasts into digital management systems, improvement of accuracy and efficiency of decision-making.

Systematization of directions of strategic development: financial, personnel, technological, marketing and digital,

Table 2

Assessment of the level of strategic development of the enterprise using an integral indicator

Formula	Explanation
$IKR = \sum_{i=1}^{n} (W_i \times P_i),$ $IKR = (W_i \times FC) + (W_i \times PC) +$ $(W_i \times TC) + (W_i \times MC) + (Wi \times DC),$ (1.1)	where IKR – the integral indicator of assessment of the level of enterprise development; P_i – the value of the i-th indicator of the assessment of the level of enterprise development; W_i – weight of significance of the i-th indicator.
$W_i = \sum \frac{R_{ij}}{R_{max}},$ (1.2)	where W_i – the weight of the significance of the i-th indicator; R_{ij} – the rank value assigned by the j-th expert to the i-th indicator; R_{max} – the maximum possible rank value.

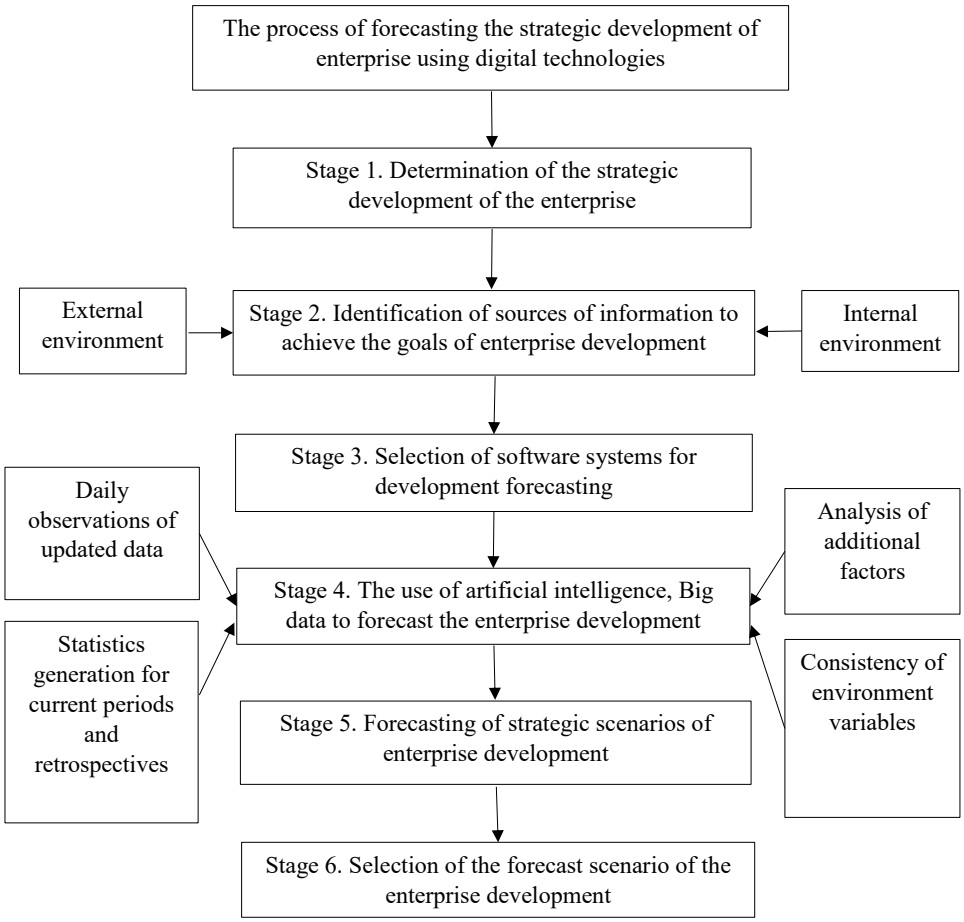

Figure 1. The process of forecasting strategic development at the enterprise using digital technologies

Source: developed by the authors

provides an opportunity to elementally investigate to what extent the enterprise meets the established strategic goals and whether it outweighs its competitors. The improvement of the strategic forecasting system using digital technologies involves ensuring the continuous integration of the forecasting system with strategic planning, the formed budget and operational management in order to instantly influence the forecast indicators on the tactical actions of the enterprise.

Further research in the direction of forecasting strategic development can contribute to the development of new algorithms and approaches that will provide even more accurate forecasts and flexibility of management decisions.

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