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Evaluation of the effectiveness of strategic and tactical controlling based on the analysis of the company's financial reports

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Abstract. The implementation of controlling is a rational necessity to ensure an effective management system in a company, so it is essential to evaluate its effectiveness in terms of tactical and strategic components. However, there is no general system of indicators reflecting the effectiveness of strategic and tactical controlling, therefore, the purpose of the study was to develop and improve a methodological approach to evaluate the effectiveness of such controlling based on the analysis of the company's financial reports as a tool for the validity of management decisions. Based on the method of comparative analysis, the differences between tactical and strategic controlling were identified and characterized, which made it possible to specify the criteria for evaluating their effectiveness. It was found that the monitoring basis of controlling mechanisms is comprehensive and covers the entire spectrum of operational and management processes in the company. A system of indicators was formed to evaluate the effectiveness of tactical and strategic controlling. A methodological approach to evaluating the effectiveness of controlling components based on the analysis of the company's financial reports is proposed. It was tested on the example of PJSC Trust Zhytlobud-1 by calculating generalizing integral indicators of the effectiveness of controlling components based on data from the company's financial reports. Using the algorithm of the taxonomic analysis method, a matrix of observations was formed and standardized, a reference vector was constructed and integral indicators for evaluating the effectiveness of the company's tactical and strategic controlling were calculated. The application of the proposed method made it possible to reveal the problematic aspects of distribution processes in the company and in the context of managerial decision-making. This allowed to evaluate the effectiveness of the controlling system in the company and to determine the reserves for improving the effectiveness of controlling processes. The practical value of the study lies in the proposed methodological approach, which may be useful in the process of diagnosing the effectiveness of the quality of managerial decision-making in companies both in the current activity and in the long run

Keywords: diagnostics; management; property value; bankruptcy; profitability; fixed assets; current assets

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INTRODUCTION

In the conditions of economic uncertainty and turbulence, an important aspect for companies' managers is the use of advanced and relevant mechanisms for substantiating and making managerial decisions, the use of financial instruments to implement these decisions. Controlling occupies an important place in the system of mechanisms for substantiating decisions. Controlling is a complex, holistic management system aimed at the sustainable development of the company. It examines the implementation of the company's business strategy based on the adopted general goal, analyses trends and coordinates the further development of operational, investment and financial activities and forms information for making substantiated managerial decisions. The main document (or set of documents) that provides information on the company's financial position and performance during a given period is its financial reports. It is an important tool for evaluating the financial result of the company's performance and thus for evaluating the effectiveness of controlling.

A number of works by Ukrainian and other economists are devoted to the study of controlling problems. General issues of controlling are examined in the works of scholars V.M. Varenyk & O.V. Shpuryaka (2019) and P.V. Pronoza *et al*. (2020), in which the authors determine the aim, objectives, tools of controlling and ways to improve the controlling system in enterprises. The authors A.A. Pylypenko *et al*. (2023) defined the place and role of strategic controlling in the system of monitoring the financial and economic activities of an enterprise association and determine its role in the implementation of strategic management. The work of I. Perevozova *et al*. (2022) focused on the feasibility of diagnostic measures and proposed a system of financial indicators that can be used to evaluate the implementation of strategic controlling mechanisms. Ukrainian researcher N. Belyaeva (2021) considered the problematic aspects of controlling in the company in relation to the information and accounting components. It is noted that the efficiency of the operating controlling system in the company directly affects the process of managerial decision-making and thus ensures the effectiveness of the company. A.V. Kamil (2020) proposed a composition of financial and non-financial indicators of accounting support of controlling and proved that controlling indicators are an important tool in the process of substantiating, making and implementing management decisions. N.V. Sablina (2019) pays attention to financial controlling, which is considered in the company management system as a multidimensional process that consists of business processes and superimposed on the organizational structure of the company. However, the issue of evaluating the effectiveness of controlling in the company was excluded in the paper. Given the wide range of issues covered by the research of Ukrainian and foreign scholars, the issues of the essence, theoretical and methodological tools of controlling based on the analysis of the company's financial reports, the development of methodological approaches to evaluating the effectiveness of controlling in the company in terms of its components, integrated approaches to the development of a controlling model are not yet sufficiently developed, which confirms that the chosen research topic is timely.

The current state of companies' activity, caused by the aggressive influences of the external environment of Ukraine, forms the need for the implementation and emphasizes the rational need to evaluate the effectiveness of controlling in the company. However, this area is characterized by ambiguity in understanding on the part of business practitioners and academics. This statement refers to a greater extent to controlling tools and the means of evaluating its effectiveness. The understanding of the concept of "effectiveness" as the ratio of the value expression of "result" to the value of "invested resources" for the controlling system is impossible in practice, which also determines the relevance of the analytical search for evaluation indicators and methodological approaches to evaluating the effectiveness of controlling on the basis of the company's financial reports. The purpose of the study was to formulate and test a methodological approach aimed at diagnosing and evaluating the effectiveness of strategic and tactical controlling using the company's financial reports on the basis of the proposed model for determining the effectiveness of controlling components, which made it possible to evaluate the effectiveness of the controlling system operating in the company. In order to accomplish this purpose, the following tasks were solved: determination of partial indicators for evaluating strategic and tactical controlling; development of a methodology for evaluating the effectiveness of strategic and tactical controlling based on the company's financial reports.

MATERIALS AND METHODS

The studies were conducted on the basis of statistical information using methods of scientific cognition. In order to study the theoretical and methodological tools of controlling and to develop a methodological approach to evaluate the effectiveness of tactical and strategic controlling and their characteristics, the methods of systematic approach, analysis, synthesis, scientific abstraction and generalization were applied. A comparative analysis was used to compare strategic and tactical controlling. To implement the methodological approach, the financial reports of PJSC Trust Zhytlobud-1 (n.d.) for 2017-2022, published on the company's official website, were used. The analysed years are chosen due to the fact that at the time of the study the company had not published the financial reports for 2023. The choice of the company for the study is substantiated by the fact that it is the largest construction company in Kharkiv (Ukraine) and continues its intensive development. To calculate the indicators of tactical and strategic controlling, the method of coefficient analysis was used and the following indicators were calculated. The net profit margin (R_{NPM}) was defined by the formula:

$$R_{NPM} = \frac{NI}{S}, \quad (1)$$

where NI is net income; S is sales. The operating profit margin (R_{opm}) was defined by the formula:

$$R_{opm} = \frac{EBIT}{S}, \quad (2)$$

where $EBIT$ is earnings before interest and taxes. The integral indicator of current assets (I_{ca}) was calculated by the formula:

$$I_{ca} = \sqrt{T_{ca} \times R_{ca}}, \quad (3)$$

where T_{ca} is current assets turnover; R_{ca} is return on current assets (with income before taxes). The integral indicator of fixed assets (I_{fa}) was defined by the formula:

$$I_{fa} = \sqrt{T_{fa} \times R_{fa}}, \quad (4)$$

where T_{fa} is fixed assets turnover; R_{fa} is return on fixed assets. The following formula was used to determine the integral indicator of the production staff effectiveness (I_{ps}):

$$I_{ps} = \sqrt{S_w \times R_w}, \quad (5)$$

where S_W is sales to wages of production staff; R_W is return to wages of production staff (with *EBIT*). The profitability of management (P_M) was calculated by the formula:

$$P_M = \frac{EBIT}{AC+SC}, \quad (6)$$

where *AC* is administrative and management costs; *SC* is sales costs. The share of means of production (S_{mp}) was calculated by the formula:

$$S_{mp} = \frac{MP}{A}, \quad (7)$$

where *MP* is means of production; *A* is assets. The indicator of economic growth sustainability (I_{egs}) is defined by:

$$I_{egs} = \frac{NI-D}{E}, \quad (8)$$

where *D* is dividends; *E* is equity. The accounts receivable turnover (*RT*) was defined by the formula:

$$RT = \frac{S}{AR}, \quad (9)$$

where *AR* is accounts receivable. The integral indicator of hidden bankruptcy (I_{HB}) is defined by:

$$I_{HB} = 0.08 \times R_{cash} + 0.77 \times R_{current} + 0.15 \times I_{Beaver}, \quad (10)$$

where R_{cash} is cash ratio; $R_{current}$ is current ratio; I_{Beaver} is Beaver's coefficient. In order to build integral indicators for the evaluation of tactical and strategic controlling, the method of taxonomic analysis was used. It involves the formation and calculation of taxonomic indicators to make a generalized evaluation of the state of objects characterized by a certain set of characteristics. In general, the taxonomy method allows solving the problem of characterization and/or comparison of multidimensional objects in relation to the normative reference vector formed by the researcher. The taxonomic indicator can vary in the interval [0; 1] and has the following interpretation: the closer the value of the constructed taxonomic indicator is to one, the higher the condition of the studied object (process) is evaluated. The algorithm of the method is presented by M. Berest & M. Bobro (2021). To analyse and evaluate the dynamics of integral indicators of the level of effectiveness of tactical and strategic controlling on the basis of logical methods of analysis, synthesis and generalization, analytical conclusions were drawn; problems and weak points in the company's activities were identified.

RESULTS

The effectiveness of the controlling system affects all indicators of the company. The result of each individual process and their integral totality depend on the scope of control – thorough attention to deviations of the actual course of production activity from the planned or reference parameters. Therefore, the monitoring basis of control mechanisms is broad and combines the characteristics of expenditure and revenue flows, such as intensity and completeness, synchronicity, regularity and conflict of priorities. The companies' business processes that represent the content of their operating activities are determined by the specifics of the business mechanism, namely the parameters of the use of production resources, i.e., in monetary terms, they correspond to the amount of costs. They cause an impact on the dynamics of business activity coefficients, profitability and structure of the company's financial potential.

Production processes at the distribution stage of operating activities depend on the result achieved after the completion of operational and production processes, and are of a strategic nature, since they are aimed at coordinating the business entity with the market environment, in particular regarding its investment attractiveness, and business reputation. The results of production processes geared to the external environment are strategic, as they determine the composition and structure of the company's financial sources in the future and, accordingly, the degree of its dependence on the environment. The quality of decisions made at the strategic level is an important determinant of the level of solvency, financial stability and the condition of the company's assets in the context of capital accumulation and reproduction.

At the same time, the analysis of financial statements is an important tool that provides a high-quality evaluation of the company's performance as a whole and, in particular, its controlling mechanisms, especially in the face of negative influences from the external environment. The use of the company's financial statements, as defined by M. Berest (2019), as an array of informative and structured data for the calculation and analysis of relevant indicators, provides an opportunity to evaluate the degree of effectiveness of controlling in the tactical and strategic contours, express reasoned assumptions and develop recommendations for management measures aimed at increasing its effectiveness. It is proposed to evaluate the effectiveness of the company's controlling system in two stages: evaluation of the effectiveness of tactical controlling; evaluation of the effectiveness of strategic controlling (controlling distribution processes and making managerial decisions) (Fig. 1). To quantify the effectiveness of tactical controlling, indicators of net profit margin, operating profit margin with earnings before interest and taxes, an integral indicator of current assets, an integral indicator of fixed assets, an integral indicator of the production staff effectiveness and an indicator of the profitability of management were selected. Net profit margin is a generalizing indicator of the effectiveness of setting up and conducting production processes (production and trading activities) and provides an opportunity to evaluate the impact of the company's product range, its pricing policy, cost structure and the cost of hired resources on its profitability. The given coefficient shows the amount of net profit included in each hryvnia of the company's net income.

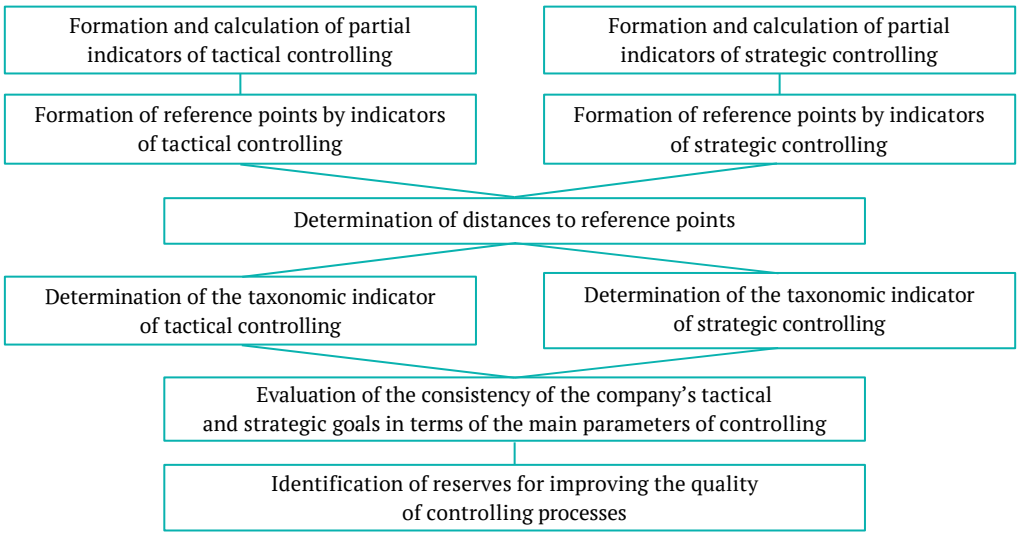

Figure 1. Methodological approach to the analysis of the effectiveness of the company's controlling mechanisms
Source: developed by the authors

The indicator of operating profit margin with earnings before interest and taxes allows to evaluate the company's ability to reproduce and expand its production processes in the form of net return on total investments consumed and indicates the overall effectiveness of controlling internal production processes and operations aimed at manufacturing the company's products. The operating margin indicator is one of the best tools for determining operational effectiveness and shows the management's ability to generate profit from the costs associated with the production and sales. Negative values of this indicator in the case of the company's unprofitable operation indicate deficiencies in the operational management of the industrial company in general and in its controlling subfunction in particular.

The integral indicator of the current assets effectiveness is calculated on the basis of indicators of current assets turnover and return on current assets. In case of the company's loss-making activity, the value of the integral indicator for further calculations is taken to be 0. This means that the company's inefficiency is confirmed when, with significant business activity (intensity of production processes), it is not possible to achieve a positive result. Thus, the economic content of this indicator reveals the value of the efficiency of the company's costs.

The integral indicator of the fixed assets effectiveness characterizes the conditional average economic effect in the form of net income from sales, core earnings and labour capital productivity, which accounts for each hryvnia of expenses invested in fixed assets. The use of this indicator for the analysis of controlling activities makes it possible to evaluate the synergistic intensity of the economic effect due to the expediency of the capital use. This indicator can take negative values in case of the company's unprofitable operation, which indicates miscalculations both at the stage of controlling the operation of production equipment and shortcomings in the company's personnel policy.

The integral indicator of the production staff effectiveness is calculated as the geometric mean of the following indicators: net sales revenue per 1 UAH of wages (including accruals); return to wages of production staff (including allocations for social requirements) for operating profit before tax. The proposed indicator reflects the conditional average economic effect in the form of sales, core earnings, which accounts for each hryvnia of wages of the main production staff – direct executors of the company's production (workers, engineering and technical personnel, employees involved in maintaining production processes). If the company operates at a loss, this indicator acquires negative values, signalling significant shortcomings in the personnel structure, the system of motivation and incentives (moral and monetary) for high-quality work.

The indicator of profitability of production processes management characterizes the profitability of the management system in the company. The functional load of this indicator includes coordinating both internally and externally oriented production processes, ensuring the coherence of interests between the company and the market environment, supporting investment attractiveness and ensuring the growth of the company's market value. This indicator is calculated as the result of dividing the *EBIT* indicator by the amount of administrative costs and sales costs. It allows to evaluate the level of core earnings compared to 1 UAH costs for maintaining administrative staff and sales service. If the value of the indicator is below zero, then the company's management requires drastic changes, in particular, the introduction of controlling mechanisms at the operational level.

To quantify the effectiveness of strategic controlling, the following indicators were selected: equity to non-current assets ratio; inventory to working capital ratio; share of means of production; indicator of economic growth; accounts receivable turnover; integral indicator of hidden bankruptcy. The equity to non-current assets ratio (type of financial policy) is determined depending on the funding ratio, which shows what share of the company's activities is financed from equity. There are aggressive, moderate and conservative financial policies, according to which the nature of controlling mechanisms changes. With an aggressive financial policy, the company's capabilities and its controlling system are somewhat overestimated, the

controlling system of companies with a conservative financial policy is rigid; a moderate financial policy corresponds to the moderate rigidity of controlling operations. Typically, the type of the company's financial policy is determined by the ratio of borrowed and own funds in the formation of the company's assets, comparing the actual indicators with their generally accepted values.

The indicator of inventory to working capital ratio (type of financial stability) is determined in accordance with the excess or shortage of sources of inventory financing, which is defined as the difference between the amount of sources of coverage and the inventory amount. The list of partial indicators is continued by the share of means of production, which not only characterizes the structure of non-monetary assets, but also determines the level of the company's production potential, the equipment of the operating process with means of production, which in turn reflects the efficiency of distribution production processes and managerial decisions. This indicator is calculated as the share of means of production in the total property amount. A higher value of this coefficient will indicate higher effectiveness of strategic controlling of production processes.

The indicator of economic growth sustainability determines the future pace of the company's development. The indicator of accounts receivable turnover characterizes the effectiveness of strategic controlling of the company's need for current capital and the effectiveness of controlling production processes related to the formation of revenue cash flows. The increase in current accounts receivable through the introduction of prepayment for goods and services contributes to the growth of the indicator of strategic controlling of production processes. Conversely, the growth in credit sales, which reduces the value of accounts receivable turnover, indicates a weakening of the severity of strategic controlling of production processes. This trend is also unfavourable for companies in the machine-building industry, which is naturally characterized by a significant duration of the production and financial cycle and high production costs.

The next partial indicator of the effectiveness of strategic controlling is the indicator of hidden bankruptcy. This indicator is the result of the summation of four ratio indicators, adjusted for weights, according to the correlation of the normative values of partial liquidity ratios: cash ratio, current ratio and Beaver's coefficient. Thus, it is necessary to evaluate the effectiveness of tactical and strategic controlling. The dynamics of the above-mentioned partial indicators calculated on the basis of data from the financial reports on the example of PJSC Trust Zhytlobud-1 (n.d.) for the period of 2017-2022 is shown in Table 1.

Table 1. Calculation of partial indicators of tactical and strategic controlling PJSC Trust Zhytlobud-1 for 2017-2022

Indicators	2017	2018	2019	2020	2021	2022
TACTICAL CONTROLLING						
Net profit margin	0.026	0.022	0.014	0.003	0.004	0.000
Operating profit margin with earnings before interest and taxes	0.050	0.040	0.030	0.016	0.014	0.010
Integral indicator of current assets	0.067	0.098	0.064	0.025	0.026	0.002
Integral indicator of fixed assets	1.369	2.207	1.774	0.736	0.924	0.414
Integral indicator of the production staff effectiveness	0.843	1.109	0.875	0.448	0.450	0.984
Profitability of management	0.862	0.781	0.631	0.232	0.262	0.491
STRATEGIC CONTROLLING						
Equity to non-current assets ratio	5.008	4.569	9.642	7.003	6.102	5.695
Inventory to working capital ratio	0.363	0.305	0.736	0.499	0.338	0.348
Share of means of production	0.692	0.626	0.539	0.662	0.639	0.576
Indicator of economic growth sustainability	0.029	0.052	0.015	0.002	0.005	0.000
Accounts receivable turnover	1.776	2.130	1.037	1.015	1.018	0.517
Integral indicator of hidden bankruptcy	1.340	1.542	2.180	1.635	1.229	1.126

Source: calculated by the authors based on PJSC Trust Zhytlobud-1 (n.d.)

The analysis of the above data shows that the values of the indicators under study have a multidirectional dynamics and affect the effectiveness of the tactical and strategic controlling of the company under study differently. The net profit margin of PJSC Trust Zhytlobud-1 constantly decreases over the analysed period and in 2022 shows a net profit of 0 per each hryvnia of the company's net income, which indicates a deterioration in the quality of the company's financial results structure and an increase in the share of expenses in the net income. The operating profit margin with *EBIT* indicates the ability of the management to profit from the costs associated with production and sales and, like the previous indicator, significantly declines throughout the period, which indicates the shortcomings of the operational management of the industrial company in general and its controlling subfunction in particular.

The value of the integral indicator of current assets rose at the beginning of the period under study, in particular reaching a peak value in 2018. After that, however, its value only decreased and reached a minimum (0.002) in 2022, which characterizes the decline in the company's efficiency, when even with significant business activity it is not possible to achieve a positive result, especially under the negative influences of the external environment (military operations on the territory of Ukraine, the 2022 large-scale military invasion).

The integral indicator of fixed assets shows an unstable trend, while in 2022 it reached its minimum, like the previously mentioned indicators. This may indicate both the problems arising at the stages of quality control and operation of production facilities and the low intensity of their utilization. The integral indicator of the production

staff effectiveness is also unstable, but unlike the others, it increases in 2022. At the same time, this phenomenon cannot be evaluated positively, because it is explained primarily by a reduction in wage costs and social contributions associated with a reduction in the scale of activities of PJSC Trust Zhytlobud-1 due to active combat operations in the Kharkiv region and the city of Kharkiv. There is a similar situation regarding the indicator of profitability of production processes management. Its increase at the end of the analysed period is due to a decrease in administrative costs and sales costs, and not to an increase in earnings before interest and taxes. All this points to the need for radical changes in the company's management, in particular strengthening the control over the achievement of performance and efficiency targets at the operational level.

As far as the partial indicators of the strategic controlling evaluation are concerned, it should be noted that for PJSC Trust Zhytlobud-1 the equity to non-current assets ratio is above 1 throughout the entire period, i.e., the company's production assets are fully covered by its own capital and its current assets are partially covered by it, which indicates a moderate level of risk in the capital structure. The dynamics of inventory to working capital ratio shows that the company's inventory is at least 30% financed by equity, and this value peaked in 2019 (73.6%). It also confirms a sufficient level of the company's financial stability and positively characterizes the level of acceptable rigidity and adaptability of the internal control system.

The share of means of means of production varies from 69% to 58%, which characterizes the equipment of the operating process with means of production and reflects the efficiency of sales processes and managerial decisions in the company. Its decrease is due to a change in the structure of the company's assets, namely a decrease in the volume of work in progress and an increase in accounts receivables, which in turn may be explained by a decrease in the scale of activities of PJSC Trust Zhytlobud-1 due to the martial law in Ukraine. The indicator of economic growth sustainability determines the future pace of the company's development and is an important indicator of the effectiveness of strategic controlling. For the company under study, the values of this indicator show significant fluctuations in the pace of the company's development and indicate a decrease in the effectiveness of strategic controlling since 2020, and in 2022 this indicator equals 0, which indicates an absolute necessity to revise approaches to the implementation of strategic controlling it the company in the context of military aggression. The effectiveness of controlling production processes related to the formation of revenue cash flows allows to evaluate the indicator of accounts receivable turnover, which varies from 2.1 to 0.5. The constant fluctuation in the accounts receivable turnover is unfavourable for construction industry companies, characterized by a significant duration of the production and financial cycle and high production costs. The integral indicator of hidden bankruptcy of PJSC Trust Zhytlobud-1 had its peak value in 2019, but then decreased significantly, and as of 2022 was much lower than its boundary value (1.126 < 1.616), which indicates a low correspondence between external controlling activity and actual management effectiveness.

Using the proposed methodology for evaluating the quality of controlling mechanisms, the indicators of tactical and strategic controlling were calculated and analysed on the example of PJSC Trust Zhytlobud-1. The authors believe that in order to build generalizing indicators of the effectiveness of controlling in the company it is expedient and necessary to use methods that would allow to fold the formed multidimensional set of indicators characterizing the object under study in time and space into a single number of characteristics, and thus to build a comprehensive evaluation of the level of controlling effectiveness. In this regard, the authors propose the use of the taxonomic analysis method, which will allow to calculate taxonomic indicators for evaluating the effectiveness of tactical and strategic controlling separately. The following interpretation of the formed indicators is proposed: the closer the value of the constructed taxonomic indicator is to one, the higher the level of controlling effectiveness is estimated.

The implementation of the algorithm for constructing a taxonomic indicator takes 5 stages: formation of a matrix of observations; construction of a standardized matrix; formation of a reference vector; determination of the distances between the indicators of the matrix and the formed reference vector; calculation of a taxonomic indicator (Berest & Bobro, 2021). It is necessary to build taxonomic indicators of the level of controlling effectiveness for the PJSC Trust Zhytlobud-1 under study. The results of calculations of tactical and strategic controlling indicators presented in Table 1 were used as a matrix of observations. Further, according to the algorithm of the taxonomic analysis method by T. Klebanova *et al*. (2018), a standardization procedure is carried out, the result of which is a standardized matrix of indicators (Table 2).

Table 2. Standardized matrix of tactical and strategic controlling indicators of PJSC Trust Zhytlobud-1

Indicators	2017	2018	2019	2020	2021	2022
TACTICAL CONTROLLING						
Net profit margin	1.320	0.997	0.214	−0.795	−0.672	−1.064
Operating profit margin with earnings before interest and taxes	1.482	0.806	0.193	−0.683	−0.774	−1.024
Integral indicator of current assets	0.566	1.446	0.477	−0.623	−0.594	−1.272
Integral indicator of fixed assets	0.195	1.439	0.795	−0.743	−0.464	−1.221
Integral indicator of the production staff effectiveness	0.211	1.173	0.327	−1.218	−1.213	0.720
Profitability of management	1.215	0.905	0.334	−1.186	−1.071	−0.198
STRATEGIC CONTROLLING						
Equity to non-current assets ratio	−0.726	−0.966	1.807	0.364	−0.128	−0.351
Inventory to working capital ratio	−0.417	−0.772	1.863	0.412	−0.573	−0.513

Table 2, Continued

Indicators	2017	2018	2019	2020	2021	2022
STRATEGIC CONTROLLING						
Share of means of production	1.236	0.063	−1.487	0.705	0.302	−0.818
Indicator of economic growth sustainability	0.608	1.723	−0.133	−0.737	−0.601	−0.860
Accounts receivable turnover	0.892	1.493	−0.359	−0.395	−0.391	−1.240
Integral indicator of hidden bankruptcy	−0.444	0.087	1.769	0.332	−0.735	−1.008

Source: calculated by the authors

The next step is to build a reference vector, i.e., to determine the reference values for all indicators. To do so, it is necessary to divide them into stimulants and destimulants, taking into account the impact of their changes on the effectiveness of controlling. In this case, all the selected indicators can be classified as stimulants, as their increase will indicate an increase in the level of effectiveness of both tactical and strategic controlling mechanisms in the company. The results of constructing the reference vector are presented in Table 3.

Table 3. Formation of a reference vector

TACTICAL CONTROLLING						
Indicator	Net profit margin	Operating profit margin with *EBIT*	Integral indicator of current assets	Integral indicator of fixed assets	Integral indicator of the production staff effectiveness	Management profitability indicator
Reference point	1.320	1.482	1.446	1.439	1.173	1.215
STRATEGIC CONTROLLING						
Indicator	Equity to non-current assets ratio	Inventory to working capital ratio	Share of means of production	Indicator of economic growth sustainability	Accounts receivable turnover	Integral indicator of hidden bankruptcy
Reference point	1.807	1.863	1.236	1.723	1.493	1.769

Source: calculated by the authors

According to the construction algorithm presented above, the Euclidean distances should be calculated by comparing the existing values of the indicators with the reference vector. Based on the calculations, taxonomic indicators of the effectiveness of tactical and strategic controlling in the company are built (Fig. 2, Fig. 3).

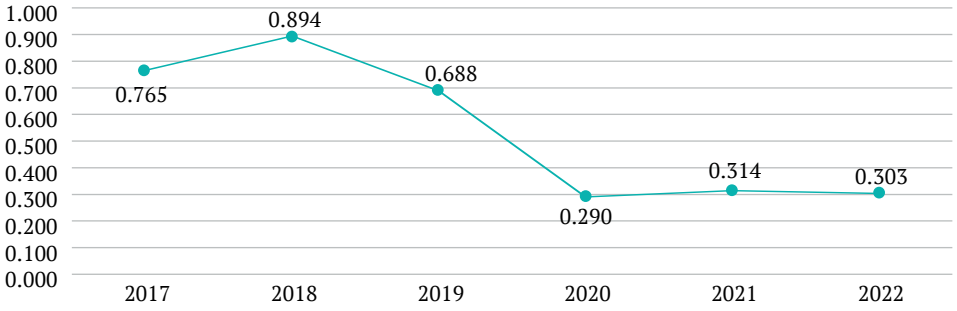

Figure 2. Dynamics of the taxonomic indicator for evaluating the effectiveness of tactical controlling of PJSC Trust Zhytlobud-1

Source: developed by the authors

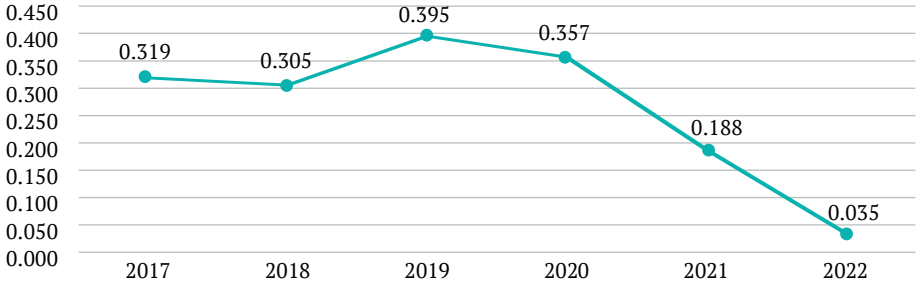

Figure 3. Dynamics of the taxonomic indicator for evaluating the effectiveness of strategic controlling of PJSC Trust Zhytlobud-1

Source: developed by the authors

The taxonomic indicator for evaluating the effectiveness of tactical controlling of PJSC Trust Zhytlobud-1 in 2017-2019 had a rather high value, close to one (maximum – 2018, 0.894). This indicates a high effectiveness of the company's controlling mechanisms at the level of tactical management during this period. Since 2020, however, there has been a significant decline in the indicator (the average value in 2020-2022 is 0.3). The level of effectiveness of tactical controlling at the company level has deteriorated significantly, which may be due to significant negative influences from the external environment (2020 – coronavirus pandemic, 2022 – the russian federation's invasion of Ukraine, in particular in the Kharkiv region, where the company under study is located). It should be noted that despite the fact that the overall level of tactical controlling effectiveness has decreased, the value of the taxonomic indicator is maintained at an average level of 0.3, i.e. the company demonstrates the ability to maintain internal controlling mechanisms at an acceptable level.

The taxonomic indicator for the evaluation of the effectiveness of strategic controlling shows significantly lower values throughout the entire period under review. The highest values of the indicator are observed in 2019-2020 (0.395), but within the interval [0; 1] this indicates a rather low level of development of the indicator. This means that the effectiveness of the company's strategic controlling mechanisms is quite low. In 2021-2022, there is a significant decline in the indicator, and in 2022 its value is close to 0 (0.035). Such dynamics can be interpreted as a result of the influence of the negative characteristics of the external operating environment described above, however, such a rapid decline in the indicator indicates the ineffectiveness of strategic controlling in the company under study.

If, under the conditions of external crisis influences, the tactical mechanisms of the company's controlling have demonstrated the ability to function adequately, the effectiveness of strategic controlling has fallen to zero. From this, it can be concluded that there is a need to replace the existing mechanisms of strategic controlling and develop effective mechanisms of strategic controlling that will allow the company not only to adapt to functioning in an unfavourable external environment, but also to set the direction for future sustainable functioning.

DISCUSSION

The proposed approach to diagnosing the effectiveness of corporate controlling mechanisms makes it possible to evaluate the degree of effectiveness of tactical and strategic controlling, identify problems and weak points. When applied, it can form the basis for managerial decisions aimed at ensuring the sustainable functioning of a business entity. The results obtained complement the modern developments of researchers in the field of formation and evaluation of the effectiveness of the controlling system in companies' activities.

In the work by N.V. Katkova & O.S. Tsyhanova (2019), the main attention is paid to the study, generalization and development of the classification aspects of the factors influencing the formation and implementation of the controlling system at the companies of the industrial complex. The authors argue that in the modern economic space there are many factors of endogenous and exogenous nature influencing the activities of economic entities. Their generalization allowed the researchers to develop a classification of factors of influence that form the structure of the controlling system. The authors suggest grouping the external factors into seven areas: technological, economic, market, political, legislative, environmental and social, and the internal factors into five, namely: production, strategy, personnel, organization and finance. It can be agreed that taking into account the influence of the selected factors enables the company to increase the effectiveness of forming the controlling system under the conditions of the specific influences of the operating environment. At the same time, the authors have not mathematically confirmed the influence of the identified factors, so it would be advisable to form a system of indicators reflecting this influence.

The study by R. Zhovnovach *et al*. (2023) is devoted to solving the problem of increasing the effectiveness of the system of adaptive management of an agricultural enterprise based on controlling, while in the present article a large construction company was considered. The need to introduce a management system aimed at ensuring a gradual management of the company's processes, taking into account the specifics of functioning with a high degree of promptness, flexibility and efficiency, is substantiated. A retrospective analysis of the emergence and development of the controlling system in industrialized countries was carried out. The results of the analysis made it possible to identify the main concepts of controlling according to their orientation. The peculiarities of the organization of the controlling system in agricultural enterprises of Ukraine in the conditions of seasonal market fluctuations are determined. The authors focused on the construction of a management model, within the framework of which controlling measures are proposed aimed at ensuring the basic conditions for the functioning of an agricultural enterprise and preventing the phenomenon of funds shortage, taking into account seasonality.

Noteworthy is the study conducted by O.A. Husak (2023) on the components of the mechanism for strategic management of enterprise development. It is proved that the mechanism of strategic development management should take into account external changes in the market segment, especially in the conditions of uncertainty, increasing rapid environmental variability and the need for immediate response. The author has improved the approach to understanding the mechanism of strategic management of the development of a transportation company by improving the existing tools for making managerial decisions based on internal potential. However, in the opinion of the authors of this article, insufficient attention is paid to controlling as a subsystem of enterprise management in the strategic perspective, which is the difference between the present paper and the analysed ones.

The system of introducing strategic controlling in the activities of small and medium-sized enterprises (SMEs) in the EU was examined by M. Pavlák & P. Písař (2020). The study was conducted in 2017-2020 on the basis of data from 403 SMEs. The researchers revealed the relationship between the defined variables of controlling, return on assets, turnover, financial analysis and strategic management. A model of strategic management controlling was proposed, which was tested and verified through

experimental implementation in small and medium-sized enterprises. Supporting the results of this study, L. Brikena (2023) also points out the low level of long-term objectives, financial planning and controlling of SME development management. The constructed model has a practical value and is certainly suitable for business practice, but since it focuses on strategic management, it does not take into account the specifics of the company's activities in the operational context.

Strategic aspects of controlling in confectionery enterprises in the context of crisis management were considered by scientists N.V. Lahodiienko *et al*. (2020). The paper develops a model for analysing and forecasting the probability of a crisis situation and bankruptcy at companies in the industry as a tool for strategic controlling. According to the authors, its undoubted advantage lies in the use of financial indicators of the company in dynamics, combined with the consideration of external factors. From the authors' point of view, the developed indicator for evaluating the financial condition is universal, which is due to the possibility of its application for companies of various forms of ownership. However, since the study focuses on strategic aspects, it does not pay enough attention to operational controlling and the evaluation of its effectiveness, which distinguishes it from the present article.

Hungarian scholar V. Lakatos (2020) regards controlling as an information support system that allows to provide managers with the information they need to make production, sales and economic decisions by planning and analysing internal business processes. The author argues that entrepreneurs, especially in micro and small enterprises, tend to evaluate the success of their business based on cash flows. Authors agree that the researcher distinguishes operational and strategic components that complement each other through a combination of understanding the strategic goal and the ways to accomplish it through well-organized and economically supported operational steps. V. Lakatos (2020) analysed 80 small and medium-sized companies characterized by various types of controlling processes, which is due to differences in the size of the company and the qualifications of the manager. One of the biggest factors that contributed to the differences in the papers is the different size of the sample for the analysis. It was found that the use of controlling tools in determining decision-making processes in companies is not yet common.

Analytical aspects of the enterprise controlling system on the example of the restaurant industry were examined by T.V. Kalaitan *et al*. (2021). The authors consider the adaptation of the ABC analysis as a controlling tool, taking into account the industry specifics of companies. The practical value of the proposed approach lies in the possibility of using it as an information and analytical basis for developing and implementing managerial actions aimed at improving effectiveness and ensuring the company's sustainable development, but the study has a rather narrow focus. It does not provide answers to the questions regarding methods for evaluating the effectiveness of controlling, whereas the present study proposes a methodological approach to this.

As the authors of the study agree that the financial dimension of controlling provides practical and useful knowledge for business planning, analysis and corporate decision-making authors of this study consider it expedient to expand the indicator system for determining the effectiveness of the controlling system in the company based on companies' financial reports. This is confirmed by the fact that the analysis of financial reports is widely used by scholars as a tool for diagnosing various aspects of the company's activity. In the paper by G. Petkovic (2019), the authors apply the analysis of financial indicators to identify differences in corporate decision-making in terms of both budgeting and capital structure, dividend policy and risk management concept depending on the ownership structure of the company. In the study by M. Yousefinejad *et al*. (2022), the authors examined the relationship between the effectiveness of risk management and financial performance based on the financial reports of 138 companies listed on Bursa Malaysia in the product and services sector for the period of 2018-2020. The problem of evaluating and perceiving the risks of companies' financial reports in the context of their control and audit was also examined by K. Liao *et al*. (2018) using a sample of financial reports of Chinese companies for the 2003-2016 period.

Thus, as a result of the analysis of modern developments in the direction of the present article, the need to improve the existing system for evaluating the effectiveness of controlling mechanisms in the company within the framework of strategic and tactical (operational) components has been revealed. It can be concluded that it is necessary to replace the existing mechanisms of strategic controlling and develop effective ones, which would allow the company not only to adapt to functioning in an unfavourable external environment, but also to shape the directions of future sustainable functioning.

CONCLUSIONS

It has been found that the monitoring base of controlling mechanisms is comprehensive and covers the entire range of operational and management processes in the company. The article highlights and reveals the differences between tactical and strategic controlling, which has made it possible to formulate criteria for evaluating their effectiveness. The study has developed a methodological approach to evaluate the effectiveness of controlling components based on the analysis of the company's financial reports. It has been found that it is advisable to evaluate the effectiveness of the company's controlling system of the enterprise in two stages: evaluation of the effectiveness of controlling distribution processes (tactical controlling) and evaluation of managerial decision-making (effectiveness of strategic controlling). A system of indicators for evaluating the effectiveness of tactical and strategic controlling is formed and formulas for their calculation are given. The proposed methodological approach was tested on the example of PJSC Trust Zhytlobud-1. Using the data of the financial reports of the company under study, the calculation of partial and generalizing indicators of the effectiveness of the components of controlling in the tactical and strategic contours for the period of 2017-2022 was carried out, and analytical conclusions have been drawn.

It has been found that the effectiveness of the company's strategic controlling mechanisms is quite low, such dynamics can be interpreted as a result of the influence of negative features of the external operating environment.

At the same time, the company's tactical controlling mechanisms have demonstrated the ability to achieve an acceptable degree of effectiveness. The proposed method has made it possible to identify problematic aspects of the company's distribution processes, evaluate the effectiveness of the existing controlling system and identify reserves for improving the effectiveness of controlling processes. The results obtained allow to form a system of indicators based on the financial reports and to analyse the effectiveness of the company's controlling in the strategic and operational contours, which is an important determinant for the diagnosis of financial efficiency and ultimately contributes to the sustainable development of the company as a whole. The application of this approach provides an opportunity to evaluate the company's hidden production and management potential and develop ways to update it, respond promptly and adjust the activities of the company's management to the achievement of strategic goals. Further research should be aimed at improving the overall controlling system in companies.

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CONFLICT OF INTEREST

None.

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Оцінка результативності стратегічного та тактичного контролінгу на підґрунті аналізу фінансових звітів підприємства

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Анотація. Впровадження контролінгу є раціональною потребою для забезпечення ефективної системи менеджменту на підприємстві, тож необхідно оцінити його результативність у розрізі тактичної й стратегічної складових. Проте не існує загальної системи показників, що відображають результативність стратегічного та тактичного контролінгу, тому метою дослідження був розвиток та удосконалення методичного підходу до оцінки результативності такого контролінгу на підґрунті аналізу фінансових звітів підприємства як інструменту обґрунтованості управлінських рішень. На основі методу порівняльного аналізу виділено та охарактеризовано відмінності між тактичним та стратегічним контролінгом, що дозволило обґрунтувати критерії оцінювання їх ефективності. Встановлено, що моніторингова база контролінгових механізмів має комплексний характер та охоплює весь спектр операційних та управлінських процесів на підприємстві. Сформовано систему показників для оцінки результативності тактичного й стратегічного контролінгу. Запропоновано методичний підхід до оцінки результативності складових контролінгу на основі аналізу фінансової звітності підприємства. Його апробовано на прикладі АТ «Трест Житлобуд-1» шляхом обчислення узагальнюючих інтегральних показників ефективності складових контролінгу на підґрунті даних фінансових звітів підприємства. З використанням алгоритму методу таксономічного аналізу сформовано та стандартизовано матрицю спостережень, побудовано вектор-еталон та розраховано інтегральні показники оцінки ефективності тактичного й стратегічного контролінгу підприємства. Реалізація запропонованого методу дозволила виділити проблемні аспекти розподільчих процесів на підприємстві та в контексті прийняття управлінських рішень. Це дозволило оцінити ефективність існуючої системи контролінгу на підприємстві та визначити резерви підвищення ефективності контролінгових процесів. Практична цінність дослідження полягає в запропонованому методичному підході, що може бути корисним у процесі діагностики ефективності якості прийняття управлінських рішень підприємствами як у поточній діяльності, так і на перспективу

Ключові слова: діагностика; управління; вартість майна; банкрутство; рентабельність; основні засоби; оборотні активи

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Management of the diversification of a trading company's activities

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Abstract. The strategy of overcoming the crisis is still relevant for Ukraine's economy: diversification, entering new areas of business and trade, and searching for risks and alternatives have become important tasks after the full-scale invasion in 2022 and the declaration of martial law. The purpose of this study was to investigate the features of diversification of trading activities in crisis conditions on the example of Ukraine. Using the method of statistical analysis, the most effective and popular methods of risk distribution and features of Ukrainian crisis management were identified. The study proved the effectiveness of such diversification measures as the transition of sales to online formats, the use of postal and courier delivery services, duplication of export routes in the process of developing supply chains during martial law, and the expansion of the range of private label products by retailers. Separately, statistics on the dynamics of sales of dietary supplements in Ukrainian pharmacy chains were analysed and it was proved that sales of this group of products increased during the crisis. Based on the data obtained and the conclusions, the need to tackle corruption and immediately reform the judiciary and tax systems was proved, as these are the actions expected by the Ukrainian business community. Using the modelling, a model of enterprise diversification was created. The practical significance of the study lies in the publication of systematic information on ways of diversification, which can be useful for representatives of business and the economic block of power

Keywords: anti-crisis management; risk distribution; online sales; own production; private label

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INTRODUCTION

In conditions of instability of the global socio-economic environment, enterprises are forced to be able to quickly adapt to internal and external changes to ensure their own survival. An important factor in this case is the ability of the enterprise to diversify its own activities, that is, to penetrate into new areas of activity, open new markets and increase the range of goods or services. Enterprises in Ukraine, as a country with a developed trade infrastructure and a dynamic business environment, are forced to constantly find new methods to improve their management strategies to ensure sustainable development. The situation in the country's economy is currently unique, as the COVID-19 pandemic, to which the business community has learned to respond and adapt its processes over several years, was followed by a full-scale military invasion that further changed the consumer market, introduced changes in the processes of supplying raw materials, changed the human resources potential, and dealt a powerful blow to financial stability. This led to the need to find new trade routes for purchasing raw materials, build new strategies for personnel management and search, and change the business model of enterprises.

Ukrainian researchers have repeatedly paid attention to the skills of companies to plan future steps and resort to strategic changes. O. Hrabovenko & O. Hrebeshkova (2020) created a model of economic management of enterprise diversification, which provides an exhaustive description of the course of relevant processes and determines the conditions under which reasonable management decision-making is possible. Among the factors of successful diversification management, the researchers attributed cyclicity, goal balancing, comprehensive controlling, a two-level

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approach, and the introduction of evaluation metrics. Investigating the key trends in the Ukrainian practice of developing corporate trading systems, I.P. Mishchuk & K.V. Trofymenko (2022) came to the conclusion that the creation of clusters and participation in business associations lose their effectiveness, but the classic type of business expansion – the creation of joint-stock companies – remains an effective tool for trading corporations and is the main diversification trend in Ukraine. D.S. Zaitsev & M.V. Litvynenko (2021) attributed assortment policy to the strategic aspect of the trading company's activity. According to their conclusions, expanding or, conversely, narrowing the range of sales is the very lever through which key sales management takes place in the company. Accordingly, the new management system in the development of the product range of retail enterprises should be based on constant feedback from consumers regarding their wishes and expectations.

Diversification of a trading company as an additional source of competitive advantages was considered by V. Proskura & V. Rosokha (2023), paying special attention to the classification of diversification into vertical, which implies the separation of manufacturing enterprises, and horizontal, where divisions operate in the same industry and even compete with each other. Considering both approaches, the researchers come to the conclusion that from the standpoint of competitive advantages, the most optimal is a concentric form of diversification, which does not force the enterprise to change its key profile, but involves expanding the range of goods and services similar to existing ones. K. Kuznetsova & G. Zavadskykh (2021), who investigated the features of developing strategies of small trading enterprises, proved that the successful launch of a small trading company requires clearly formulated ambitious goals, careful market analysis and identification of its own unique trading offer, and reasonable inclusion of such advantages as location, friendly relations with suppliers, narrow market focus.

It is important to note that almost any diversification activity requires funding and additional investment. A. Loi (2023), defining strategies for using such funds, argued that the company, first of all, should clearly define its goals and needs and assess possible risks. Using the example of "METRO Cash and Carry Ukraine" network, the researcher proved that choosing the right strategy for connecting additional financial flows is the key to the further success of a trading enterprise. The greatest development potential in the modern world is found in those trading companies that introduce online sales to their traditional sales channels. O. Shaleva & I. Sereda (2023), who dedicated their work to the capabilities of online stores, described the process of creating them and their advantages over traditional retailers operating in an offline format. Having investigated the synergistic effect that arises from the combination of digitalisation and a balanced assortment policy, the researchers conclude that traditional sales can only be an adjunct to online trading. However, most of these and similar studies did not address the issue of diversification in the context of cumulative effect of the COVID-19 pandemic in 2020-2021 and a full-scale invasion of Ukraine. The purpose of this study was to determine the specifics of managing the diversification of trade enterprises in modern Ukraine.

MATERIALS AND METHODS

The study used methods of statistical analysis and synthesis. The comparison was also used to contrast indicators for several previous years to obtain not only statistical data at the moment, but also to track the dynamics of processes in such a key indicator of trade entrepreneurship development as the number of business entities by type of economic activity. These indicators were additionally compared in the context of two types of business entities – enterprises and individual entrepreneurs (sole proprietors). As part of the theoretical study, the impact of the COVID-19 pandemic and the subsequent quarantine regime in 2020 and 2021 on the processes of diversification in the trade industry was analysed, and the synthesis method systematised and combined data on the transfer of part of sales by a number of retail operators to an online format with the involvement of postal and courier structures.

The materials used for this study included operational and archival data from the State Statistics Service of Ukraine (Number of economic entities…, 2023). The open access data held by the Ministry of Economy of Ukraine (Register of data sets…, 2023), current laws and regulations (Law of Ukraine No. 904-IX, 2020), and observations by GfK (Analysis of the PL development…, 2023) on consumer behaviour towards private label (PL) products were used. Using the method of statistical analysis, the increase in the share of diversified enterprises during crisis conditions in the economy was investigated.

Based on the data obtained during the study of the state of business in Ukraine by the Advanter Group companies in cooperation with the Ministry of Digital Transformation and the Ministry of Reintegration of Temporarily Occupied Territories, the study also analysed business problems and the most important tasks for the economic block of the government from the standpoint of 753 owners and managers of small and medium-sized businesses. By using the induction method, data on the dynamics of total sales in the pharmacological market in previous years and, in particular, dietary supplements were identified and extrapolated to the retail market as a whole. This information was analysed as a special case of diversification of the trade enterprise's activities in the direction of creating an economic "safety cushion".

Based on the modelling, a theoretical model of diversification of a trading enterprise was created in the form of a flowchart, which shows the conditions for the emergence and interrelation of various components of the phenomenon, and the influence of external and internal factors, awareness of the need and substantiation of the feasibility of diversification. Using the descriptive method, based on the data obtained, the further development of diversification in Ukraine among companies specialising in trading activities and the prospects for business expansion in this area were described, in particular, what actions the business community expects from the economic block of power, so that its further steps on diversification are effective and bring the expected profit.

RESULTS

The impact of the COVID-19 pandemic on the global economy is difficult to overestimate – entire industries, such as tourism, hotel, and show business, were forced to stop or

significantly reduce any activity for a long period of time, and a large number of companies went bankrupt. However, if at the beginning of 2022 the rest of the world began to gradually recover from the consequences of the coronavirus and the forced isolation regime, then for Ukraine, on the contrary, the conditions of economic activity have become even more critical. The multiplicative effect of the pandemic crisis and the subsequent full-scale military crisis forced Ukrainian businesses to look for opportunities to minimise risks and diversify their further activities.

During the pandemic restrictions, when traditional trading, with a few exceptions, was restricted, many trading companies and consumers discovered the benefits of online orders and contactless purchases. An indicator of these processes was the growing statistics of online sales. In 2020, Ukrainians spent more than UAH 107 billion on online purchases, which, according to the news portal, is 41% higher than the same indicator in 2019 (Number of the day..., 2020). During the year, the number of online payments increased by half, which also illustrates the diversification processes of that period – in order not to lose business, trading companies quickly changed their market strategy, transferring their retail outlets, showrooms, and cash registers to a contactless electronic format. Those enterprises that managed to diversify their operations in time not only retained their business, but also made additional profits at the expense of companies that failed to digitise and were forced to leave the market. A separate factor in the strengthening of e-commerce was the adoption by the Verkhovna Rada of Law of Ukraine No. 904-IX "On Amendments to Article 19 of the Law of Ukraine 'On Medicinal Products' Regarding Electronic Retail Trade of Medicinal Products" (2020), which allowed e-commerce of the relevant goods, significantly enhancing diversification processes in the pharmaceutical industry.

The next test for the ability to manage diversification processes in crisis conditions was 2022. Despite the temporary loss of certain territories and localities, the number of online purchases in Ukraine in 2022 almost recovered and amounted to three-quarters (77%) of the indicators of 2021 (Everyone needs smartphones..., 2023). This fact shows that the Ukrainian segment of trade was able to cope with the second crisis in a row and, using the diversification of sales channels, responded in a timely manner to changes in consumer expectations and general market conditions.

In the context of crisis management analysis and risk distribution, special attention should be paid to the powerful development of courier delivery and postal services as an example of a company's diversification in response to market needs. A clear example of the expansion of trade specialisation is the Rozetka and OLX market places – reflecting the need of customers to physically receive the purchased goods, the former created their own extensive network of export points with free delivery, while others implemented the "OLX-delivery" system, through which 11 million orders were sold in 2022, which was twice as high as in 2021 (Everyone needs smartphones..., 2023). According to the State Statistics Service of Ukraine, the number of commercial enterprises in the period from 2019 to 2022 had a negative trend, but insignificant (Number of economic entities, 2023). More detailed information is shown in Figure 1.

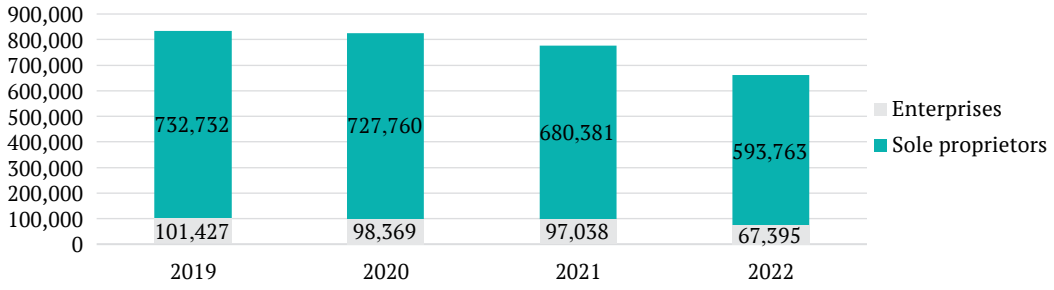

Figure 1. Number of sole proprietorships in Ukraine by year

Source: compiled by the author based on Number of economic entities by types of economic activity (2023)

The trend shown in Figure 1 confirms the fact that in the process of passing through two consecutive crises, Ukrainian business suffered losses in quantitative terms. Firstly, not all trading market operators have focused on time and reallocated existing resources to such new market niches as e-commerce and contactless sales. Secondly, some of the companies were destroyed by invasion and military operations. Thus, this trend is typical for both commercial enterprises and sole proprietors. However, those companies and entrepreneurs who were able to diversify not only retained, but also strengthened their own positions in the sales market, and the existing drop in the nominal number of legal entities by only 20% over the three crisis years does not look critical. Further challenges and obstacles faced by Ukrainian business, and the most important tasks that commercial structures expect the economic block to address, were investigated as part of the Initiative for economic recovery, business development and export of Ukraine (2023). According to the conducted Study of the state of business in Ukraine (2023), priorities were distributed according to the bar charts below (Fig. 2). According to the results of a survey of 753 entrepreneurs from all regions of Ukraine, entrepreneurs consider further uncertainty to be the main challenge for business – both in the context of the unpredictable future of the warring state and in the context of the actions of government representatives. Accordingly, crisis management skills and an understanding of the most promising areas of development for risk distribution remain relevant in 2024. The study of the highest priority tasks for the authorities, which was conducted within the framework of the same initiative, is shown graphically in Figure 3.

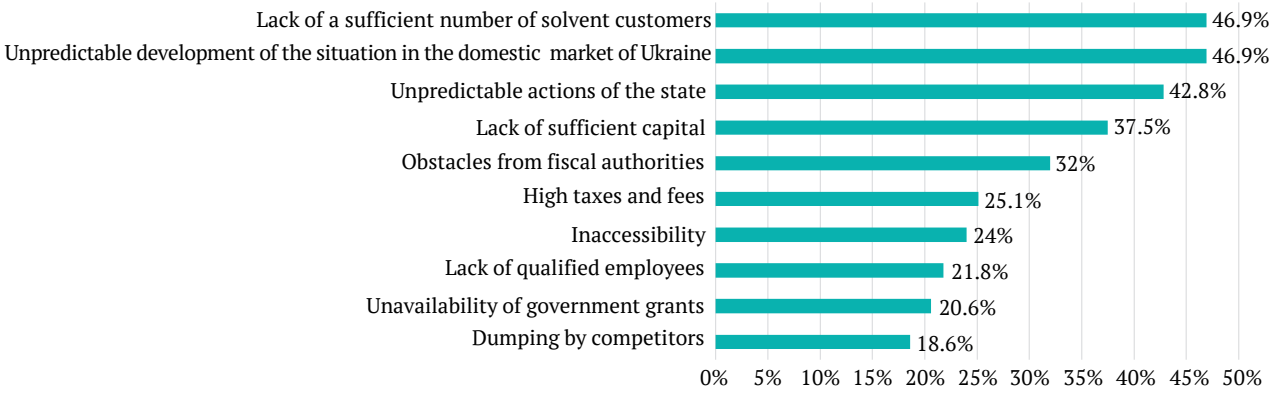

Figure 2. Rating of business problems in Ukraine from the standpoint of entrepreneurs
Source: compiled by the author based on the Study of the state of business in Ukraine (2023)

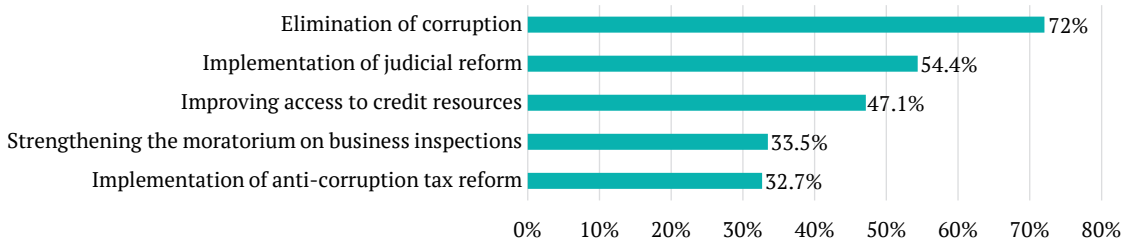

Figure 3. Rating of tasks for the economic block of power from the standpoint of entrepreneurs
Source: compiled by the author based on the Study of the state of business in Ukraine (2023)

As can be seen from the diagram above, entrepreneurs consider defeating corruption and implementing judicial and tax reforms to be key conditions for improving the business climate. Until these expectations of the Ukrainian business community are met, risk diversification may turn into a form of capital flight abroad, which will negatively affect the situation in the country's economy. One of the key vulnerabilities of the trading business is dependence on manufacturers and suppliers of products, and in conditions of uncertainty, it is especially difficult to correctly assess risks, quickly respond to disruptions in the supply of goods, and prevent the breakdown of the manufacturer-distributor-buyer chain. As a result, in crisis conditions, the usual logistics cycles are disrupted, warehouses can either quickly become empty, or, conversely, be overloaded with goods that have lost demand in the new realities.

In order to reduce dependence on third-party factors that the business entity is not able to influence, after weighing all the risks and available resources, the distributor can decide to diversify its activities towards its own production and transform the business into a trading and production enterprise. This step, in addition to guaranteed deliveries and, accordingly, the possibility of confident planning, also gives the company an assortment advantage – having its own production facilities at its disposal, the business can more flexibly manage the introduction of new products that are in demand in the market, or vice versa – quickly remove items from the assortment that have ceased to be profitable.

As an example of assortment diversification, it is worth mentioning the pharmacy market. In particular, according to the assessment of a specialised publication Apteka.UA newspaper (n.d.), since 2017, the share of dietary supplements in retail sales of pharmacies has been growing by 1% annually. This growth is approximately UAH 1.5 billion per year, and, in relative terms, corresponds to global trends observed in the markets of Europe and America. In 2020, the COVID-19 pandemic further stimulated demand for dietary supplements, bringing the share of dietary supplement sales to 7% of the total pharmacy market. Moreover, the full-scale aggression in 2022 and the resulting decline in the purchasing power of the population and the relocation of a significant share of the target audience only strengthened the position of dietary supplements, increasing their share in the retail pharmacy market as of the first half of 2023 to 10%. Thus, pharmacies that once shared the risks and included dietary supplements in their range were able to compensate for losses from reduced turnover in other product categories with the help of additional profit in this product niche.

Another case of high-quality management of diversification processes is the export channels of Ukrainian grain during martial law and the increased danger of navigation in the Black Sea. Due to a well-thought-out policy regarding the distribution of risks and the use of both the so-called sea "grain corridor", and the transportation of grain by river through the Danube estuary and the use of rail transport, Ukraine managed to increase exports of a number of grain crops in 2022. According to the Deputy Minister of Economy T. Kachka, up to 25 million tonnes of corn, 2 million tonnes of soybeans, and 2.7 million tonnes of sunflower seeds were exported (Ukraine exported..., 2023). Revenues from the sale of these volumes partially covered the losses of the economy from the decline in exports in other industries, which is also an illustration of sound diversification.

An important tool for diversifying retail trade enterprises (mainly network ones) is the inclusion of PL in the product range. Trading companies order such products from manufacturers under their own brand and, accordingly, sell them exclusively through their own sales channels. Since such products are cheaper than familiar brands without a significant loss of quality, the demand for PL products is increasing due to a number of crisis factors for the population. According to the results of GfK's observations, sales of Ukrainian PLs in the first half of 2022 increased by +35% compared to the same period in 2021 (Analysis of the PL development era, 2023). Thus, by diversifying their risks, retail chains have become a supplier of unique low-cost products and do not lose profits, even if the demand for familiar brands decreases.

In the current economic and political realities, it is important for the Ukrainian commercial environment not only to determine the impact of social factors on diversification processes, identify and classify factors that influence management decision-making in the company, but also to create applied models of diversification processes that are substantiated by complex mechanisms. One of the variants of such a structural model-scheme is shown in Figure 4.

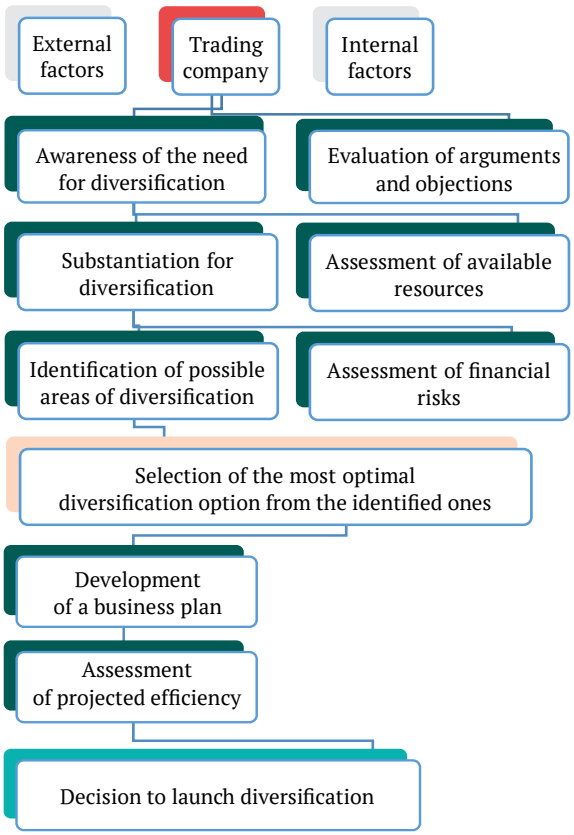

Figure 4. Conceptual model-scheme for launching diversification processes by the management of a trading enterprise

Source: developed by the author

As can be seen from the analysis and data obtained, risk diversification is an important factor in business activities even in normal conditions, and during crises, managing diversification processes becomes many times more important. Since Ukraine and its economy have been in a state of permanent crisis since 2020, high-quality anti-crisis management and balanced risk distribution are vital for the very existence of the state. At this stage, the government and business jointly manage to solve pressing issues, using such forms of diversification as building trade and production associations, reviewing assortment policy, online sales, maintaining operational feedback with consumers, searching for new logistics channels, and developing PL.

However, as noted above, the business community has a clear request for reforms that can solve a number of problems at the system level, not just reducing some threats, but completely neutralising them. If tax and judicial reforms in Ukraine are not implemented in the near future, there will be a risk of leakage of production capacities and capital abroad, which is also a form of commercial diversification.

DISCUSSION

Diversification of a trading company's activities has many dimensions and is usually addressed not only in crisis circumstances. It is through diversification that the company has the opportunity to explore new areas of activity that can minimise future risks and ensure sustainable development. It is not uncommon for an additional vector of development to become more promising over time than the main ones. The experience of other countries in this matter quite often appears as objects of research.

G. Li *et al*. (2022) considered diversification as a way to mitigate supply disruptions and guarantee the sustainability of the supply chain – it is the effectiveness of this option to minimise risks that was also discussed in this paper. Despite some departure from stereotypical views, the researchers proved that a manufacturer can have an incentive to share insider information about demand with its supplier, and such an exchange of information can even increase the reliability of supply. It was found that in the case when the reliability of supplies is low, the manufacturer still prefers diversification. The impact of hidden diversification on macroeconomic stability was described by D. Lederman *et al*. (2021). As mentioned above, in the event of increased pressure within the parent market, the business has a fallback option in the form of relocating abroad. This hidden diversification, in contrast to the more familiar internal risk management, considers the potential movement of production capacity and capital to countries where the company has previous export experience, and creates an additional reserve in case of forced relocation. In the Ukrainian context, such a movement of resources can be critical for the economy.

Diversification of export channels, as a method of protecting supplies, which was also used in Ukraine in relation to grain, became the object of research by V. Sarin *et al*. (2022). The researchers analysed almost a hundred papers on the topic published in various scientific journals. Most of these sources proved the positive impact of export diversification on economic growth, which confirmed the need to duplicate supply channels by various transport routes – sea, rail, and road. If one or two channels are temporarily blocked (as was the case with the "grain corridor"), the trading campaign will not spend resources searching for alternatives. S. Gopal *et al*. (2021), exploring the boundaries of diversification processes in emerging

economies, found that traditionally dominant business groups in such countries diversify by expanding the scale of existing subsidiaries and creating new ones. Such manipulations, which only have the appearance of competition, but in fact are a form of internal cartel collusion, negatively affect the economic and investment climate of the country. Since this topic is also relevant for Ukraine, it is important to realise that a high-quality tax reform is a guarantee of preventing such transactions – this was the subject of the analysis of urgent requirements from business to the Ukrainian authorities.

Export diversification in developing countries was also discussed by S.A. Carrasco & E.D. Tovar-García (2021), assessing the structure of the external sector of the economy. The researchers identified features that demonstrated a certain relationship between economic growth and the consequences of economic reforms. Based on a sample of 19 developing countries and using the dynamic panel data method, it is found that the structure of exports and export diversification have little impact, while the domestic content of exports and the share of high-tech products in them are of importance. However, the results of this study call into question this statement, since the diversification of Ukrainian exports turned out to be an important factor. The Portuguese scientist F. Esposito (2022) developed his own theory of calculating risks in trading According to the diversification index, which depends on the ratio of demand in the country and in its neighbouring countries, a trading company can make additional profits if it takes deliberate risks. Using statistics from a number of trading companies, the researcher demonstrated that the "diversification index" significantly affects the size and stability of profits, and risk diversification increases trading income by 17% compared to neutral risk models.

As mentioned above, one of the most effective ways to diversify risks for a trading company is to introduce PL to the product range. On the one hand, the company does not turn into a production company, saving money on the purchase and launch of industrial equipment, on the other hand, it is guaranteed to receive high-quality exclusive goods at an affordable price. The advantages of this approach were described by K. Gielens *et al*. (2021), who confirmed that over the past 40 years, the volume of production under PL has been steadily increasing worldwide. Due to modern monitoring technologies, retailers are able to collect and analyse huge amounts of data, which is used to understand the diverse needs of customers and respond accordingly. Similar conclusions regarding private stamps were also reached by M. Sansone *et al*. (2021), who confirmed the hypothesis that the trust of a particular seller extends to its PL, despite the fact that the actual manufacturer of these products is another company. The influence of the coronavirus pandemic on the diversification of trading activities in the field of e-commerce was investigated by L. Eger *et al*. (2021). By examining the impact of COVID-19 on the structure of the retail market and consumer purchasing behaviour, the researchers have shown a significant increase in the share of online sales and a corresponding increase in offers from former offline networks.

P. Aversa *et al*. (2021) conducted a longitudinal study of Amazon's business model diversification, and demonstrated how the company's use of the network effect and the single window effect drives sales growth. The competitive advantage of sales in the digital space was also investigated by D. Pernot (2021). The researcher proved that the popularisation of online order pickup, as discussed in this study, allows consumers to adopt a diversified shopping practice that can be easily integrated into their personal schedules. It was the activation of these service areas during the pandemic that was discussed above – the new shopping algorithm provoked by the pandemic turned out to be not only safe, but also convenient for many conservative consumers.

Another dimension of diversification processes against the background of military aggression, which was discussed in this paper, is risk management on the part of European states. As noted by M.A. Ruiz Estrada & E. Koutronas (2022), numerous restraining sanctions imposed against the aggressor country, forced to change trade chains not only at the European, but even at the transcontinental level. The refusal of energy carriers from sanctioned sellers forced them to diversify their energy activities and find more reliable suppliers of natural oil and gas. A similar network analysis of the impact of war on the economy of third countries was also conducted by E. Braun *et al*. (2023), who came to the same conclusions – the rejection of the products of the aggressor country and the diversification of energy suppliers added constancy and predictability to European economy.

In general, high-quality management of diversification processes is a guarantee of development for any trading company. Businesses that are unable to adapt to rapid external and internal changes are forced to leave the modern dynamic market. Business leaders need to keep constant feedback from both consumers and competitors to understand the mood and prospects of the industry.

CONCLUSIONS

As a result of the analysis of statistical data, the dynamics of the number of commercial enterprises and sole proprietors for several previous years, including the first year of a full-scale war, was revealed. Despite a certain decline in indicators, it can be concluded that in general, the industry withstood the blow and avoided a catastrophic scenario. In addition, based on the example of the pharmaceutical business, some positions, on the contrary, increase their economic attractiveness in crisis situations. The results obtained indicate a high level of risk diversification management in Ukraine – both in the case of forced transition of sales from the traditional to the electronic and courier sector, and in the case of expanding the range of retail chains with products of PLs, and in the case of redirecting logistics flows of export products bypassing the temporarily occupied territories. Accordingly, there is every reason to be sure that the Ukrainian anti-crisis management will cope with future challenges, having calculated in advance alternative diversification ways that will minimise risks.

This study allows identifying the factors that influence managerial decision-making in diversification processes in order to open new ways of development and ensure effective operation. This applies both to managing real sales channels and export logistics chains, and to strengthening the role of e-commerce, virtual marketplaces, and postal services. However, the request of the Ukrainian business community regarding the implementation of reforms and

the elimination of corruption remains unanswered. If the authorities continue to ignore proper communication with private business, there is a risk that human and production resources will flee abroad. A comprehensive analysis of such a negative scenario may be the topic of the next study.

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CONFLICT OF INTEREST

None.

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Управління диверсифікацією діяльності торговельного підприємства

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Анотація. Для економіки України стратегія подолання кризових явищ досі актуальна: диверсифікація, вихід підприємства в нові сфери діяльності й торгівлі, пошук ризиків та альтернативних шляхів стали важливими задачами після повномасштабного вторгнення у 2022 році та оголошення воєнного стану. Метою даної роботи було дослідження особливостей диверсифікації торговельної діяльності в кризових умовах на прикладі України. Завдяки методу статистичного аналізу були виявлені найбільш ефективні та популярні методи розподілу ризиків та особливості українського антикризового менеджменту. У результаті дослідження була доведена ефективність таких диверсифікаційних заходів, як перехід продажів в онлайн-формати, використання поштових служб та служб кур'єрської доставки, дублювання експортних маршрутів у процесі формування логістичних ланцюжків у період воєнного стану, а також розширення роздрібними торговими мережами асортименту продуктів під власною торговою маркою. Окремо було проведено аналіз статистики щодо динаміки реалізації біологічно активних добавок в українських аптечних мережах та доведено, що продажі цієї групи товарів під час кризових станів зросли. На основі отриманих даних та зроблених висновків була доведена потреба в подоланні корупції й негайному реформуванні судової та податкової систем, оскільки саме цих дій від влади очікує українська бізнес-спільнота. За допомогою методу моделювання було створено модель диверсифікації діяльності підприємства. Практична значимість дослідження полягає в оприлюднені систематизованої інформації щодо шляхів диверсифікації, що може бути корисна представникам бізнесу та економічному блоку влади

Ключові слова: антикризовий менеджмент; розподіл ризиків; інтернет-продажі; власне виробництво; приватна марка

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Directions for using big data analytics in logistics management

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Abstract. Logistics operations are becoming increasingly complex and require accurate data for effective management. The use of big data in logistics management is a relevant issue due to the growing volume of data and the need to optimize delivery and inventory management processes to meet market demands. The purpose of the study was to develop ways to optimize the management of big data analysis in logistics. To achieve this goal, the methods of analysis, experimentation, and comparison were used. As a result of the study, strategies for optimizing logistics management of big data analysis were developed and successfully applied. The Python programming language based programme effectively optimizes delivery routes using a clustering algorithm and visualizes the results of this process. Additionally, an informative diagram has been drawn up to illustrate the key stages of the developed strategies. The study also developed and presented a table describing the use of big data analysis methods in various logistics companies. The companies were compared in terms of functionality, data, results, and field of activity. It is established that the use of machine learning methods and optimization of data storage and processing significantly increases the efficiency of logistics operations. The results of this study can be used by logistics companies of any size, as well as enterprises engaged in supply chain management. In addition, the recommendations and strategies developed in this study may be useful for information technology and data analytics professionals involved in the development of software solutions and systems to optimize logistics processes

Keywords: supply control; use of volumetric information; ways to optimize management; transport and warehouse organization; big data analysis

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INTRODUCTION

The study of the directions of using big data in logistics management is an important task in the modern business world. With the growing volume of data and complexity of logistics operations, there is a need for effective information management to ensure operational efficiency and competitiveness of companies. In the rapidly changing economic and competitive environment of the logistics market, the use of advanced analytical tools and techniques such as big data analytics, machine learning and Internet of Things (IoT) is becoming key to ensure competitiveness and efficiency in logistics operations. Unlike traditional analytics, new techniques can process and analyse large amounts of data in real time, identify hidden patterns and predict trends, giving companies an edge in making strategic decisions and optimizing operations. Thus, the use of advanced analytical tools becomes a prerequisite for successful operations in today's logistics environment.

There are many other studies that have addressed this topic and attempted to address the challenges associated with managing big data analytics in logistics. For example, S.K. Serikbayeva *et al.* (2021) noted that modern data technologies have a significant impact on logistics management, providing new opportunities for optimizing processes. The introduction of big data in logistics is accompanied by increasing demands for effective information management and productivity improvement. Research in this area includes analysing data processing methods and defining the requirements for the information system of a logistics company. In their paper, G. Zhanbirov & E. Zhanbirov (2022) stressed that efficient organization of

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production operations plays a key role in the dynamics of the logistics system by minimizing costs and synchronizing processes. Standardization of material resources helps to improve production performance and reduce storage and picking costs. A flexible supply chain provides a balance between reliability and cost-effectiveness in a highly dynamic logistics management environment.

In a study by S. Abdikul *et al.* (2022), the prospects of using digital technologies in supply chain management were examined, particularly the integration of blockchain technology in logistics. Supply chain management processes are focused on optimizing virtualization and the development of the digital economy. In this context, the application of blockchain technologies is seen as a means to improve the management of supply chain processes by providing transparency and security of transactions, which can be beneficial for efficient business management and logistics systems. A. Userbayeva *et al.* (2022) emphasized that strategic management helps companies to succeed in the long term through effective logistics, which plays an important role in achieving business goals. The authors emphasized that the development of logistics strategies and infrastructure is of high importance for the economic growth of a country. In turn, Z. Alimova *et al.* (2023) discussed a project funded by the government of Kazakhstan through the Ministry of Science and Higher Education to create an algorithm and software for data analysis. Modern technologies allow efficient collection and storage of data in digital format. However, specialized computer analytics tools and techniques are required to extract useful information from this data. Researchers N.K. Mukazhanov & A.M. Tolegenov (2022) described the creation of a data model and its visualization in a logistics information system for strategic and operational management. The authors described visualization methods that allow quick access to multidimensional data, as well as software for storing and analysing information.

In addition, R. Karki *et al*. (2024) emphasized that data analytics in logistics and supply chain management is attracting more and more attention from companies. It has the potential to improve supply chain performance, but many companies have not yet fully utilized these capabilities. The author noted that it is important to investigate the factors affecting supply chain performance and understand which ones can be optimized using big data analytics. The study by Z. Chen & Z. Liao (2023) revealed that the use of data analytics and artificial intelligence-based solutions can improve the warehouse management efficiency of logistics companies as well as optimize the entire supply chain. Big data can accurately forecast demand and coordinate supply chain operations, which helps improve cost control and resource utilization. However, the application of big data can raise ethical concerns in the logistics industry, which negatively affects the security of information and personal safety of customers and logistics companies.

Previous studies have raised issues related to this topic, but challenges such as effective information management, performance optimization and digital integration remain unresolved. With the increasing volume of data and complexity of logistics operations, it is becoming increasingly difficult to manage information effectively, making it difficult to make informed decisions and reducing the operational efficiency of companies. The challenge is also the diversity of data sources, formats, and structures, which not only makes it difficult to make informed decisions, but also creates difficulties in adapting to rapidly changing market conditions. New customer requirements and expectations reinforce the need for a more flexible and adaptive approach to data management in logistics. The development of new data management strategies becomes a necessity to improve the operational efficiency and competitiveness of logistics companies, which emphasizes the relevance of this issue in modern logistics. With this in mind, the aim of the research was to create effective methods for managing big data analysis in logistics.

MATERIALS AND METHODS

To achieve the research objective, a comprehensive methodological approach was used, including such methods as analysis, experimentation, and comparison. The method of analysis allowed for an in-depth investigation of relevant aspects of big data management and analytics in the context of logistics. This research not only analysed the current trends, issues, and challenges faced by logistics companies, but also explored existing strategies and approaches to data management in this sector. This method allowed for a more detailed examination of various aspects of data processing, including its dynamics within logistics systems, the application of blockchain technologies and virtualization, as well as exploring strategic management, computer analytics techniques and data models. The method of analysis covered a wide range of technological innovations and solutions used in logistics. This included the study of supply chain management, application of big data in omnichannel logistics, analysis of bibliometric data, application of artificial intelligence, impact of e-commerce on logistics operations, various technological and organizational solutions. An equally important aspect of the study was to examine the impact of IoT on logistics processes, as well as to analyse trends related to the development of Industry 4.0. Various innovative business models were also explored, including their application in the logistics context, as well as the impact of the use of big data and machine learning techniques on the field of mergers and acquisitions in the logistics sector.

During the research, the experimental method was used to implement the developed strategies to optimize the management of big data analytics. For practical demonstration of the strategies, a programme was implemented using delivery route optimization, which performed clustering of delivery points and visualization of the results. This programme is written in Python programming language in the Replit environment. It works in such a way that after generating random coordinates of delivery points, it applies a clustering algorithm to determine the optimal routes. Clustering allows delivery points to be grouped into clusters so that the distance between points within a cluster is minimized and the distance between clusters is maximized. The software then visualizes the initial delivery points and the clustering results in a graph where each cluster is marked with a different colour to provide a visual representation of the optimal delivery routes. The programme saves the graph with the clustering results to a file for easy analysis and visualization of the results. The

experiment was also used to create a scheme illustrating the main stages of the developed strategies. The scheme included analysis, selection, implementation, integration, optimization, and refinement.

The comparison method was applied to evaluate the effectiveness of big data analytics management strategies in logistics. For this purpose, a comparison table including different logistics companies was developed. This table compared the companies on the basis of their functional capabilities, volume and quality of data, results obtained in the application of big data analytics and scope of operations. The comparison of the data presented in the table allowed identifying the main advantages and disadvantages of each company in the use of big data analytics in logistics. This approach helped to systematise the information and provide a better understanding of which data management strategies are most effective for different logistics companies.

RESULTS

Logistics plays a key role in ensuring the smooth operation of many industries. As transport volumes grow and supply chains become more complex, companies are faced with the need to process and analyse huge amounts of data. In this context, big data analytics becomes an indispensable tool for optimizing logistics operations and increasing their efficiency. To gain a deeper understanding of the role of big data analytics in logistics management, it is worth paying attention to real examples of its application in large companies (Table 1).

Table 1. Comparative table of the use of big data in companies

Company	Functional features	Data	Results	Industry
Walmart	Demand forecasting, route optimization, warehouse stock management	Historical sales data, weather data, traffic data, customer geolocation data	Reduction of logistics costs by 20%	Retail trade
Amazon	Route optimization, demand forecasting, personalization of offers	Order data, customer location data, product data, weather data	Leadership in the e-commerce market	Electronic commerce
Dalsey, Hillblom, Lynn (DHL)	Monitoring the condition of the cargo, tracking its movement, forecasting the delivery time	Data from sensors, data about routes, data about weather conditions, data about customs procedures	Improving the quality of customer service	Logistics
United Parcel Service (UPS)	Route optimization, delivery time forecasting, warehouse stock management	Data on orders, data on routes, data on vehicles, data on customs procedures	10% reduction in delivery time	
FedEx	Optimization of routes, forecasting of demand, management of warehouse stocks, forecasting of customs procedures	Data on orders, data on customs procedures, data on security, data on road traffic	Increasing the efficiency of logistics operations by 15%	
XPO Logistics	Route optimization, demand forecasting, warehouse stock management	Data about orders, data about routes, data about vehicles	Reduction of logistics costs by 20%	
Maersk Line		Data on orders, data on routes, data on vehicles, data on weather conditions	Increasing the efficiency of logistics operations by 10%	
Kuehne+Nagel		Data about orders, data about routes, data about vehicles	Reduction of logistics costs by 15%	

Source: made by the author based on Maersk Data Integrations (n.d.), Z. Blank (2021), M. Garland (2022; 2024)

Retail giant Walmart uses big data analytics to forecast demand, optimize delivery routes and manage inventory. The implementation of such technologies has resulted in a 20% reduction in logistics costs (Garland, 2024). Amazon, the global leader in e-commerce, is actively applying big data management to optimize delivery routes, forecast demand and personalise offers for customers (Garland, 2022). This has allowed Amazon to establish itself as a leader in the e-commerce market. DHL, one of the world's largest logistics service providers, uses big data analytics to monitor shipment status, track its movement and predict delivery times (The real value of IoT…, n.d.). This has helped to improve customer service.

UPS uses these analytics to optimize delivery routes, predict delivery times and manage inventory (Tatlidil, 2023). As a result, the company has reduced delivery time by 10%. FedEx also uses big data management to optimize delivery routes, forecast demand and manage inventory (Blank, 2021). This has enabled the company to improve the efficiency of its logistics operations by 15%. XPO Logistics applies big data analytics to optimize delivery routes, demand forecasting and inventory management (How data and digitisation…, 2020). As a result, the company has reduced logistics costs by 20%. Maersk Line also uses big data analytics to optimize delivery routes, demand forecasting and inventory management (Maersk data integrations, n.d.). This has enabled the company to improve the efficiency of its logistics operations by 10%. In addition, Kuehne+Nagel applies big data analytics to optimize delivery routes, demand forecasting and inventory management, which has reduced logistics costs by 15% (Digitalisation in logistics, n.d.).

Thus, analyses of the application of big data in logistics have revealed widespread use of this tool by leading companies in the industry. The results include cost reductions, increased efficiency, and improved customer service. It can be highlighted that the leaders in this area are Walmart, Amazon, DHL, DHL, UPS, and FedEx. However, there

are many other companies using big data in logistics management. In order to realise the research objective, certain methods should be developed to improve the management of big data analysis in logistics (Fig. 1).

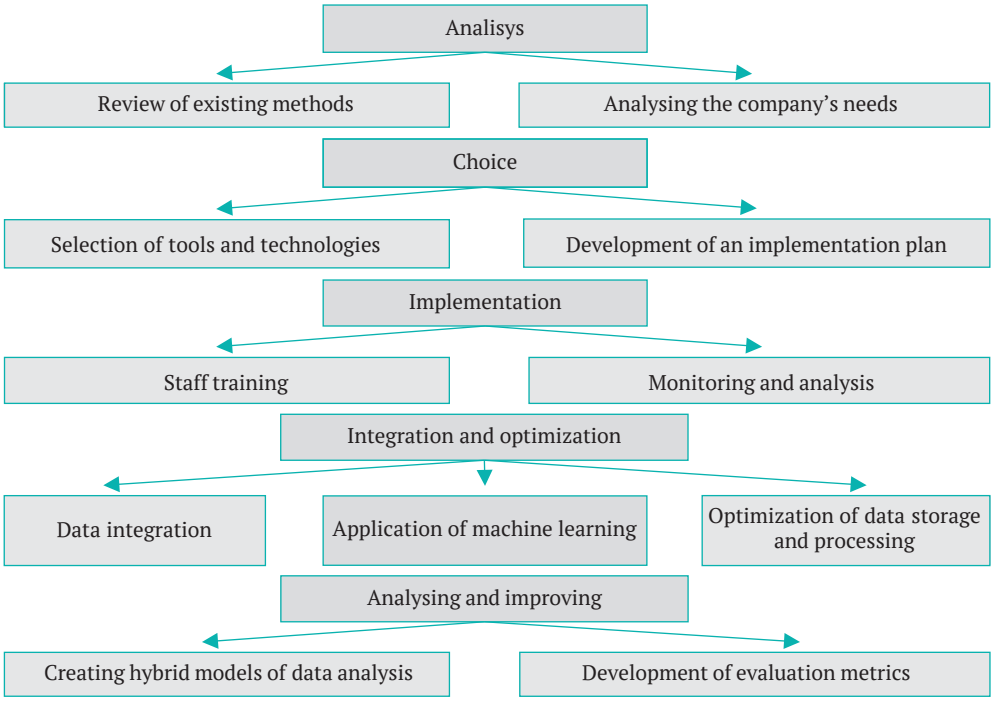

Figure 1. Scheme for improving the management of big data analysis in logistics
Source: made by the author

First, it is necessary to conduct an overview of existing methods that contribute to the improvement of the management of big data analysis in the field of logistics. This will allow determining the most effective strategies and approaches that can be implemented in practice. It is necessary to analyse the needs and peculiarities of a specific logistics company. This stage will help to develop individual optimization strategies that will best meet the requirements and goals of the company. Next, it is necessary to choose the most suitable tools and technologies for optimizing the management of big data analysis in a specific company. It is important to take into account the specifics of business processes and the peculiarities of collected data when choosing such tools.

The next step is to develop a plan for implementing the selected strategies and tools. Determining the stages and terms of implementation, as well as those responsible for their implementation, will help ensure the effective implementation of new methods. One of the key aspects is providing personnel training in the use of new tools and technologies. Trained and competent personnel are the key to successful implementation of innovations in the company's work processes. It is also necessary to establish a system of monitoring and analysis of the results of implementation of optimization strategies. This will make it possible to quickly identify problems and adjust plans if necessary, ensuring constant improvement of processes. In addition, it is important to integrate data from various sources to create a single information base. This will make the analysis more complete and accurate, which will increase the quality of the decisions made.

The next step could be the use of machine learning algorithms to automate the processes of data analysis and trend forecasting in logistics. This will help reveal hidden patterns and optimize business processes. It is necessary to develop methods and technologies to optimize the processes of storing and processing large volumes of data. This will increase the speed and efficiency of the analytics system, reducing time spent. One of the promising directions is the creation of hybrid data analysis models that combine various methods, such as statistical methods, machine learning, and artificial intelligence. This will help to obtain more accurate and reliable analysis results. An important stage is the development of a system of metrics and indicators that will allow assessing the effectiveness of management of big data analysis in logistics, which will help identify areas for further improvement and optimization of processes. Thus, the implementation of the described methods and strategies will allow not only improving the management of big data analysis in the field of logistics, but also ensuring the long-term efficiency and competitiveness of the company.

It is worth concluding that improving the management of big data analysis can significantly increase the efficiency of logistics operations and improve the company's competitive position. For a more in-depth study of the applied strategies, it is worth conducting a practical test of them. For example, develop a simple Python programme that optimizes delivery routes using a clustering algorithm and visualizes the results. This code creates random delivery points, then clusters them using the k-means algorithm and visualizes the results (Fig. 2).

```
import numpy as np
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans

# Generate random coordinates of delivery points
np.random.seed(0)
delivery_points = np.random.rand(30, 2)

# Visualization of starting delivery points
plt.scatter(delivery_points[:, 0], delivery_points[:, 1], color='blue')
plt.title('Clustering of delivery points')
plt.xlabel('Latitude')
plt.ylabel('Longitude')
plt.show()

# Optimizing routes using clustering
num_clusters = 5
kmeans = KMeans(n_clusters=num_clusters)
kmeans.fit(delivery_points)
centroids = kmeans.cluster_centers_

# Visualization of clustering results
colors = ['red', 'green', 'orange', 'purple', 'yellow']
for i in range(num_clusters):
  cluster_points = delivery_points[kmeans.labels_ == i]
  plt.scatter(cluster_points[:, 0], cluster_points[:, 1], color=colors[i])
  plt.scatter(centroids[i][0],
        centroids[i][1],
        color='black',
        marker='x',
        s=100)
plt.title('Clustering of delivery points')
plt.xlabel('Latitude')
plt.ylabel('Longitude')
plt.show()

# Saving analysis results
plt.scatter(delivery_points[:, 0], delivery_points[:, 1], color='blue')
for i in range(num_clusters):
  cluster_points = delivery_points[kmeans.labels_ == i]
  plt.scatter(cluster_points[:, 0], cluster_points[:, 1], color=colors[i])
  plt.scatter(centroids[i][0],
        centroids[i][1],
        color='black',
        marker='x',
        s=100)
plt.title('Clustering of delivery points')
plt.xlabel('Latitude')
plt.ylabel('Longitude')
plt.savefig('delivery_clusters.png')
```

Figure 2. Created code

Source: made by the author

That is, this programme is an example of practical implementation of delivery route optimization, which is related to the management of big data analysis in the field of logistics (Fig. 3).

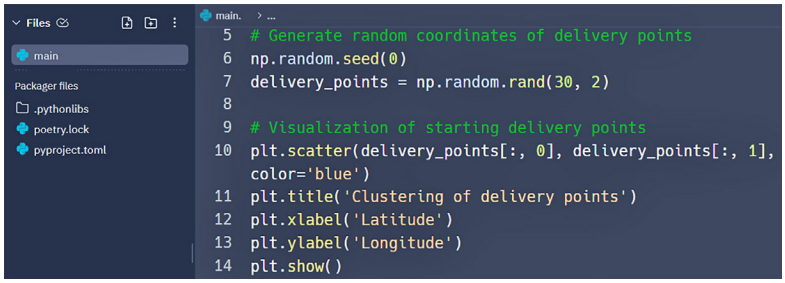

Figure 3. Code fragment in the Replit environment

Source: made by the author

This code demonstrates the application of machine learning methods to optimize logistics processes. The output of the programme is a graphical representation of optimal delivery routes, which allows logistics companies to make more informed decisions when planning routes and optimizing delivery (Fig. 4).

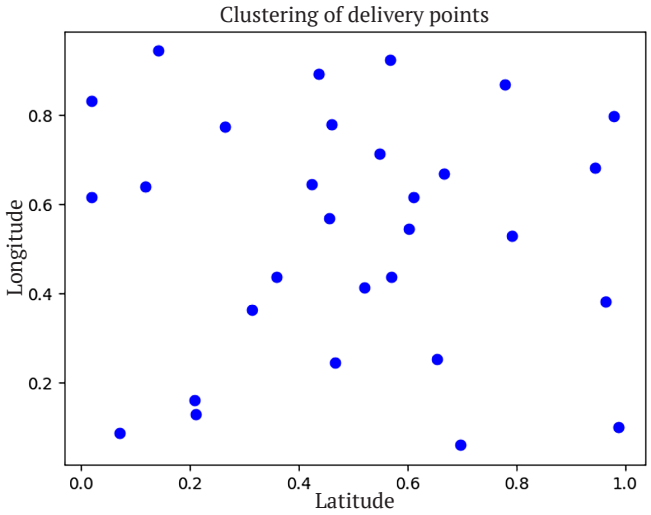

Figure 4. Result of the programme

Source: made by the author

That is, the programme first generates random coordinates of delivery points. Then it applies a clustering algorithm (in this case k-means) to determine the optimal delivery routes. Clustering groups delivery points into clusters such that it minimises the distance between points within a cluster and maximises the distance between clusters. Further, it visualises the initial delivery points and clustering results in a graph. Each cluster is marked with a different colour and the centres of the clusters are marked with crosses. And it saves the graph with the clustering results to the file delivery_clusters.png.

In addition to software development, it is also possible to implement strategies to optimize the management of big data analysis by conducting pilot projects in the real environment of a logistics company. This will test the effectiveness of the strategies in practice and identify potential problems. Training workshops and seminars can be organised for company employees to improve their skills in working with data and applying new analysis methods. A necessary step would be the introduction of a monitoring and evaluation system, which would allow constantly analysing the effectiveness of the applied strategies and make adjustments if necessary.

Considering the research conducted, it is worth providing certain recommendations. Effective management of big data analysis in logistics requires a comprehensive approach that includes analysing existing methods, adapting them to the needs of a particular company, selecting optimal tools and technologies, developing an implementation plan, staff training and a system for monitoring results. It is important to analyse the needs and peculiarities of a particular logistics company before developing and implementing strategies to optimize the management of big data analysis. This will identify the key aspects that should be considered when selecting analysis methods and tools.

The application of machine learning techniques, such as clustering or predictive algorithms, can significantly improve the efficiency of logistics processes. However, it is necessary to choose the appropriate methods wisely and adapt them to the specific conditions of the company. An important step is also the creation of a system for monitoring and analysing the results of the implementation of optimization strategies. This will allow promptly identifying problems and adjusting strategies according to the company's needs. For long-term efficiency and competitiveness of the company it is recommended to constantly improve the processes of big data analysis management, as well as to implement new methods and technologies in accordance with the changing needs of the market and the development of technology. Thus, the implementation of the obtained methods and strategies will not only improve the management of big data analysis in the field of logistics, but also ensure the long-term efficiency and competitiveness of the company.

DISCUSSION

The methods of optimizing the management of big data analysis in the field of logistics were considered, existing approaches were analysed, the needs and characteristics of companies were identified, optimal tools and technologies were selected, and an implementation plan was developed. For a deeper understanding of the research topic, it is necessary to analyse the results of other studies with similar problems. For example, S. Shaikh *et al.* (2023) emphasised that e-commerce plays an important role in the global economy, requiring the development of effective web applications to meet the increasing demand for services and products. The study shows the importance of using technologies such as MongoDB, Node.js and Express.js in building flexible and scalable e-commerce applications. The authors also explored the application of big data analytics in logistics and supply chain management, highlighting innovative methods and practices in this area. The findings provide a better understanding of how modern technology,

and analytics can improve the efficiency of logistics operations and supply chain management. While both studies highlight the importance of using modern technology, each study focuses on different aspects. The current study on logistics management focuses on optimizing data management, while the analysed work highlights the importance of creating flexible applications.

X. Li (2024) highlights that the use of big data analytics in logistics helps to optimize delivery processes, reduce costs, and improve service quality. This proves the relevance of the research in the application of big data analytics to improve logistics management and sustainability. Both studies highlight the relevance of applying big data analytics in logistics to improve business performance and operations, and indicate that the use of big data analytics helps to optimize delivery processes and reduce costs. However, while the study by X. Li (2024) focuses on the general importance of big data analytics in the field, the study on logistics management provides specific strategies for optimizing big data analytics, which enables more efficient solutions to complex problems and high logistics performance. Thus, this study goes beyond general recommendations by providing valuable tools and techniques to improve big data management in logistics.

The study by R. Mishra *et al*. (2023) evaluates the impact of big data analytics on omnichannel logistics and identifies the most important factors affecting this field. A survey was conducted and a case study was conducted to identify the key aspects of this logistics. The results showed that effective information management is a critical factor that can improve omnichannel logistics. It emerges that both papers consider the impact of big data analytics on logistics, although they focus on different aspects. The current study looks at the field of logistics in general, while the other paper focuses solely on omnichannel logistics.

Authors P.V. Pawar & R.A. Paluri (2022) discussed that the amount of data produced by various sectors has increased dramatically, which creates challenges in processing it for professionals. The study aims to analyse the sources and applications of big data analytics in logistics and supply chain management through bibliometric analysis. The study also identifies the benefits of using big data analytics and categorises the trends and research directions in the field. The common aspects of both studies are to explore the problem of data growth and its impact on logistics and management professionals. However, the current study on logistics management focuses on specific strategies for optimizing data management in logistics, which makes it more valuable for developing effective solutions in this area. Thus, this approach is different in that it proposes specific methods to optimize data management, which can lead to more effective solutions in this field.

Researchers M.A. Al Doghan & V.P. Kaliani Sundram (2023) studied how the application of artificial intelligence and big data analysis affects resource management and waste management in Saudi Arabian industry. The study also evaluates the role of plant efficiency and the impact of integrating environmental processes on this process. The results provide insights into how the use of new technologies can improve resource management efficiency and reduce waste in industry. Both studies turn to analysing the impact of big data analytics on management, but the current study delves into big data analytics specifically in the field of logistics management. Although both studies address the topic of big data analytics in management, the current paper's approach focuses on developing strategies to optimize data management, which can bring more practical benefits in the field of logistics.

S.D. Kurniawan *et al.* (2024) examined the basic concepts of big data, the benefits and challenges of its use, and the technologies that enable the management and analysis of big data. In addition, the authors analysed examples of big data usage in different industries and reflected on the future challenges and opportunities of this field. Both studies recognise the significance of big data analysis, but while the above-mentioned study looks at its application in general, the study on logistics management delves into specific methods and strategies to optimize data management in the field of logistics. Thus, the current study offers a deeper and more specific view on the use of data in logistics management, making it a more valuable tool for developing effective strategies in the field.

L.Y. Xiang *et al.* (2021) emphasised that the impact of big data analytics on global companies is creating new opportunities for data-driven decision making across industries and business functions. Big data analytics promises to improve performance in logistics and supply chain, although many companies are not yet utilising it to its full potential. The 2021 study also emphasises the growing importance of big data analytics and its potential impact on the logistics industry, similar to this study. However, unlike the current study, it does not provide specific strategies to optimize the management of big data analytics in logistics, focusing mainly on general theoretical aspects. This allows seeing that the study on logistics management stands out with a more practical approach, which makes it a valuable tool for developing specific ways of optimization in the field of logistics.

In addition, Y.-T. Chen *et al.* (2021) emphasised that when studying the vehicle routing problem, travel time determination plays a crucial role in optimizing logistics companies. IoT for transportation collects data from various sources to analyse the current traffic status in real time and improve the efficiency of logistics management. However, IoT big data analysis has complex and interconnected characteristics, which makes travel time determination based on real data unpredictable. The study proposes a new travel time prediction method based on IoT data, which successfully improves the accuracy of time prediction after comparing with other computational methods. The common aspects in both papers are that they highlight the importance of using data to optimize logistics processes. However, while this study focuses on a broad analysis of the directions of application of big data in logistics and proposes methods to optimize the management of this data, the analysed work focuses on the specific task of travel time prediction based on IoT data to improve transport routing.

Authors A. Wahyudin *et al.* (2023) pointed out that big data analytics technology can improve supply chain monitoring by increasing the flexibility of logistics companies. Information management systems generate data from different sources and formats. The development of big data analysis uses the method of rapid software development, which is suitable for solving complex problems in logistics.

That is, both studies draw attention to the significance of big data analysis technology in logistics management and its ability to improve supply monitoring and increase the flexibility of logistics companies. The study on logistics management focuses on developing specific methods to optimize the management of big data analytics in logistics, allowing a deeper understanding of the potential of this technology and applying it more effectively. While the 2023 study discusses the general benefits and challenges of using big data analytics technology without delving into specific optimization methods, making its approach more generalised and less applicable in practice.

Researchers A. Kwasek & D. Prokopowicz (2023) discussed that information technology and Industry 4.0 are important for the development of knowledge in the economy. Their use improves management and logistics processes in companies. Data analysis allows for more efficient production management and risk control. The study analyses the impact of these technologies on organisation and management in Poland. Both projects emphasise the importance of information technologies, including big data analytics, in improving management and logistics processes in companies. However, the study of 2023 discusses the overall impact of IT and Industry 4.0 on organisation and management in Poland. One of the main differences is also the focus and highly specialised analysis in this study, while the other study looks at the broader context and general trends in IT development.

In their paper, C. Liu *et al*. (2020) proposed an innovative IoT-based Cloud Laundry business model for mass laundry service. This model utilises big data analytics and machine learning techniques to provide efficient and convenient services to customers. The study on the application of big data analytics in logistics management focuses on optimizing data management in logistics, while the 2020 study on the Cloud Laundry business model describes the use of data analytics to optimize industry-specific IoT-based services. The study presents valuable examples of using data analytics to improve business processes, and this strategy can consider the results for better data management in logistics.

Author A. Abbas (2024) investigated the use of big data analytics and machine learning in mergers and acquisitions and information technology supply chain. He concluded that organisations can improve decision-making processes, optimize operational efficiency and gain competitive advantage by applying these technologies. The implication is that both studies address the application of big data analytics, but their focuses are different. The study on logistics management focuses on improving data management in logistics, while the mentioned study by A. Abbas (2024) examines the application of data analytics and machine learning in M&A and information technology supply chain. It is important to note that both approaches have their relevance and applicability in their respective fields, but this strategy focuses on specific methods to optimize data management in logistics, which may be more relevant to address the specific problems and challenges faced by logistics companies.

Finally, N. Novanda & H. Medyawati (2023) noted that logistics plays an important role in enabling corporate commerce by providing the necessary services to deliver goods from producers to consumers. The study aims to analyse the impact of service quality, price perception and promotion on consumer satisfaction with Shopee Xpress service and identify the most influential factors. The author used partially least squares method and data was collected using questionnaire instruments. The results showed that service quality and promotion affect customer satisfaction but price perception has no influence on it, the most important factor is promotion. In contrast to this paper, the 2023 study focuses on a specific service and determines which variables are most significant for consumer satisfaction in this area.

Thus, all the reviewed studies confirm the significance of using big data analytics to optimize management processes and improve business performance, including the field of logistics management. However, each of them highlights unique aspects of the application of these methods and technologies in a particular area, which emphasises the diversity of approaches and the potential of big data analytics in modern business.

CONCLUSIONS

The study analysed the topical aspects of big data management and analysis in logistics. The results showed that big data analytics plays a key role in optimizing logistics management processes, improving productivity and supply chain efficiency. The main findings of the study include the development of strategies to optimize logistics management using big data analytics. A programme has been created that effectively optimizes delivery routes using clustering algorithms and shows the results of this process. An informative diagram has been developed that clearly illustrates the key steps of the resulting strategies. A table describing the application of big data analysis techniques in various logistics companies was compiled. This table compared the companies based on their functional capabilities, data, results, and scope. The analysis showed that the use of machine learning techniques and optimization of data storage and optimizing processes significantly improves the efficiency of logistics operations.

Based on the findings, certain recommendations can be offered. For example, to develop and implement software solutions based on big data analysis, as well as to use machine learning methods to create predictive models. IoT technologies should be implemented to collect real-time data on equipment status and transport conditions, and data security should be strengthened by implementing appropriate security measures and encryption. Training and development of company personnel in big data analytics and modern technologies should be provided so that they can effectively use tools to improve logistics processes. Implementation of the proposed recommendations will allow logistics companies not only to improve operational efficiency, but also to reduce costs by optimizing logistics processes and demand forecasting. This also contributes to improved customer service through more accurate planning and supply management, which will significantly enhance their competitiveness in the market.

For further research in the field of logistics and big data analysis, it is recommended to study in-depth the application of artificial intelligence and automated systems in the management of logistics processes. It is also important to investigate the impact of new technologies such as

blockchain and virtual reality on the optimization of logistics systems. Additionally, it is worth analysing the effectiveness of using big data analytics and machine learning methods in different logistics industries to identify the most effective strategies and approaches.

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CONFLICT OF INTEREST

None

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Напрями застосування Big Data аналітики в логістичному менеджменті

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Анотація. Логістичні операції стають дедалі складнішими та вимагають точних даних для ефективного управління. Використання Big Data в логістичному менеджменті є актуальною темою у зв'язку зі зростанням обсягу даних і необхідністю оптимізації процесів доставки та управління запасами для задоволення потреб ринку. Метою дослідження була розробка способів оптимізації управління аналізом Big Data у сфері логістики. Для досягнення мети використовувалися методи аналізу, експерименту та порівняння. У результаті дослідження було розроблено та успішно застосовано стратегії оптимізації логістичного управління аналізом Big Data. Створена на мові Python програма ефективно оптимізує маршрути доставки, використовуючи алгоритм кластеризації, й візуалізує результати цього процесу. Додатково, складено інформативну схему, що наочно ілюструє ключові етапи розроблених стратегій. У рамках дослідження також було розроблено та представлено таблицю, що описує застосування методів аналізу Big Data в різних логістичних компаніях. Проведено порівняння компаній за функціональними можливостями, даними, отриманими результатами та сферою діяльності. Встановлено, що використання методів машинного навчання та оптимізації процесів зберігання й обробки даних істотно збільшує ефективність логістичних операцій. Результати цього дослідження можуть бути використані логістичними компаніями будь-якого масштабу, а також підприємствами, що займаються управлінням ланцюгами поставок. Крім того, рекомендації та стратегії, розроблені в рамках дослідження, можуть бути корисними для професіоналів у галузі інформаційних технологій та аналітики даних, які займаються розробкою програмних рішень і систем для оптимізації логістичних процесів

Ключові слова: контроль поставок; використання об'ємної інформації; способи оптимізації управління; транспортно-складська організація; аналіз Big Data

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Security in cloud computing: Methods for ensuring privacy and integration in modern applications

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Abstract. Cloud computing has become a necessary component for data storage and processing and is becoming more widespread. However, there are threats to the security and privacy of user data, which is why it is important to find out the most effective methods for ensuring data security in the cloud. The purpose of the study was to develop methods aimed at ensuring privacy and security in cloud environments and in modern applications. The method of analysis was used to review other publications on the topic, and the method of experiment was used for practical implementation. The main results of the study include the development of a security monitoring programme. It analyses event logs and determines the number of failed login attempts, which indicates the detection or absence of suspicious activity. Access to resources is checked, and the necessary information is displayed on the console. A comparison table of cloud platforms has been created, considering their advantages and disadvantages in the context of data security and privacy. It specifies the criteria for delivering services to the selected services. A block diagram of ways to provide security in cloud computing is developed, illustrating the relationship between various aspects of providing security in cloud systems. It contains parameters and strategies for encrypting data, protecting sensitive data, and countering attacks. Various aspects of security and methods of ensuring privacy in cloud computing are considered, namely authorisation, intrusion detection, regulatory requirements, integration with modern applications, monitoring and logging, user identification and authentication. The practical significance of the study lies in the creation of innovative ways to help improve security and privacy in cloud computing. They will allow cloud developers and administrators to effectively protect user data and ensure their privacy in modern applications

Keywords: online payments; data protection; privacy assurance; security of up-to-date applications; virtual environment

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INTRODUCTION

A large amount of personal and corporate data is stored in cloud environments, so it is important to ensure that it is protected from potential threats. Criminals and hackers are constantly looking for opportunities for unauthorised access to data. Loss or leakage of sensitive information can have serious consequences for users and organisations, enterprises, and administrative institutions specifically. Information security becomes key, in particular, considering mandatory regulatory requirements and standards. Security threats in cloud computing include the possibility of attacks on the infrastructure of cloud systems, violations of regulatory requirements for data protection. These threats can lead to serious consequences for businesses, including financial losses, loss of confidential information, and privacy violations.

Other studies on this topic are of interest. For example, O. Vakhula & I. Opirsky (2023) consider the "Security as a code" approach in cloud environments, which involves integrating security controls directly into software development processes. The researchers emphasise that embedding security measures in programme code, templates, and automated processes guarantees consistent and mandatory implementation of security controls at all stages of development. This approach is an important strategy for ensuring security in cloud environments and plays a role in protecting digital assets. V. Bohomia & V. Kochegarov (2023)

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focus on cybersecurity, which is becoming increasingly relevant in Ukraine due to its growing reliance on technology and war-related threats. The increased use of cloud services leads to an increase in cybersecurity threats, especially in terms of privacy and data protection. The study aims to analyse the possibilities of using cryptographic methods to ensure security in cloud services. V. Mazur (2023) implements effective security methods for Amazon Web Services (AWS) cloud services to protect against various types of cyber-attacks. The paper includes an analysis of cyber threats, characteristics and consequences of cyber-attacks, and a study of the advantages and limitations of using AWS cloud services. The proposed security methods include the installation of firewalls, intrusion detection systems, data encryption, backups and recovery, authentication and authorisation of users, improving the security and reliability of the AWS cloud infrastructure against cyber-attacks. Similar is the study by A. Nafiiev & D. Lande (2023), where the researchers consider two methods for controlling malware intrusion recognition. Based on calculations, researchers have created a model for detecting virus programmes based on artificial intelligence (AI). It was noted that to get an optimal result, it is better to use a narrow sample among the entire set of features instead of a large amount of data.

L. Sultanova & M. Prokofieva (2022) substantiate the need to improve digital security in the field of higher education against the background of the threat of spreading fake information. The paper analyses the problem of spreading fake content in Ukraine and highlights ways to combat it. The researchers also consider the concept of digital competence for Ukrainian citizens and suggest improving digital education for teachers and students on digital security issues. In turn, M. Horodyskyi *et al*. (2021) examine the impact of cloud technologies on the organisation of accounting and its regulatory framework. It is noted that the introduction of information and computer technologies in accounting will lead to the reform of its technical and administrative components. The impact of cloud technologies on the organisation of accounting is considered in the aspect of using their advantages and disadvantages. T. Amro (2022) examines the relationship between information security and public administration systems during martial law and examines methods for ensuring effective information security in these conditions. The researcher uses empirical and theoretical methods, including analysis of legal acts regulating these systems. The paper is original because it addresses an under-studied issue and proposes new approaches to ensuring information security under martial law.

All of the above papers focus on security in the cloud, but this study focuses on the importance of integrating security directly into software development processes in cloud environments, which was previously poorly understood. The scope of the study should include the integration of security into modern applications that use cloud computing: this is important because many applications exchange data with cloud systems, and their developers must ensure that this data exchange is secure. The purpose of this study was to develop methods aimed at improving the level of privacy and security in the cloud environment and modern applications.

MATERIALS AND METHODS

The methods of analysis and experiment were used to achieve the research objective. The analysis was used to review other publications and scientific sources on this topic. This analysis helped to clarify existing security approaches and developments in cloud computing, and identify shortcomings and opportunities for further research. This method covered various aspects, including cryptographic methods, security methods for cloud services, firewall settings, unauthorised access detection systems, determining user access rights, backup and data recovery, the problem of fake content spread, ways to improve digital education, the impact of cloud technologies on accounting, analysis of legal acts, and ensuring information security under martial law. The issues of access control and identity management, the role of cloud service providers, various methods of ensuring data privacy, internal threats, data leaks, illegal access to sensitive information, legal and standard requirements for protecting user data in cloud environments were also considered. Some of these aspects include PRISMA approaches, Fog computing, Internet of Things (IoT) devices, scalability, flexibility, reliability, efficiency and outsourcing, and secure configuration, multi-factor authentication, regular audits, security testing, incident response plans, data security and integrity, service level agreements and staff training.

The experimental method was applied for the practical implementation of this topic. The code was written in Java, which is a console application for security monitoring. This programme analyses event logs and checks access to resources to detect suspicious actions. If the number of failed login attempts exceeds a certain value, the application displays suspicious activity, otherwise – suspicious activity is not detected. The code contains a method for checking access to resources, a function for getting the number of failed login attempts from event logs, a function for checking file access, and a function for checking user authorisation. The study also used a structural diagram of these methods of ensuring security in cloud computing, which was created using the Drawio tool. It used data encryption, protection against attacks on third-party code, methods for protecting confidential data, methods for data backup and recovery, threat monitoring and response systems, cryptographic methods, network protocol protection, integration with identification systems, and other methods for providing security in cloud computing. In addition, a comparison table of the leading cloud environments – AWS, Google Cloud Platform (GCP), Microsoft Azure, Salesforce – was created using the comparison and the graphical method. This was done to assess their main characteristics. This table summarised the listed services based on such criteria as the platform name, main services, advantages and disadvantages. The use of the comparison contributed to obtaining an objective comparative overview of well-known cloud platforms, which helped to determine which of them best meets the security requirements.

RESULTS

Cloud computing provides convenient access to resources and data over the Internet and allows efficient use of computing resources without significant investment in own

servers and infrastructure. However, along with the growing popularity of cloud computing, the risk of data security and privacy is also growing. Criminals are constantly looking for opportunities to access this data, which leads to serious consequences for users. Key security aspects in cloud computing include data encryption, physical security and infrastructure, authentication and authorisation, incident detection and response, and regulatory requirements and standards.

Encryption is one of the key methods of ensuring privacy. It allows protecting personal data from unauthorised access, even if criminals gain physical access to the data warehouse. Ensuring the security of the physical infrastructure where servers and computing resources are stored is important to prevent physical access to data. It is necessary to protect access to resources and data by authenticating users and controlling access using authorisation tools. Attention should be paid to intrusion detection systems, methods for responding to possible threats, and data protection requirements that are regulated by legislation and standards. Integration with modern applications is another important component for ensuring security in cloud computing. Since many modern applications share data with cloud systems, developers must ensure that this data exchange is secure.

When implementing cloud solutions and defining methods for ensuring security and privacy in cloud systems, certain advantages and disadvantages should be considered. Benefits may include ease of access, cost, scalability, automation and updates, backup and recovery. Cloud computing allows users to access data and resources from anywhere with an Internet connection, which promotes convenience and mobility. Using cloud resources allows avoiding significant costs for equipment and maintenance of own infrastructure, in particular, for small companies and startups. Cloud services are easily scalable, allowing users to increase their resources as needed. Many cloud solutions are automatically updated and maintained, reducing the need for manual work. In addition, most cloud services provide the ability to automatically backup and restore data, which helps to avoid data loss. Disadvantages include data privacy and security, dependence on the Internet connection, denial of control, configuration restrictions, and regulatory compliance issues. Under the terms of cloud computing, user data is stored on third-party servers. This increases the risk of privacy violations and the possibility of unauthorised access. Cloud services require a stable internet connection, and losing Internet access can lead to data unavailability. Using cloud solutions means that users transfer some control over their infrastructure and security to third parties. Some cloud services may limit the user's ability to configure computing resources, and using cloud services may require compliance with various regulatory requirements that are quite complex to meet.

There are many examples of modern cloud computing. For example, AWS, which is one of the leading cloud service providers and offers a wide range of services such as computing, data storage, databases, networks, etc. AWS Lambda allows developers to execute code without the need for infrastructure management. In addition, GCP, another leading cloud service provider, offers a variety of services for developing, deploying, and managing applications in the cloud. And GCP Cloud Functions allows developers to create features that automatically respond to events and requests. In turn, Microsoft Azure is another popular cloud solution that provides a wide range of services for developing, deploying, and managing applications in the cloud. Azure IoT Hub allows a user to connect, monitor, and manage IoT devices. Another example is Salesforce, which is a leading provider of cloud-based customer relationship management (CRM) systems and other CRM services. There are other cloud platforms, but all of them provide a variety of solutions for sales, marketing, customer service, and other business processes. A comparison of these cloud platforms is shown in Table 1.

Table 1. Comparison of leading cloud environments

Platform	Basic services	Advantages	Disadvantages
AWS	Computing, data storage, databases, networks, etc.	Easy access to resources, wide range of services, scalability, automation, backup	High costs, difficulty in using for beginners, low customer support
GCP	Development, deployment, and management of applications in the cloud	Ability to automatically respond to events, wide range of services, scalability	Specificity for use in some other areas, lack of certain services, insufficient data localisation
Microsoft Azure	Development, deployment, and management of applications in the cloud	Wide range of services, scalability, IoT support	Difficult integration with some applications, limited opportunities for users with non-paid support
Salesforce	CRM systems and CRM services	Specialised services for businesses	Limited opportunities for other types of services, high usage costs for some businesses

Source: compiled by the author based on L. Dignan (2021)

Therefore, each cloud platform has its own advantages and disadvantages. When choosing a specific platform to use, an organisation should carefully consider its needs and requirements. It is important to consider which services and functionality are critical for a particular business or project, and what limitations or disadvantages may arise when using a particular platform. Careful planning, risk assessment, and continuous monitoring will help ensure successful use of cloud computing in the enterprise. Despite the presence of many criteria for choosing cloud systems, the main priority will always be security. Thus, the study considers an example of a console programme for security monitoring. The main idea of the code is to analyse event logs and check access to resources to detect suspicious activity (Fig. 1).

```
import java.util.Timer;
import java.util.TimerTask;
public class SecurityMonitoringSystem {
    public static void main(String[] args) {
        // Analysis of event logs
        boolean eventLogsResult = analyzeEventLogs();
        // Checking access to resources
        boolean resourceAccessResult = checkResourceAccess();
        if (eventLogsResult) {
            System.out.println("Suspicious activity was detected in the event logs.");
        } else {
            System.out.println("The event logs contain no suspicious activity.");
        }
        if (resourceAccessResult) {
            System.out.println("Resource access is OK.");
        } else {
            System.out.println("Incorrect access to resources was detected.");
        }
    }
    // A method for analysing event logs
    private static boolean analyzeEventLogs() {
        int failedLoginAttempts = getFailedLoginAttemptsFromLogs();
        // If the number of failed login attempts exceeds 5, return true (suspicious activity)
        if (failedLoginAttempts > 5) {
            return true;
        }
        // Otherwise, return false (no suspicious activity detected)
        return false;
    }
    // A method for checking access to resources
    private static boolean checkResourceAccess() {
        boolean hasAccessToFile = checkFileAccess("importantfile.txt");
        // If the user has access to the file, return true (access is OK)
        if (hasAccessToFile) {
            return true;
        }
        // Otherwise, return false (incorrect access)
        return false;
    }
    // A function to get the number of failed login attempts from the event logs
    private static int getFailedLoginAttemptsFromLogs() {
        return 7; // An example of a value that can be retrieved from logs
    }
    // A function to check access to a file
    private static boolean checkFileAccess(String fileName) {
        // A function that checks whether a user has access to a file by name
        if (isUserAuthorizedToAccessFile(fileName)) {
            return true; // If the user has access, return true
        } else {
            return false; // If access is not available, return false
        }
    }
    // A function to check user authorization
    private static boolean isUserAuthorizedToAccessFile(String fileName) {
        return true; // In this example, always return true
    }
}
```

Figure 1. Console programme code for security monitoring

Source: created by the author

Firstly, the "main" method is started, which is the starting point of the program. The analyzeEventLogs method analyses event logs. The number of failed login attempts is obtained (the failedLoginAttempts variable), and if this number exceeds, for example, 5, true is set, indicating that suspicious activity has been detected. The checkResourceAccess method checks access to resources. This example checks access to the "importantfile.txt". If the user has access to the file (the hasAccessToFile variable), true is set, indicating correct access. The "main" method displays the results of analysing event logs and checking access to resources on the console.

The programme itself will display the following result (Fig. 2). However, this programme is a basic example and does not include real-world event log analysis or access verification. In a real system, a user will need to implement this functionality using more complex logic and real data.

Suspicious activity was detected in the event logs.
Resource access is OK.

Figure 2. Programme result

Source: created by the author

Considering the above information, methods for ensuring privacy and security in cloud computing should be developed. These may include the following aspects: data encryption (development of encryption methods to protect data during transmission and storage in cloud computing); authentication and authorisation (implementation of user authentication methods and resource access control); intrusion detection and incident response (development of systems for detecting and responding to suspicious activity or potential intrusions); regulatory requirements and standards (consideration of legislation and standards on data security and privacy); integration with modern applications (development of methods for secure integration of cloud computing with modern applications); monitoring and logging (implementation of monitoring and event logging systems to track activity and detect suspicious activity); user identification and authentication (development of methods for securely identifying and authenticating users before granting access to resources).

Therefore, due to the constant development of cryptographic methods, it is recommended to follow the latest trends and adapt encryption to new challenges. It is important to study modern approaches to multi-level authentication and role-based access control. A combination of monitoring techniques and intelligent analytics can be useful. It is recommended to constantly update the knowledge of security legislation and standards. Logging techniques and monitoring systems should be developed to detect problems in a timely manner. The general recommendation is to be constantly open to new security techniques and technologies in cloud computing and actively participate in the community to share knowledge and improve security practices. A block diagram of these security methods in cloud computing is shown in Figure 3.

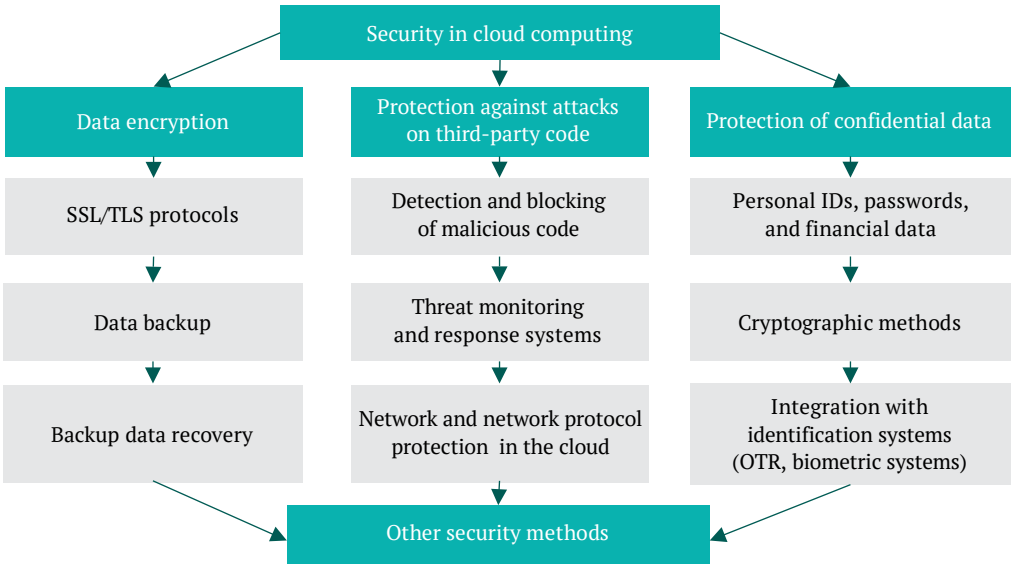

Figure 3. Provision of security in cloud computing

Note: SSL – secure sockets layer; TLS – transport layer security; OTR – off-the-record messaging

Source: created by the author

This diagram reflects a group of security techniques that can be used to ensure privacy and security in cloud environments. Each method has its own sub-branch and includes different approaches and technologies to ensure the relevant aspects of security and privacy. Based on the conducted research, certain recommendations are proposed that follow from the study and have important practical significance. It is necessary to ensure the security of data at every stage of its life cycle, from storage and transmission to processing. It is recommended to use data encryption and improve user authorisation and authentication methods. Regular security audits and activity monitoring should be conducted to detect suspicious activity. This will help to identify possible threats in time and take measures to prevent them. It is worth developing plans for responding to possible security incidents and backing up data. Inventory and plans will help restore the system after the incident and reduce possible losses. It is important to learn about and comply with all regulatory requirements and standards relating to data processing and storage. This will help to avoid legal problems and fines. Consideration should also be given to introducing innovative security approaches and technologies, such as AI and machine learning, to detect threats. Provide training and advanced training of security personnel. An informed workforce is an important link in ensuring security in cloud computing, and it is necessary

to cooperate with cloud service providers and demand high security standards from them. Check their certificates and security recommendations. These guidelines are aimed at improving security and privacy in cloud systems and can help organisations and users store and process data in a secure environment.

Therefore, the results show that security can be achieved in cloud environments if appropriate measures and methods are taken. The developed methods and approaches play an important role in ensuring data confidentiality and protecting resources. These results can open up prospects for the development and improvement of security systems in cloud computing.

DISCUSSION

There are various studies on security in cloud computing. Some researchers focus on aspects of data encryption during transmission and storage, while others focus on user authentication and access control, and explore aspects of intrusion detection and monitoring systems. It is worth considering the study by S. Varun (2023), which provides an overview of security and privacy issues in cloud computing and proposed solutions. The researcher notes that cloud computing has become an important part of modern business, but at the same time there are significant threats to data security and privacy. Various aspects of security and privacy, such as encryption, access control, and identity management, are addressed, and the role of cloud service providers is considered. In conclusion, the paper provides recommendations for improving the level of security and privacy in cloud computing. Common aspects between this and the current study are the creation of solutions for implementing privacy and security in cloud computing, and in the aspects of security and privacy. However, in the first case, the research is more theoretical, while this study contains a practical implementation of the subject.

I.S. Mohd Fadhil *et al*. (2023) emphasise that cloud computing is an important technology that provides access to computing resources over the Internet. The paper examines the security and privacy challenges in cloud computing that arise with the widespread use of this technology. The researchers analyse methods to ensure data privacy, and discuss the role of cloud service providers and compliance issues. In conclusion, they make recommendations for improving security and privacy in cloud computing. Both studies applied practices for security and privacy issues in cloud computing, and considered examples of various cloud services. However, the examples themselves and their descriptions differ.

The study by R. Patel *et al*. (2023) also points out that when an organisation moves to cloud computing to reduce costs and improve efficiency, privacy concerns arise. The researchers emphasise that in order to effectively implement privacy protection strategies in cloud computing, modern methods for managing these problems are required. The paper discusses the needs for protecting private data, and considers the basic principles of security measures in cloud computing. The comparison then discusses various privacy strategies in cloud environments. As in this study, it introduces certain methods of providing security in cloud computing, but these methods are different. F.K. Aljwari (2023) notes that cloud computing is a fast-growing field in the field of information technology. They allow accessing various tools and services over the network. However, there are serious issues with data privacy and security. The paper discusses these issues and possible solutions that are relevant for researchers and security experts. Common aspects between the two studies are security issues in cloud computing. But this study focuses specifically on creating methods for ensuring privacy and security, and the rest – on ways to solve problems on this topic.

J. Uma Maheswari *et al*. (2023) also emphasise that the modern world is increasingly using cloud computing, which allows organising data, managing its storage, processing and access. However, this technology raises questions about the security and privacy of data in cloud environments. The main task of using cloud computing is to keep data private and secure when processing and storing it in external data centres. This study discusses various risks, including internal threats, data leaks, and illegal access to sensitive information. Legal and standard requirements for protecting user data in cloud environments are also considered. Both studies focus on security and privacy in cloud systems, but the current study does not address specific standard and legal protection requirements, unlike the study analysed.

In turn, A. Bhansali (2023) points out that there are many risks that threaten the privacy and security of the Internet environment. Therefore, the researcher discusses these issues and possible solutions. The most common user complaint about cloud computing is the security and privacy of data in the cloud. The researcher discusses in detail issues related to internal threats, data leaks, and illegal access to confidential information. Ultimately, the paper highlights the legal requirements that businesses must comply with to protect user data in the cloud. Thus, privacy and security issues in cloud computing remain relevant for organisations and individuals. Both studies address security threats in the cloud environment. However, the current study is not as focused on legal requirements as another.

N. Ukeje *et al*. (2024) emphasise that many companies use cloud services to store data in a virtual environment. However, there are problems with ensuring the security and privacy of data in cloud computing, as users do not have control over what happens in the cloud, and this poses threats to the security and privacy of information. The study discusses issues related to data security and privacy in cloud computing and how to solve them. The main solution to this problem is the preferred reporting items for systematic reviews and meta-analyses (PRISMA) approach. It can be concluded that both studies focus on the issues of data protection and privacy in cloud computing. However, the current study develops specific security and privacy techniques, while another uses a specific PRISMA approach.

Just like the previous researchers, S. Reema (2023) notes that the proliferation of cloud computing has raised serious questions about the security and privacy of sensitive information stored in the cloud. The purpose of the study is to explore the security and privacy issues associated with cloud computing and consider the possibilities of using this technology to solve them. The paper emphasises that cloud computing can be an effective solution to security and privacy issues, provided that relevant standards and practices are followed. Therefore, the general criteria

are to consider security and privacy in the cloud environment. Although, this study is more practical, since it contains code and a block diagram. And the considered study is more theoretical, since it contains an analysis of ways to achieve security and privacy.

N. Haider & C. Azad (2022) considers "Fog computing", which aims to bring the cloud closer to IoT devices to solve the problems that arise in cloud computing when processing IoT data. This is an intermediate layer between the cloud and computers. In addition to the security and privacy issues that are inherent in cloud computing, Fog computing also has its own set of unique issues. The study analyses previous studies of Fog computing applications to identify security flaws. It evaluates the impact of these problems and possible solutions, provides guidance on future security for those responsible for the development and design of Fog systems. What the two studies have in common is the use of cloud technologies and the identification of related problems. Despite this, the 2022 paper deals specifically with Fog computing and the IoT system, which is not present in this study.

Other studies also use cloud computing, examining privacy and security issues and how to address them. For example, E. Geetha Rani & D.T. Chetana (2023) note that the widespread use of cloud computing has raised serious questions about the security and privacy of information stored in the cloud. The study examines various security and privacy issues related to cloud computing and examines how the technology can be used to address these issues. The researchers suggest that by following certain best practices on the part of cloud service providers and users, cloud computing can be an effective solution to security and privacy concerns in the digital age.

The purpose of the study by Y. Abdulsalam & M. Hedabou (2022) is to examine the security and privacy challenges associated with cloud computing and examine the technology's capabilities to overcome these challenges. By analysing existing research and examining practical examples, the paper suggests that cloud computing can be an effective solution to security and privacy concerns in the digital age, provided that certain best practices are followed by both cloud service providers and users. H. Gavit & Y. Patil (2023) note that cloud computing has gained popularity due to its profitability and flexibility. However, security remains a serious issue, as data in the cloud can be vulnerable to breaches, internal threats, and other risks. The study examines security issues and suggests measures to address them. Important security measures that organisations need to implement include encryption, access control, multi-factor authentication, audits, backups, secure configuration, security testing, incident response plans, etc. The implementation of these measures will allow taking advantage of cloud computing, ensuring the security and confidentiality of data. M.Z. Hasan *et al*. (2023) explores various security issues in cloud computing and measures that can be taken to address them. The study discusses data security and integrity, which are key aspects. The researchers emphasise that organisations should develop a comprehensive security strategy that considers the specific needs and requirements of their cloud resources to ensure the security and confidentiality of their data and applications.

It can be concluded that all considered studies are aimed at developing ways and solving problems related to user privacy and security in cloud computing. This paper also addresses these aspects, but it offers a comprehensive approach to the problem, providing not only an analysis of existing risks and challenges, but also considering practical recommendations for implementing effective security and privacy strategies in cloud computing. In addition, this study provides promising guidance for the development of this area, contributing to further improvements in data protection and security in cloud computing.

CONCLUSIONS

This study considered various aspects of security and privacy in cloud computing. The possibilities of integrating security at various stages of software development for consistent and effective implementation of security controls in cloud systems are examined. The findings of the study include a number of solutions. The main result is the development of security monitoring application that analyses event logs and checks access to resources. It shows whether suspicious activity has been detected and can be a basis for practical application. A comparison table of various cloud platforms has been compiled, with an emphasis on their advantages and disadvantages in the context of data protection and privacy. For this purpose, some well-known cloud services were analysed. A block diagram has been developed for security methods in cloud computing, which illustrates the relationship between various aspects of security in cloud systems. This diagram covers information encoding, protection from external attacks, and security of private data. The results also include analysis of various aspects of security and privacy practices in cloud computing, such as authorisation, data encryption, intrusion detection, regulatory compliance, logging, integration with modern applications, monitoring, and user authentication and identification.

The development and application of new cryptographic protocols can help improve the level of security in cloud environments. For practical applications, it is recommended to implement systems for monitoring and responding to suspicious activity, which would allow organisations to maintain a stable state of security and provide an appropriate response to possible threats. Security should also be considered as an ongoing process and security practices should be updated based on new threats and vulnerabilities. Ensuring privacy and security in cloud computing requires a systematic approach. In further research, it is advisable to continue developing innovative methods and approaches to ensuring security in cloud computing. This will help increase user confidence in cloud technologies and help meet regulatory requirements for data processing.

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CONFLICT OF INTEREST

None.

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Безпека в хмарних обчисленнях: методи забезпечення приватності та інтеграції в сучасних додатках

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Анотація. Хмарні обчислення стали необхідною складовою для зберігання й обробки даних та набувають все більшого поширення. Проте існують загрози щодо безпеки й приватності даних користувачів, через що важливо з'ясувати найефективніші методи забезпечення безпеки даних у хмарі. Мета дослідження полягала в розробці методів, спрямованих на забезпечення конфіденційності та безпеки в хмарних середовищах і в сучасних застосунках. Використано метод аналізу для розгляду й вивчення інших публікацій із теми, а також метод експерименту для практичної реалізації. Основні результати дослідження включають у себе написання програми моніторингу безпеки. Вона аналізує журнали подій та визначає кількість невдалих спроб входу, що показує виявлення чи відсутність підозрілої активності. Проводиться перевірка доступу до ресурсів, необхідна інформація виводиться на консоль. Створено таблицю порівняння хмарних платформ, з урахуванням їх переваг та недоліків у контексті безпеки та конфіденційності даних. У ній вказуються критерії постачання послуг обраних сервісів. Сформовано структурну схему способів забезпечення захисту в хмарних обчисленнях, що ілюструє взаємозв'язок між різними аспектами забезпечення захисту в хмарних системах. Вона містить параметри та стратегії щодо шифрування даних, захисту конфіденційних даних та протидії атакам. Розглянуто різні аспекти безпеки та методи забезпечення конфіденційності в хмарних обчисленнях, а саме: авторизацію, виявлення вторгнень, регуляторні вимоги, інтеграцію з сучасними додатками, моніторинг і журналювання, ідентифікацію та аутентифікацію користувачів. Практичне значення дослідження полягає в створенні інноваційних способів, які допоможуть підвищити рівень безпеки та приватності в хмарних обчисленнях. Вони дозволять розробникам та адміністраторам хмарних систем ефективно захищати дані користувачів і забезпечувати їхню конфіденційність у сучасних додатках

Ключові слова: онлайн-розрахунки; захист даних; гарантування конфіденційності; охорона актуальних застосунків; віртуальне середовище

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Soft, hard, and digital skills for managers in the digital age: Business requirements and the need to master them

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Abstract. Digitalisation in Ukraine and the world changes products, services, and business processes, affecting the number and quality of jobs due to the need for digital skills. Employers are requiring new skills from candidates in job profiles for existing managerial positions. The purpose of this study was to investigate the impact of soft skills, hard skills, and digital skills on managers in the era of digitalisation based on the analysis of business requirements. The following methods were used: theoretical generalisation and comparison (disclosure of the content of each group of skills), analysis (skills most frequently and most demanded by employers), statistical method (summary and grouping of data collected from the job search portal), synthesis (combination of different types of information), and concretisation (identification of problems in the legislative and regulatory framework of Ukraine). The study established the ratio of skill groups in the analysed positions: sales manager, HR manager, and logistics manager mainly need the following skill groups: soft and hard, but to varying degrees. Soft skills are essential for the positions of sales manager and HR manager, while hard skills prevail for the position of logistics manager. Only project managers need hard skills and digital skills because of their specificity. To provide a better understanding and visualisation of complex information about competencies or skill levels, the authors first introduced a "three-zone competency stoplight" and a colour matrix of the result of soft, hard, and digital skills requirements of employers by position. Three skills groups are proposed to be represented in different colours: orange (soft), pink (hard), and green (digital), which will allow businesses to use this visualisation to see the zones that correspond to their job offers and understand what skills they will require from candidates for the relevant position and to what extent. The practical significance of the study is the possibility of using its results in the development of educational programmes for planning the development of necessary disciplines

Keywords: professional competencies; logistics manager; sales manager; HR manager; project manager; job advertisement; skill ratio

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INTRODUCTION

Different digitalisation technologies have different effects on employment and skill requirements. However, the general conclusion in expert studies is that there is an expected increase in demand for highly skilled workers who, on the one hand, can stimulate the development of technologies and design digital solutions for production systems and workplaces, and, on the other hand, can effectively implement and support digital solutions (e.g., through data

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processing and analysis) (What about skills..., n.d.). Such statements enabled an in-depth study of this issue.

A significant number of researchers from different countries worked on the study of different skill groups, in different fields of activity and in different countries. This topic is quite popular, but over time, it requires more and more research. M. Poláková *et al*. (2023) pointed out in their paper that there is a marked demand in technologically driven areas for soft communication skills such as critical and analytical thinking, problem solving, communication skills, and creativity with flexibility. In addition, it is noted that people must have balanced software and digital skills to succeed in a future characterised by technological progress. N. Shah *et al.* (2023) focused on the future career development of students of higher educational institutions in Pakistan. In their study on soft skills, they identified, in their opinion, three main ones: creative self-efficacy, confidence in problem solving, and teamwork, which will promote employment and fulfil their role in preparing graduates for an unpredictable labour market. As part of the review of digital competencies for the project management position, S. Marnewick & A. Marnewick (2021) pointed out the need to be digitally competent, and this requires digital intelligence. The acquisition of digital intelligence is being introduced. Competencies related to digital intelligence are formulated. Some of the main ones, according to the researchers are online communication and collaboration. The study was conducted to determine the digital intelligence of project managers in the context of South Africa.

The required skill groups for construction companies and construction economists were considered. In addition, T. Tsyfra *et al*. (2022) in their paper pointed out that the world is now breaking the VUCA (volatile, uncertain, complex, ambiguous) era to BANI (brittle, anxious, nonlinear, incomprehensible) world, which will allow sectors of the economy and spheres of life to make a digital leap towards digital skills. As for the necessary set of skills for a manager, the researchers noted the insufficiency of the traditional division into hard skills and soft skills and added a separate group of qualities – digital skills. Digital skills are defined as the ability to find, evaluate, use, share, and create content using digital devices such as computers and smartphones. However, the researchers noted that such a soft skill as lifelong learning is extremely important.

The library industry needs its own individual set of skills to develop library-user relations based on civilizational challenges. O. Ivashkevych (2023) pointed out that among the three groups of skills: soft, hard, digital, prospects are seen in the application of soft skills as a cluster of success in this industry. For future social workers, according to T. Kochubey & Y. Tkachuk (2021), it is necessary to develop a triad of skills: hard skills, soft skills, and digital skills. The researchers have established a relationship between them. However, soft skills were distinguished as necessary for the successful work of social workers who receive education in modern Ukrainian higher education institutions.

To adapt to the changes of the digital age, neither the old ways of managing processes nor the employees themselves are enough. Nowadays, top managers need to be exceptional in having (or creating) a digital vision, meaning they need to imagine how their company will use technology in the future and implement a people-centred approach. Managers need to make sure that their employees have up-to-date relevant skills that will help them adapt to work with new technologies. To ensure successful management activities of future managers of enterprises, G. Cherusheva (2023) argue that in the process of their professional training, it is extremely necessary to develop "soft skills". The researcher cited the key structural components of soft skills and substantiated their socio-economic role. Just as for future business leaders, the development of soft skills is important for future education managers, but their set has its own characteristics. Y. Yampol *et al*. (2023) pointed out that in order to improve the quality of training in educational institutions for future education managers, it is necessary to develop such soft skills as leadership, communication skills, motivation, creativity and innovation, adaptability, and conflict resolution. To obtain the profession of a teacher in the context of professional activity, N. Nosovets *et al*. (2021) introduced a new group of skills, such as "self skills", which, according to researchers, can develop the inner core of all competencies, on which all others are built.

The paper "Identifying leadership skills required in the digital age" by the German authors M. Klus & J. Müller (2020) is of interest. The researchers used a three-stage study design and compared leadership skills described in the literature with statements of managers and data obtained from job advertisements for leadership positions. It was determined that the key challenges for managers are a high level of information diversity, a wide range of business problems, the speed of change, and a heavy workload. The purpose of the study was to determine the essence and composition of soft skills, hard skills, digital skills, their impact on groups of related specialities (subtypes) of the manager profession, such as: sales manager, HR (human resources) manager, logistics manager, and project manager. In order to achieve the stated purpose, the following tasks were set: to evaluate and specify the existing skills related to the professional activity of the manager in terms of improving the quality of training; to suggest a skill ratio based on the application of the methodology "three-zone competency stoplight" for candidates for four positions of the manager profession for different companies with different types of economic activity; to draw conclusions about the importance for managers to develop different skills groups to further understand what skills the business needs and what skills they lack, in what area they need to develop to get the desired position.

LITERATURE REVIEW

The issue of the definition and necessity of soft and hard skills is mainly studied by companies that offer vacancies to future professionals and show how to develop important skills for employment. Researchers mainly investigate these concepts from the perspective of their theoretical meaning or disclosure of the components that relate to them. N. Nosovets *et al*. (2021) conducted a theoretical study of the content of the concept of "self skills", self-competence in the context of professional activity of a teacher, which is associated with a change in the learning paradigm

in the New Ukrainian School and will provide for a change in the attitude towards the school teacher. The activity of a modern teacher should motivate him to creativity and self-improvement, self-management, self-development, etc. According to researchers, the teacher should be capable of constant change, i.e., develop their own "self skills" and be able to motivate their students.

T. Kochubey & Y. Tkachuk (2021) in their study considered the problems of developing the competencies of future social workers. The need for applicants to develop the skills of three skills groups was noted. The researchers suggested that soft skills include communication skills, the ability to solve problems comprehensively, critical thinking, emotional intelligence, empathy, decision-making ability, and flexibility. Social workers in their professional activities should effectively communicate with various groups of the population with the state's demand for high quality of services provided. In the context of the current issue, Y. Yampol *et al*. (2023) considered the importance of developing soft skills among education managers to improve the quality of training in educational institutions. The researchers noted that future organisers and managers of educational institutions are future leaders who should develop leadership, communication skills, and the ability to resolve conflicts. In addition, the ability to plan, organise, and monitor the work of the team, and help it achieve good results.

G. Cherusheva (2023) emphasised the extremely necessary task of the system of professional training of future senior personnel of the country. Possible challenges in the system of higher education in the development of the country's managerial potential are noted, since it has a special mission to create creative leaders. The main approaches to defining the concept of "soft skills" and its structural components: creativity, critical thinking, communication, and cooperation were considered. The paper substantiates the introduction of a new approach to the development of educational programmes that should represent a set of competencies, according to which employers will evaluate potential candidates for managerial positions, which will serve as effective human resource management in the company. M. Poláková *et al*. (2023) noted that among the important challenges facing Industry 4.0 is the issue of effectively managing the role of human resources in the context of the current digital revolution. New technologies can exacerbate labour shortages, reduce human labour, and allow organisations to allocate human resources to higher-value-added capacities. The digital revolution, which is characterised by the need for dynamic competencies and the acquisition of knowledge and expertise from external sources, can be of great importance and will require careful consideration of human resource management.

N. Shah *et al*. (2023), using a quantitative approach, developing and analysing a questionnaire for data collection, highlighted the importance of communication skills in students' career development and their future career intentions. The study aims to help higher education students in Pakistan in the digital age to understand what issues require serious concentration for their survival. The subject of study by S. Marnewick & A. Marnewick (2021) was digital competencies, which are considered important in project management in the digital economy. It also provides recommendations for organisations on how to plan and structure training and improve the skills of their current project managers. It is established that joint efforts are required to improve the skills of project managers.

T. Tsyfra *et al*. (2022) focused on the development and use of digital skills by construction economists at the turn of the era of VUCA-world and BANI-world concepts. The study notes that given the current realities of globalisation of socio-economic institutions and institutions, challenges related to climate change, pandemics, military conflicts and natural disasters, digitalisation skills will replace the "soft" skills that construction economists need, both in the training of such specialists and in continuous education throughout life. O. Ivashkevych (2023) investigated the resource content of soft skills components as an integral success option. It is noted that the librarian who will be more successful in the face of global changes in the role and multifunctionality of libraries will acquire new skills, expand their specialisation in their profession: coaching consultant, social media marketing specialist, event manager, etc. Those who understand teamwork will acquire the ability to plan options and approaches, master knowledge, be effective in achieving goals, feel confident, self-sufficient, and comfortable. A modern library and information specialist will know, apply, and plastically accumulate the advantages of soft skills both in the personal and career spheres, and, accordingly, will influence life in the country. M. Klus & J. Müller (2020) explored how leaders should lead organisations and their employees in the increasingly digitalised business environment and what skills are needed to succeed. It is found that although the development of digital technologies significantly changes the work environment in organisations and creates new challenges for managers, there are still challenges and technological changes associated with the requirements for the skill set required for managers.

The analysis of studies has shown that Ukrainian and foreign authors have paid sufficient attention to the concepts and components of "soft skills", while "hard" and "digital skills" have been rather neglected. The need to apply different skill groups in different positions was considered. But time is changing rapidly, even epochs and circumstances are changing, which will constantly require additional research.

MATERIALS AND METHODS

The materials used for this study are important sources of information that allowed considering different models and approaches for determining the essence and composition of soft, hard, and digital skills, conducting a detailed analysis of each group of skills to understand the difference between them. The main sources of the research are the Resolution of the Cabinet of Ministers of Ukraine No. 1341 "On Approval of the National Qualifications Framework" (2011), European Commission European Skills, Competences, Qualifications and Occupations (ESCO) (European skills/competences..., n.d.), Educational and professional programme "Management" (2023). The data from the Robota.ua (n.d.) portal were used to analyse the required skills based on the requirements of employers according to the proposed distribution for the group of related specialities (subtypes) of the profession of manager, such as: logistics

manager, project manager, sales manager, and HR manager. After analysing job advertisements, key trends and principles were identified that can serve as a basis for further recommendations in substantiating the need to master the components of each skill group for each of the subtypes of the manager profession.

The first method used in the study to reveal the content of each skills group was the method of theoretical generalisation and comparison. This method helped to consider the essence of the definitions "soft skills", "hard skills", and "digital skills", and prove that they can be divided into three different equivalent groups of skills. The analysis was used to reveal the most frequent and popular components of the selected skills groups by employers, which helped to understand and reveal the components of each skill and prove its significance. This method was also used to investigate the skills that employers require from a candidate for the relevant position, which allowed distributing the skills that employers put forward into three skill groups and three positions.

The statistical method was used to summarise and group data collected from the Robota.ua portal, to determine the share of each skill group in a potential candidate for the following positions: logistics manager, project manager, sales manager, and HR manager. Data processing helped to distribute skills by position and determine the required percentage of digital skills, soft skills, and hard skills, which proved that employers require specialists with digital skills. The next method was synthesis, which was used to combine different types of information, concepts, and approaches to prove that there is indeed a need to separate "digital skills" into a separate group of skills. This method helped to better understand and interpret various aspects of the need for the emergence of a third group of skills in the digital age. It also helped to explore the most important digital skills to learn from experts.

To visually represent the distribution of skills in companies, the authors first developed and implemented the method of "three-zone competency stoplight", based on the idea of a three-zone stoplight, where each zone reflects the corresponding level of skills. The companies are located in different colour-coded zones in the respective cities, which corresponds to the competencies they require from job candidates. Other methods used in the study were generalisation and concretisation. The first of these methods was used to summarise key findings and key aspects of the study. In particular, this method allowed focusing on the most important ideas and results of the study. It also helped to clarify the results and highlight the need to constantly learn new skills and new technologies in the digital age. The concretisation was used to identify problems in the legislative and regulatory framework of Ukraine, which turned out to be outdated and required updating.

RESULTS AND DISCUSSION

General set of skills and analysis of soft skills, hard skills, and digital skills that are most in demand by employers

The result of the learning process is obtaining a profession that consists of the acquired knowledge, skills, and abilities. The Resolution of the Cabinet of Ministers of Ukraine No. 1341 "On Approval of the National Qualifications Framework" (2011) defines the concept of "skill" as "the ability to apply knowledge to perform tasks and solve problems". Skills can be divided into different types of thinking: logical, creative, and intuitive. They are also called cognitive. There are also practical skills that consist of manual dexterity, the possibility of applying practical methods, materials, tools and instruments, and communication. Therefore, a graduate of an educational institution, getting a particular profession, must possess a set of skills that can be both cognitive and practical. In the business world, employers have long used the concepts of "soft skills" and "hard skills", which implies exactly the skills acquired in the course of training.

With the rapid transition of the entire world to online, new opportunities for work in various sectors of the economy have emerged. However, new problems and challenges have emerged. They can be solved by understanding and mastering new competencies, such as "digital skills". No less valuable skills have emerged, and in the context of digitalisation, perhaps the most important ones. Technology companies and all organisations in the digital economy are beginning to understand that digital skills are vital for employees in the digital age. According to McKinsey, in the 8 weeks of 2020, the world has made a 5-year leap in the introduction of digital consumer and business solutions. An unprecedented acceleration of digital transformation has begun (Digital competence..., 2021). Active digitalisation and the transition to online, remote work, telecommuting is not something temporary or short-term, but something that will remain with us for a long time, which should be clearly understood. The paper examines what groups of skills (soft, hard, digital) and in what proportion company managers want their employees to have and how to achieve a balance between them. Therefore, each skill group is analysed in more detail and their needs are determined by employers.

Soft skills (flexible skills) are universal competencies. Some sources define them as "situational skills, knowledge, and character traits that can be used in any job" (What are hard skills and soft skills..., n.d.). Their development continues throughout life and is difficult to measure. Most often, the degree of manifestation depends on the type of personality, character traits, and temperament. An analysis of soft skills, which, according to various sources, are the most frequently used and demanded by employers, was carried out (Table 1).

Table 1. Soft skills that are the most frequently required by employers

Source	List of soft skills
What are hard skills and soft skills: How the employer evaluates us (n.d.)	• ability to work in a team; • critical thinking; • leadership; • creativity; • ability to meet deadlines; • responsibility and discipline

Table 1, Continued

Source	List of soft skills
M.M. Robles (2012)	• honesty; • sociability; • courtesy; • responsibility; • social skills; • positive attitude; • professionalism; • flexibility; • teamwork; • work ethic
Educational and professional programme "Management" (2023)	• technologies of effective thinking; • management skills; • leadership; • time management; • public speaking; • responsibility and discipline
J. Andrews & H. Higson (2008)	• professionalism; • reliability; • ability to cope with uncertainty; • stress tolerance; • ability to plan and think strategically; • ability to communicate and interact with others both in a team and over a network; • good written and oral communication skills; • ICT (information and communications technology) skills; • creativity and self-confidence; • good self-control and time management skills; • willingness to learn and take responsibility

Source: summarised by the authors

The components of managerial skills may include: administrative activities, leadership and motivation, supervision of people, organisation, planning and scheduling of work and activities, decision-making, recruitment and hiring, allocation and control of resources, development of goals and strategies, and establishment and development of teams. The European Commission ESCO provides a classification of skills that are relevant to the EU labour market, education, and training (European skills/competences..., n.d.). There is a whole block of cross-cutting skills and competencies that can be classified as universal, i.e., flexible skills. The skills group "Basic skills and competencies" is the basis for interaction with other people, and for development and learning as a person. These include the ability to understand, speak, read, and write in the language(s), work with numbers and measures, and use digital devices and applications. It includes such components as mastering languages, working with digital devices and applications, and working with numbers and measures.

Skills such as "Mental abilities and competencies" are related to the ability to apply thought processes of collecting, conceptualising, analysing, synthesising, and/or evaluating information obtained as a result of observation, experience, reflection, reasoning, or communication, or generated by them. These include the ability to evaluate and use various types of information to plan activities, achieve goals, solve problems, and perform complex tasks in a routine and new way. These include problem solving, information processing, ideas and concepts, planning and organisation, creative and innovative thinking.

Group skills such as "Self-management skills and competencies" include demonstrating a desire to learn, perform effectively, take a proactive approach, and maintain a positive attitude. Mastering this skill requires people to understand and control their own capabilities and limitations, and use this self-awareness to manage activities in different contexts. These include the ability to act reflexively and responsibly, accept feedback, adapt to changes, and seek opportunities for personal and professional development.

Group skills "Social and communication skills and competencies" refers to the ability to interact positively and productively with others. This manifests itself in communicating ideas effectively and empathetically, aligning own goals and actions with the goals and actions of others, acting in accordance with values, ensuring the well-being and progress of others, and demonstrating leadership qualities. It has the following components: compliance with the code of ethics of conduct, leadership of others, support of others, cooperation in teams and communities, and communication. Such a group of skills as "Life skills and competencies" is of interest. They consist of the application of civic skills and competencies, environmental skills and competencies, the application of general knowledge, the application of cultural skills and competencies, the application of health-related skills and competencies, and the application of entrepreneurial and financial skills and competencies. From the standpoint of employers, soft communication skills are of paramount importance for entry-level success in the workplace.

Hard skills are professional skills; these are the skills and knowledge necessary for a particular job and a particular profession (What are hard skills and soft skills..., n.d.). In other words, these are the technical skills and knowledge required to perform the relevant work in the job description. Hard skills are those achievements that are included in the resume, what can be learned and tested, such as education, work experience, knowledge, and skill level. Hard skills are characterised by: a list of knowledge and skills that can be objectively evaluated and verified;

availability of educational documents; certificates of the level of proficiency of certain knowledge.

Examples include the ability to type quickly, speak foreign languages, know programming languages, and perform mathematical calculations. In other words, any skill can be assessed objectively, and to gain the necessary knowledge, one must study, and a certificate or diploma will be a confirmation (What are hard skills and soft skills..., n.d.). If the applicant is studying to become a manager, they will definitely need such a hard skills group as "Application of entrepreneurial and financial skills and competencies", which will help to effectively manage their own and other people's finances and resources. A person with these skills will be able to demonstrate perseverance, openness to opportunities and risks, the ability to mobilise resources, and a willingness to learn from their own experience. This group of skills can be divided into two components: the first is the ability to "show an entrepreneurial spirit", and the second is the ability to "manage financial and material resources".

The first component of the skill will enable a person to learn how to develop, organise and manage their own business, identifying and exploiting opportunities and mobilising resources with a view to profitability. Demonstrate a proactive attitude and determination to achieve business success. They will also learn how to strive for company growth, lead the technological development of the organisation, identify pricing opportunities, new processing opportunities, analyse supply chain strategy, learn how to identify market niches, processes for re-design, attract new customers, identify innovative packaging concepts, identify new business opportunities, etc. The second acquired component of the above skill will help to effectively carry out financial planning, using loans, savings, investments and pensions to achieve short- and long-term goals, using financial advice with critical thinking, comparing offers when purchasing products or services, and actively choosing appropriate insurance products.

Digital skills are defined as the skills required to use digital devices, communication applications, and networks to access and manage information. Digital skills, as defined by UNESCO, are the ability to use digital devices, applications, and networks to access and manage information (Digital competence..., 2021). In 2021, the University of Edinburgh named the five most important digital skills for learning: effective literature and source searching, data management, communication, software use, and cybersecurity. Bubble has added two more skills – text processing and data visualisation. An analysis of digital skills, which, according to various sources, are the most frequent and in greatest demand among employers, was carried out (Table 2). The components of digital skills proposed to be applied by state institutions of Ukraine and the European Union are analysed (Table 3).

Table 2. Digital skills that are most in demand among employers

Source	List of digital skills
University of Edinburgh (Digital competence..., 2021)	• effective search for literature and sources; • data management; • communication; • use of software; • cybersecurity
Bubble (Digital competence..., 2021)	• effective search for literature and sources; • data management; • communication; • use of software; • cybersecurity; • text processing; • data visualisation
City administration experts (CFO and digitalization..., 2023)	• basic knowledge of modern digital technologies and ability to apply them; • digital thinking and the use of digital technologies in solving problems; • data management skills – business intelligence-based decision-making; • use of digital channels for internal and external interaction; • digital ethics – understanding the principles of behaviour in a digital environment; • knowledge of information security principles

Source: summarised by the authors

Table 3. Digital skills offered by government agencies

Source	List of digital skills
Digital competence framework for Ukrainian citizens (The Ministry of Digital Transformation..., 2021)	• fundamentals of computer literacy; • information literacy and ability to work with data; • creation of digital content; • communication and interaction in the digital society, security in the digital environment; • solving problems in a digital environment and lifelong learning
ESCO European Commission (European skills/ competences..., n.d.)	• work with computers: using computers and other digital tools to develop, install, and maintain ICT software and infrastructure, and to view, search, filter, organise, store, extract, and analyse data, collaborate and communicate with others, and create and edit new content; • information skills: collecting, storing, monitoring, and using information; conducting research, investigations and testing; maintaining documentation; managing, evaluating, processing, analysing, and monitoring information and predicting results

Source: summarised by the authors

The digital competence framework for Ukrainian citizens reveals the concept of the above digital skills (The Ministry of Digital Transformation..., 2021). And each component can be detailed depending on the level of proficiency in a particular skill. Information skills of working with a computer depending on the position, for example, logistics manager, may include obtaining skills to manage digital documents, link data between all internal business units, integrate ICT data, digitise documents, create databases of freight rates, plan enterprise resources, manage a standard system, combine data from sources to provide a single view of the totality of this data, manage quantitative data, transfer existing data, use special software for data analysis, keep computer records of railway (transport) traffic, coordinate database resources, use software libraries, use geographic information systems, manage flight data transmission program, perform data mining, perform data cleaning, store digital data and systems, maintain warehouse accounting databases, create digital files, develop data transmission services for navigation purposes, etc.

Thus, the essence and structure of each skill group (soft, hard, digital) was investigated. It was established that an unambiguous interpretation has not been developed, but depending on the profession, employers may need these skills in different proportions. Professional skills and knowledge (hard skills) are more important mainly for specialists in theoretical areas, for developers, engineers, and designers. The overall success of their work often depends on their professional skills. But the ability to communicate is sometimes not important at all. For example, for software development specialist, the most important ones will be digital skills, such as perfect command of HTML and CSS, knowledge of frameworks and libraries, knowledge of JavaScript, the ability to compose queries, and many other important professional knowledge. These will also be hard skills for them. Soft skills will receive less attention.

Certain professions require a balance of hard, digital, and soft skills. These are lawyers, economists, teachers, and doctors. How they interact with their environment is just as important as their professional competencies. For example, an editor of an online publication needs completely different skills: their area of interest is content planning, assigning tasks to authors, editorial work, and knowledge and ability to use genre stylistics. This position requires all skills in equal proportion. Translator must be proficient in the language and translation techniques, which are hard skills together with digital skills, which will guarantee the translator a successful professional activity. Soft skills will also be required to organise interaction between people, teamwork, etc. For the position of Chief Financial Officer (CFO), according to a survey conducted by the Kyiv City State Administration in 2020, according to the respondents, the following skills and competences are required for the position of CFO, which are in the greatest demand for digital transformation,%: analytics, data skills (66%); methods and tools for digitalising products and services (66%); process and project management (58%); self-education and adaptation (57%); technological expertise (50%); strategic thinking (46%); communication skills (39%); creativity, ingenuity (35%); programming, algorithmic thinking (25%) (CFO and digitalization..., 2023).

HR experts agree that soft skills are the benefits of the future. Over time, even in theoretical disciplines, someone who knows how to communicate and understands teamwork will be more successful. And they are also likely to make more progress in their career. Thus, it is analysed and proved that soft, hard, and digital skills are skills of the same level and can be divided into three separate groups. However, while today's universities teach soft and hard skills, digital skills remain underdeveloped. According to statistics, in 2024 there will be a growing demand for specialists with digital literacy: 24% of employers suggest that over the next 5 years, finding employees with the right skill set will remain their biggest challenge; 50% of all employees will need retraining over the next 5 years; 85% of Americans believe that digital skills will be important for success in the modern workplace (What are digital skills, 2022). The number of vacancies requiring digital skills is projected to grow by 12% by 2024; 94% of business leaders expect employees to gain new skills at work.

Analysis of skills put forward by employers in the labour market

The analysis of skill requirements for potential candidates for the sales manager is carried out (Table 4). Data from the website Robota.ua (n.d.) was used as the basis.

Table 4. Analysis of skills required by employers from a candidate for the position of sales manager

Company	Skills (functional responsibilities)		
	soft skills	hard skills	digital skills
MatroLuxe LLC	• maintaining a customer base and finding new opportunities; • active sales and execution of plans; • maintaining accompanying sales documentation; • conducting presentations; • controlling accounts receivable; • expanding customer base	• maintaining a customer base and finding new ones; • maintaining accompanying sales documentation; • working in a designated area	• maintaining a customer base and finding new ones; • expanding customer base; • fulfilment of objectives; • knowledge of office software: MS Word, Excel, 1C.8, Bitrix24
Sky-Energy	• attracting potential clients to cooperate from the existing "warm" contact base; • building and maintaining long-term customer relationships; • customer advice on products and delivery terms; • conducting negotiations and meetings to expand the product range and analyse customer needs	• active customer search and engagement; • ensuring sales volumes based on a working customer base at a given level; • preparing commercial offers and providing necessary information on customer requests; • implementing the sales plan; • control of mutual settlements and work with accounts receivable; • ensuring high-quality document flow with clients	• working with the 1C database; • study and thorough knowledge of the product range; • interacting with the company's structural divisions

Table 4, Continued

Company	Skills (functional responsibilities)		
	soft skills	hard skills	digital skills
Nestle Ukraine LLC	• coordination and control of work with clients; • ensuring that short-and long-term goals and key performance indicators are met; • developing and approving a procurement plan and budgets for sales development	• conducting annual negotiations and agreeing on terms of cooperation with clients; • coordinating the principles of placement of Nestle equipment and products in the sales divisions of clients; • approval and implementation of the customer procurement plan; • developing a strategy for cooperation between Nestle and key clients	• planning and implementation of promotional activities, analysis of their effectiveness; • search for new opportunities for the company's business growth in the client
Alfatech Trading House LLC	• visiting regular customers to boost and increase sales; • commercial support of transactions; • sale of truck, industrial, and agricultural tires; • searching for and attracting new counterparties to cooperate, working with the existing customer base; • working with accounts receivable	• knowledge of primary accounting documentation; • implementation of the sales plan and objectives set by management	• searching for and attracting new counterparties to cooperate, working with the existing customer base
Woodyloftstyle	• providing high service; • advising clients by phone and in the office; • full support of the client at all stages (from the meeting to the delivery stage)	• implementation of the sales plan; • working with documents	• maintaining a customer base in a customer relationship management (CRM) system

Note: LLC – limited liability company
Source: developed by the authors based on Robota.ua (n.d.)

The result of the analysis (Table 4) showed that soft skills are preferred for the position of sales manager of the company, because this profession is more related to working with clients. The specifics are that Sky-Energy, which belongs to the electrical engineering industry and Nestle Ukraine, which is engaged in retail, needs candidates with more developed hard skills, although another retail company (Alfatech Trading House LLC) pays more attention to soft skills. The production companies Matro-Luxe LLC and Woodyloftstyle need employees with more developed soft skills. This shows that the distribution of skills requirements often depends on the type of activity of the company.

The analysis allowed building a "competency stoplight" (Fig. 1), which clearly shows the extent to which different companies require different skills.

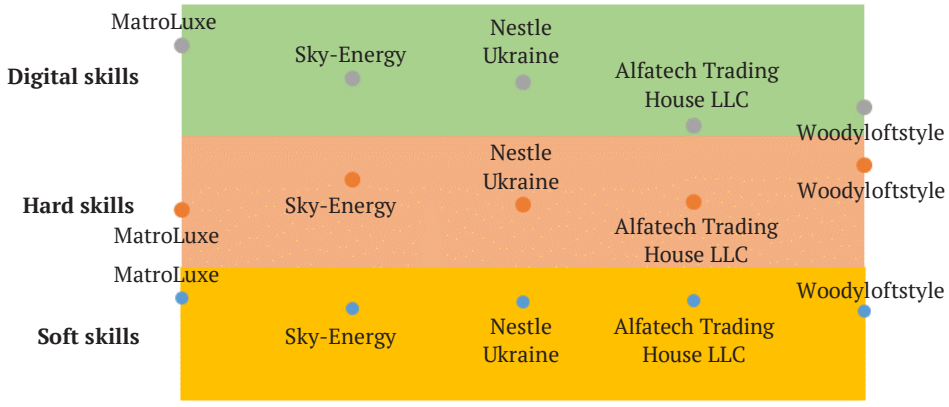

Figure 1. "Competency stoplight", built for the position of sales manager
Source: compiled by the authors

The analysis of skills for the position of HR manager is carried out, which is shown in Table 5. It became clear that the same requirement can be assigned to multiple skills at the same time.

For example, such a skill as "interviewing" was classified as a soft skill because it requires good communication skills, the ability to listen and create a friendly and open atmosphere during the interview. It was also classified as hard skills, which may require specific technical skills, such as the ability to create interview questions, maintain documentation, and assess candidates using appropriate methods.

Table 5. Analysis of skills required by employers from a candidate for the position of HR manager

Company	Skills (functional responsibilities)		
	soft skills	hard skills	digital skills
EVA	• coordination of the project "Mentoring system for new employees"; • development of certification procedures for various levels of both office and retail positions	• development of online surveys, tests, and competency assessment questionnaires; • coordination of events in the distance learning system, user support; • organisation and conduct of personnel assessment; • summing up results and reporting	• updating existing evaluation procedures (revision, updating); • conducting an analysis
Silpo	• organisation of motivational events; • adapting new employees	• search and selection of supermarket staff	• search and selection of supermarket staff; • maintaining HR records
Ukrposhta	• adapting new employees; • conducting interviews	• active search for candidates for open vacancies; • conducting interviews	• active search for candidates for open vacancies; • conducting interviews
DTEK LLC	• preparation of meetings with employees (collecting information by department, preparing presentations, receiving and analysing feedback); • support of corporate events and dates (preparation of greeting materials, organisation of contests and flash mobs); • search for ideas for internal communications (formal and informal), participation in the development of communication plans and strategies	• content and administration of the enterprise page on the corporate portal on the Share Point platform (writing texts of various topics, shooting videos, technical placement); • filling and monitoring the state of information stands in structural units; • search for ideas for internal communications (formal and informal), participation in the development of communication plans and strategies	• content and administration of the enterprise page on the corporate portal on the Share Point platform; • preparation of text and photo materials; • participation in the development of communication plans and strategies
Windows "STEKO"	• ensuring effective search, selection, and adaptation of personnel; • development of corporate culture	• ensuring effective search, selection, and adaptation of personnel; • monitoring of team climate, organisation of corporate events	• monitoring of team climate, organisation of corporate events

Source: developed by the authors based on Robota.ua (n.d.)

Similarly, with the skill "active search for candidates for open vacancies": it was assigned to soft skills, because it requires knowledge of various sources of candidate search, the ability to use various search methods, such as the Internet, databases, professional networks, etc. It was also classified as hard skills, as it requires the use of online platforms to find candidates, such as job sites, professional networks, etc. Based on the results of the study, a "competency stoplight" for the position of HR manager is constructed, which is shown in Figure 2.

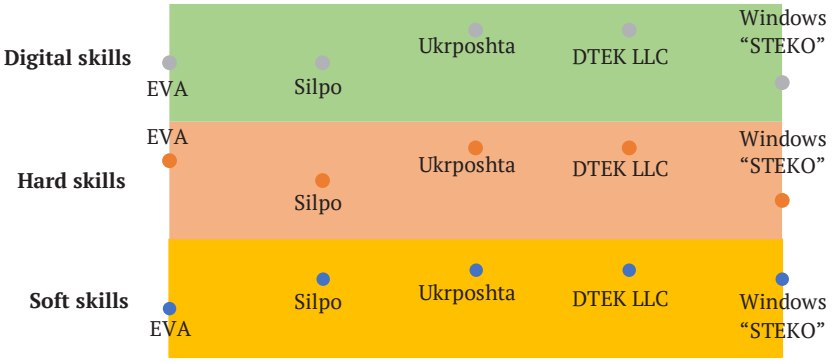

Figure 2. "Competency stoplight", built for the position of HR manager

Source: compiled by the authors

"Competency stoplight" has three skill zones. It shows that companies in the retail industry need different skill ratios: Silpo requires more soft skills, EVA gives a greater advantage to candidates with hard and digital skills. Ukrposhta and DTEK LLC companies need specialists with an equal amount of soft skills, hard skills, and digital skills. The production company of the Windows "STEKO" needs specialists in soft skills and hard skills equally, and half as many digital skills. The analysis of skills for the position of logistics manager is carried out, which is shown in Table 6.

Table 6. Analysis of skills required by employers from a candidate for the position of logistics manager

Company	Skills (functional responsibilities)		
	soft skills	hard skills	digital skills
INTERPIPE	• ability to understand and analyse production plans for appropriate logistics process planning; • search and organise transport to fulfil production plans; • willingness to participate in projects aimed at implementing digital tools and optimising logistics processes	• ability to work with numerical information and perform analysis to calculate logistics needs; • defining and organising transport for effective implementation of implementation plans; • ability to create documentation for logistics operations, such as bills of lading; • ability to organise and maintain a database for effective monitoring of shipments	• ability to work with digital tools, which includes participation in projects to implement digital technologies and optimise logistics processes
PepsiCo	• high communication skills to ensure effective interaction between logistics and other services; • ability to analyse data and make informed decisions; • monitoring and reconciliation of service level indicators and communication with the sales department; • organisation and management of interaction with logistics partners; • ability to organise and conduct activities aimed at improving interaction with partners	• knowledge of and ability to work with Microsoft Office, Excel, 1C; • skills in controlling the storage of inventory items in warehouses; • ability to participate in budgeting and cost tracking processes; • active search and implementation of ideas for cost optimisation and improvement of logistics processes; • manage initiatives and processes aimed at optimising and reducing costs	• knowledge and skills of working with various applications, including Microsoft Office and Excel, which is important for digital work and data analysis
INVOGUE Fashion Group	• organisation and resolution of issues related to cargo delivery from other countries and on the territory of Ukraine; • communication with transport companies; • coordination with the supplier of the planned shipment date and terms of shipment	• monitoring the implementation of product supply contracts; • monitoring and ensuring timely shipments; • timely distribution of shipping documents; • reconciliation of mutual settlements with suppliers	• using spreadsheets and financial planning programmes; • using inventory and shipment monitoring systems to optimise the movement of goods
Meest	• organisational skills for resource allocation and logistics process planning; • communication skills for effective cooperation and coordination of details with carriers; • communication and analytical skills to effectively control and ensure high quality of services; • analytical thinking and ability to evaluate potential partners in the transportation market	• choosing the best routes and vehicles; • monitoring and analysis of logistics processes; • tracking and verification of transport and customs documents; • financial skills for controlling payment for services and mutual settlements	• use of specialised programmes for analysing logistics process data, cargo tracking, or other tools for optimising and automating logistics tasks
Nova Poshta	• ability to manage time effectively and provide high-quality customer service; • communication skills for successful cooperation and sale of international cargo transportation services; • ability to analyse and use data to evaluate the effectiveness of a delivery service; • documentation and reporting skills; • organisation and efficient distribution of applications among freight forwarders	• skills in planning and controlling loading processes according to schedules; • registration of documentation, preparation and planning of transportation routes; • knowledge and skills of participating in tender procedures to attract new customers and carriers; • ability to analyse rates in the transport services market and interact with them; • control of completeness and execution of product and accompanying documentation, ensuring proper execution of documents; • skills in financial accounting and mutual settlements; • financial skills and operational efficiency in the context of cash transaction processing	• knowledge of digital tools for automating reporting and document management

Source: developed by the authors based on Robota.ua (n.d.)

Thus, for the position of logistics manager (Table 6), companies mostly equally prefer soft and hard skills. Digital skills are not important to them. This is due to the specifics of the logistics activity itself, which is clearly shown in Figure 3.

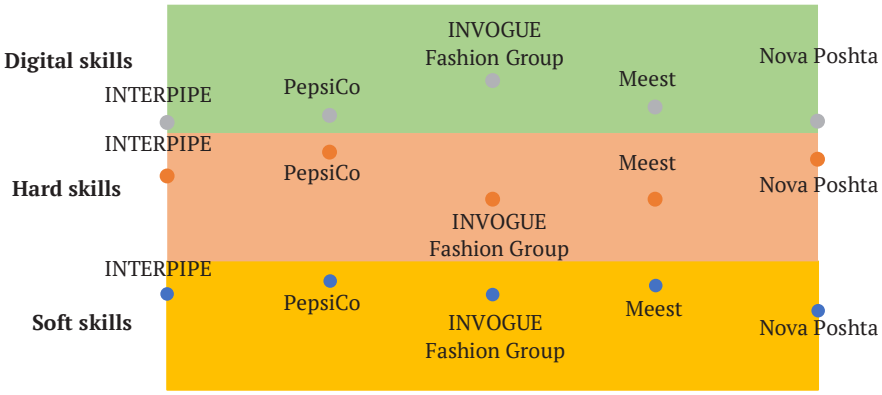

Figure 3. "Competency stoplight", built for the position of logistics manager

Source: compiled by the authors

The analysis of skills for the project manager position is shown in Table 7. The corresponding skills ratio for this position significantly depends on the type of activity of the company.

Table 7. Analysis of skills required by employers from a project manager candidate

Company	Skills (functional responsibilities)		
	soft skills	hard skills	digital skills
InnovateRecruit	• interaction with partner banks, introduction of new agreements, support of current processes; • cooperation with Diia and company representatives; • pre-sale preparation of clients; • implementation of new projects of the company; • analytical skills; • strategic thinking	• proficiency in Corezoid; • ability to manage IT projects; • skills in implementing, developing, and supporting new products	• knowledge and skills in SEO promotion and Google advertising
PrivatBank	• coordination of the development team, analysts and testers; • solving problems and managing IT support risks in a project; • communication with customers, team members, and third-party suppliers	• planning and management of IT projects in the banking sector; • identification and management of risks related to IT projects, with a focus on banking aspects and auditing; • preparation of reports on the progress of the project and its status; • ensuring compliance with deadlines and quality of task completion; • development and compliance with information technology project management standards and methodologies; • preparation of reports and presentations for stakeholders in Ukrainian and English; • follow best project management practices, such as Project Management Institute or Agile; • compliance with banking-specific data security and confidentiality standards	• definition of requirements related to IT projects, including IT audit and IT risks; • development and compliance with IT project management standards and methodologies; • compliance with banking-specific data security and confidentiality standards
VARUS	• interaction with stakeholders; • effective communication with different departments and management levels	• planning, execution, and control of projects related to the development and optimisation of IT infrastructure; • resource planning: optimising the use of human and material resources to maximise project efficiency; • monitoring and reporting: systematic monitoring of project progress, analysis of results and preparation of reports for internal and external stakeholders; • risk management: identifying and managing project risks to ensure their successful completion; • creating technical documentation for the project; • experience in creating technical documentation; • knowledge of Corezoid and Creatio CRM	• skills in developing and updating technical documentation for projects; • ability to use graphical tools to display the architecture and interaction of system elements; • skills in working with web services and processing data in JSON format; • experience in implementing and optimising Corezoid and Creatio CRM systems

Table 7, Continued

Company	Skills (functional responsibilities)		
	soft skills	hard skills	digital skills
Canyon Development	• organisation of meetings and interaction with key project participants; • use systematic monitoring to provide information about the status of the project and understand its progress; • fast response and effective problem solving; • effective interaction with various project participants	• designing a new product or functionality; • consideration of all factors that affect development, including employee qualifications, risks, and dependence on third-party services; • systematic monitoring to keep a "finger on the pulse" and understand the progress of the project	• use of modern tools and techniques in the design process; • using planning optimisation software; • using tools to systematically monitor and analyse project progress; • using technologies to effectively solve problems and optimise workflows; • using email, chats, video conferencing, and other means for effective real-time communication
Allo	• actively participate in project work and take initiatives to improve processes; • ability to focus on the needs of customers and partners, cooperation to achieve common goals; • cooperation and coordination with other departments	• management and organisation of project stages to achieve the set goals; • control and maintenance of process automation; ensuring the stability and efficiency of current processes; • creation and approval of documents regulating work processes; • experience in project implementation and administration; • experience in writing and developing documents regulating work processes; • ability to formulate requirements and specifications for projects	• ability to work with tools for planning, reporting, and monitoring projects; • ability to use Jira, Confluence, and Google Workspace for effective project management; • ability to work with electronic documents, including technical specifications and orders; • using tools to automate and optimise business processes

Source: developed by the authors based on Robota.ua (n.d.)

For example, InnovateRecruit is a recruitment agency that requires mostly soft skills from project manager. Canyon Development, an IT company, needs digital skills more, although soft skills are also considered important. Companies that carry out sales (Allo and VARUS) and banking activities (PrivatBank) give a greater advantage to hard skills, followed by digital skills. Soft skills are considered not important enough. Based on the results of the study, a "competency stoplight" was built for the project manager position, which is shown in Figure 4.

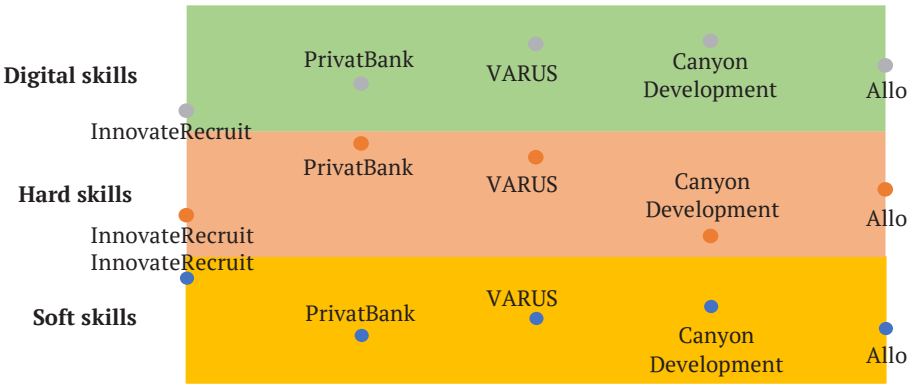

Figure 4. "Competency stoplight", built for the position of project manager

Source: compiled by the authors

Having analysed the functional responsibilities (skills) of 20 Ukrainian companies with different types of economic activity for four subtypes of the managerial profession, it was found that each position requires all groups of soft, hard, and digital skills. However, by depicting this ratio as a percentage, a colour matrix of the result of competence requirements was obtained, as shown in Table 8.

Table 8. Colour matrix of the result of soft, hard, and digital skills requirements of employers by position

Position	Soft skills	Hard skills	Digital skills
Sales manager			
HR manager			
Logistics manager			
Project manager			

Source: developed by the author

Analysing skills and understanding the differences between the skills groups is important for everyone, namely for students to understand their strengths and choose the career path that best suits their skills and interests. Some professions require more soft skills, such as leadership and communication, while others focus more on hard skills, such as programming or engineering. For candidates for the position to achieve greater success in their professional activities, understanding the difference between these types of skills helps a person better manage their career development. For example, knowing that digital skills are becoming increasingly important in today's world, a person can focus on learning digital technologies to improve competitiveness in the labour market (for businesses themselves, to build effective teams). The ability to balance a team of people with different skills helps to ensure greater success in achieving the organisation's goals to increase the productivity and efficiency of employees. When employees understand the difference between these types of skills, it is possible to more effectively identify staff training and development needs to achieve better results at work.

Importance of different groups of professional competences: analysis of Ukrainian and international experience

Ukrainian and foreign researchers have made a significant contribution to the field of research studying various skill groups. V. Rogo *et al*. (2020) examined the impact of transformational leadership and communication skills of a construction project manager on factors of its success. It was noted that construction projects are among the most complex, and the lack of influential leaders makes their productivity quite low. The result was a vision of transformational leadership and communication skills among project managers to address failures in the construction industry in Indonesia. T. Tsyfra *et al*. (2022) examined the required skill groups for construction companies and construction economists in Ukraine. N. Nosovets *et al*. (2021) investigated a similar issue in the context of the teaching profession and for this professional activity it was proposed to introduce a new group of skills such as "self skills", which will include skills of self-development, self-improvement, self-management and adaptation, which may be extremely relevant for the future teacher. Ultimately, it is the teacher who prepares people for life in an uncertain future, and if the teacher is capable of constant change, they will be able to teach young people to do the same.

T. Kochubey & Y. Tkachuk (2021) offered to develop a triad of skills for future social workers, but focused on the development of soft skills. Professional activity of such specialists will require communication with children, teenagers, the elderly, victims of violence, war, prisoners, etc., and each group of the population must find "its own key", be empathetic, and communicate without conflict. Therefore, the researchers suggest that it is soft skills combined with hard skills that can ensure effective and high-quality work. O. Ivashkevych (2023) proposed individual skill set for 5 the development of the library-user relationship for the library industry. G. Cherusheva (2023) emphasised the development of soft skills to ensure successful management activities of future business leaders, and training managers. For this purpose, it is recommended to establish a new approach to defining a set of competencies in the educational programmes that future managers will study, which would allow creating effective personnel management systems in the future. Y. Yampol *et al*. (2023) focused on improving the quality of education in educational institutions for future education managers. Understanding that further positive changes in society depend on the future head of the educational institution. By focusing on leadership qualities, researchers have proven that it is the manager-leader who can effectively influence the innovative learning process and create a stimulating learning environment.

A. Hidayati *et al*. (2020) studied the position of project manager and pointed out to global software development teams the need to learn Scrum techniques, which can be attributed to both hard skills and digital skills at the same time. The most important hard and soft skills are established. S. Marnewick & A. Marnewick (2021) also considered the position of project manager in their study and pointed out that this position requires the development of digital skills to a greater extent. A new type of intelligence was introduced, such as digital intelligence, which was considered for project managers in the context of South Africa. N. Shah *et al*. (2023) considered soft skills in order to develop the future careers of Pakistani higher education students, thus preparing them for an unpredictable job market. M. Poláková *et al*. (2023) emphasised the importance of soft skills for technologically driven fields. It was also noted that it is important to have balanced software and digital skills that will thrive in the future. M. Klus & J. Müller (2020) used a three-stage design of the study, which was of particular interest to the authors of this paper. Special attention was paid to leadership skills.

M. Al Asefer & N.S. Zainal Abidin (2021) in their paper examined soft skills and employment opportunities from the standpoint of employers. The current study is consistent with the findings that higher education institutions need to understand what employers want from graduates. In turn, the researchers found that hard skills help to find a job, while soft skills help to maintain a job. It has been established that in order to grow quickly in a profession, it is necessary to combine hard and soft skills. This topic was expanded by C. Jantarachot & C. Lalaeng (2023), who investigated the causal variables of hard and soft skills that affect the performance of future managers. The study used multiple regression analysis, which proved which skills need to be given more attention and developed, and which affect the performance of graduates.

A separate issue for the study was the need for "soft skills" and "hard skills" for a modern business leader, which was addressed by N.M. Makhnachova & A.K. Midlyar (2017). The researchers have made a comparative characterisation of them and identified the influence of personal qualities of a manager on the process of personnel management at an enterprise and their importance in the process of team development, and have proposed "soft skills" for a manager of an enterprise, dividing them into four blocks. But the researchers did not consider the question of what digital skills are necessary for the head of a modern enterprise in the context of digitalisation. S.I. Marin-Zapata *et al*. (2022) conducted a systematic review of the business literature to explore the meaning of the terms "competencies" and "soft

skills". The answers to three questions were examined: how are soft skills and competencies conceptualised in the literature; what are the main theories used in the study of soft skills and competencies; what are the main characteristics of research from a methodological standpoint? It was found that a significant share of business research lacks a solid theoretical foundation, while the rest suffers from theoretical dispersion. A theoretical model was developed that explained the relationship between concepts, considering reasonable theoretical views.

The comparison of soft and hard skills and determination of their importance in the US energy sector was covered by W. Lyu & J. Liu (2021). The researchers took job advertisements from the internet for 10 years as a database. It is proven that vacancies in the US energy sector increasingly require a high level of "soft" skills, but when analysing the skill requirements between the four main professions, significant differences were found. The results showed that more attention should be paid to "hard" skills in human resource management, rather than following the growing trend of "soft" skills in hiring. A. Sopa *et al*. (2020) measured the impact of hard and soft skills on employees' ability to be innovative in Indonesia using organisational training as an intermediary variable. Researchers have proposed a model for increasing the innovation ability of employees through hard and soft skills with organisational training as an intermediary.

The digital age and modern living conditions make people think about the future. S. Sumchenko (2022) considered the most relevant skills in today's context. A detailed analysis of seven skills was carried out and it was noted what skills are inherent in specialists in any field, why their acquisition is an integral part of professional training, and their development is a lifelong process. The same opinion is shared by G. Santos *et al*. (2021) in skill analysis for quality managers 4.0. The researchers argue that it is difficult to predict what skills people who will work in quality management in a few years will need. If an organisation wants to compete based on quality and innovation in the future, it is important to ensure that quality professionals are supported by senior management.

CONCLUSIONS

The study summarises the components of the three groups of skills and examines in detail the essence of each of them. Their analysis was carried out by a detailed study and processing of job advertisements for 20 Ukrainian companies with various types of economic activity. It is established that business requires candidates for positions in the manager profession to possess all groups of skills, but in different ratios. For the position of sales manager, soft skills are preferred. Companies belonging to the electrical and retail industries need candidates with more advanced hard skills. It is established that the distribution of requirements for skills often depends on the type of activity of the company. For the HR manager position, the same requirement can be assigned to several skills at the same time. It is established that companies need three skills groups equally, regardless of the type of activity. None of the companies under study are dominated by soft skills, which may seem strange at first glance.

For the position of logistics manager, companies need both soft and hard skills equally. Digital skills are not important to them. The study suggests that this is conditioned by the specifics of logistics activities. The position of project manager significantly depends on the type of activity of the company. For example, a recruitment agency requires mostly soft skills. An IT company focuses on digital skills, although soft skills are also considered important. Retail companies and banks prefer hard skills, followed by digital skills. Soft skills are considered not important enough. The method of "three-zone competency stoplight" was introduced, which is based on the idea of displaying each zone with the appropriate level of skills for their distribution in companies. This helped to visualise the information provided, which will help both employers and job candidates to see the areas that their vacancy corresponds to and understand what skills are required and to what extent, or to understand what skills are lacking and in what areas to develop in order to obtain the desired position. The results of the study show that there are differences in the very wording of the corresponding skill groups and their correlation. Therefore, this area of research has considerable potential.

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None.

CONFLICT OF INTEREST

None.

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Soft, hard та digital skills для менеджерів у цифрову епоху: запити бізнесу та необхідність їх опанування

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Анотація. Цифровізація в Україні та світі змінює продукцію, послуги та бізнес-процеси, впливає на кількість і якість робочих місць через потребу у володінні необхідними цифровими навичками. Роботодавці в робочих профілях для чинних посад менеджерів вимагають від кандидатів нових навичок. Метою даного дослідження було дослідити вплив soft skills, hard skills, digital skills на менеджерів в епоху цифровізації на основі аналізу запитів бізнесу. При проведенні дослідження були використані методи: теоретичного узагальнення й порівняння (розкриття змісту кожної групи skills), аналізу (skills, найчастіших і найзатребуваніших роботодавцями), статистичний метод (зведення та групування даних зібраних з порталу пошуку роботи), синтезу (поєднання різних типів інформації), конкретизації (виявлення проблем у законодавчо-нормативній базі України). У результаті дослідження встановлено співвідношення груп skills в аналізованих посадах: менеджер з продажу, HR менеджер та менеджер з логістики переважно потребують такі групи skills: soft та hard, але в різній мірі. Для посади менеджер з продажу та HR менеджер суттєвими є soft skills, для посади менеджер з логістики переважають hard skills. І тільки project manager потребує hard skills та digital skills через свою специфіку. Для забезпечення кращого розуміння та візуалізації складної інформації про компетенції чи рівні навичок, у дослідженні авторами вперше запроваджено «тризонний світлофор компетенцій» та кольорова матриця результату потреб роботодавців soft, hard та digital skills за посадами. Три групи skills запропоновано зображувати різними кольорами: помаранчевим (soft), рожевий (hard), зелений (digital), що надасть змогу бізнесу за допомогою такої візуалізації побачити зони, яким відповідає їх вакансія, і зрозуміти, які skills вони вимагатимуть від кандидатів на відповідну посаду, в якій мірі. Практичною цінністю дослідження є можливість використання його результатів при розробці освітніх програм для планування опанування необхідних дисциплін

Ключові слова: професійні компетентності; менеджер з логістики; менеджер з продажу; HR менеджер; project manager; оголошення про вакансії; співвідношення навичок

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Transformation of business ecosystems of the energy sector enterprises

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Abstract. Transformation of business ecosystems of the energy sector enterprises is a strategic necessity for their sustainable competitiveness in the context of changes in the global energy landscape, which determines the relevance of the study. The purpose of the study was to substantiate the need to transform the business ecosystems of the energy sector enterprises. The following methods are applied: scientific abstraction – in substantiating the meaning of "business ecosystem" and its definition; inductive, deductive – in collecting, systematising, and developing a conceptual model of a business ecosystem; abstract and logical – for theoretical generalisations and forming conclusions; systemic – for detailed development of a strategy for business ecosystems of energy sector enterprises. A conceptual model of the business ecosystem is proposed, which includes the relationship and interdependence of large, niche and key players. A mechanism for implementing the business ecosystem strategy is proposed. It is established that the success of implementing a business ecosystem strategy depends on the ability to effectively coordinate interaction between different participants in this ecosystem, and on existing agreements concluded. A mechanism for implementing the business ecosystem strategy is proposed in the following sequence: modernisation of the management vector of the business ecosystem, a system of cooperation between enterprises of the energy and related industries, investment support for enterprises of the energy sector, transition to "green" energy, and development of a vertical and horizontal business ecosystem. The features of developing the business ecosystem in the energy sector enterprises are revealed: energy and digital transformation, resistance to change, energy services, partnership and cooperation, and improvement of energy efficiency. It is proved that the business ecosystem of energy sector enterprises is a complex and multifaceted category, which is developed under the influence of a set of advantages, the combination of which forms a more stable position in the market for the enterprise. The practical value lies in developing recommendations that determine the transformation of business ecosystems of the energy sector enterprises and consist in the modernisation of the

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management of the business ecosystem, the development of cooperation between energy and related industries, investment support for energy sector enterprises, and the need to switch to "green" energy, vertical and horizontal business ecosystem

Keywords: professional competencies; logistics manager; sales manager; HR manager; project manager; job advertisement; skill ratio

INTRODUCTION

Ecosystem building is growing in popularity among businesses in various industries in Ukraine. However, ecosystem development is only one of the tools that can lead participants to a win-win model, where each of them receives additional profits and maximises the results of their work, which will occur within the built ecosystem. B. Shestopalov (2023) states that if an effective ecosystem is built, each participant receives uniqueness and can use it with maximum multiplication both for themselves and for others. It is also advisable to pay attention to the ecosystem approach, which encourages enterprises to enter foreign markets by manufacturing new products. The practical implementation of this approach will take place if concentration is created. However, it is necessary to prove the need to apply the ecosystem and build trust in it. According to research by O. Tsyhanenko *et al.* (2022), the ecosystem is the basis of business sustainability, which has the following main characteristics: stimulating cooperation between different business structures, which together can serve not only individual enterprises but also markets in general. The participants of the business ecosystem are bound by common interests, goals, and values that encourage everyone to develop. In this context, I.K. Bystriakov & D.V. Klynovyi (2019) specify that the subjects of business structures that can interact are the state authorities, business and the population that interact within information technology platforms in using natural assets. In this case, T. Kviatko (2023) points out the close relationship between business structures, both medium and small, in the development of business models. This is the fundamental basis of the ecosystem.

By forming the structure of the business ecosystem, its entities create a common platform to support entrepreneurs. This is not like a conventional infrastructure. The point is not about physical spaces or existing buildings, but about pooling capital or large institutions. Instead, the founders of the ecosystem focus on creating a consistent joint interaction of all participants in the structure. This refers to the process, not the product. In this context, I.K. Bystriakov & D.V. Klynovyi (2019) point out the conceptual foundations for the development of modern territorial business ecosystems based on natural assets using the tools and mechanisms of the platform economy in the context of the Fourth Industrial Revolution. The researchers focus on four phases of creating business ecosystems: economic management, project, programme and platform, with an emphasis on the development and application of advanced mechanisms for managing economic development. T. Kviatko (2023) proves that the development of ecosystems by companies is a progressive area of economic development. Given the current state of development of the digital society, the priority in creating an ecosystem of energy sector enterprises, according to V. Zamlynskyi *et al*. (2023) is the need to diagnose the company's readiness at the initial stage of digital transformation, which allows identifying existing internal constraints that may become an obstacle to achieving the desired result. The functioning of the ecosystem is based on achieving the set goal of all business entities simultaneously. This leads to the development of each of them both in an innovative area and on a global scale. The business ecosystem of energy sector enterprises is a complex and multifaceted category, which is developed under the influence of a set of advantages, the combination of which creates a more stable position in the market for the enterprise.

The development of energy sector ecosystems is becoming a new profession at the intersection of economics and energy development in general. When building effective ecosystems, it is necessary to focus on a combination of conventional and modern approaches to economic development, based on the principle of "top-down", considering the functioning of the environment managed by society, in which most entrepreneurs of the energy industry operate. Modern approaches to the development of the energy industry consist in the application of digitalisation ecosystems, which is ensured by the interaction of participants in the chain of forming the value of the final product, includes open interfaces and digital platforms for communication between the state, business, customers, etc. However, this may also apply to other industries. Therefore, the topic under study indicates the need to build business ecosystems of energy sector enterprises considering changes in the external environment. Among such changes in the modern world is Russia's full-scale invasion of Ukraine, which has exacerbated existing problems of business ecosystems, for example, the destruction of infrastructure, the lack of qualified human capital and labour, reduced demand for goods and services, and logistics problems. The main purpose of this study was to substantiate the transformation of business ecosystems of energy sector enterprises. To achieve this goal, it is necessary to perform the following tasks: to reveal the essence of the concept of "business ecosystem"; to substantiate the essence and components of the conceptual model of the business ecosystem; to identify the features of the business ecosystem of energy sector enterprises.

The tasks set in the study are solved using the following methods: scientific abstraction, which is used to substantiate the meaning and definition of "business ecosystem". Inductive and deductive methods are used in collecting, systematising information and developing a modern conceptual model of the business ecosystem, the interests of all subjects of which are balanced. The comparison method is used in the study of economic and organisational tools for implementing the business ecosystem strategy. The abstract and logical method is used for making proposals for the process of performing tasks in accordance with the implementation of the business ecosystem strategy and when forming theoretical generalisations and summing up

conclusions. One of the most important approaches used in the study is systematic: it helped to develop a conceptual model of the business ecosystem, establish the stages of tasks in accordance with the implementation of the business ecosystem strategy, and identify the features of the development of the business ecosystem of energy sector enterprises. The study includes the investigation of the complexity of the ecosystem, benefits of its application in modern society, and the construction of a conceptual model of the business ecosystem. Using specified methods, the stages of implementation of the business ecosystem strategy are proposed, and the features of transformation of the business ecosystem of the energy sector are substantiated.

THE ESSENCE OF THE BUSINESS ECOSYSTEM AND THE ADVANTAGES OF ITS APPLICATION IN MODERN SOCIETY

The need to develop business ecosystems of energy sector enterprises is provided by several key factors and strategic priorities. They consist in the use of the latest technologies that contribute to improving production efficiency and reducing emissions and the development of renewable energy sources; development and implementation of energy-efficient technologies and processes, ensuring the reduction of energy consumption and optimisation of available resources; introduction of digital initiatives such as the Internet of Things (IoT), data analytics, and artificial intelligence (AI); increasing automation and management of energy processes; development of sustainable partnerships between different actors in the energy sector. This contributes to the exchange of innovations, resources; development and modernisation of energy infrastructure to ensure the reliability and sustainability of systems; development and implementation of strategies aimed at ensuring the safety of energy systems in the face of growing threats to cybersecurity and natural disasters; introduction of environmentally friendly practices and measures to reduce the impact of energy production on the environment; ensuring the availability of qualified personnel who have the necessary knowledge and skills to develop and implement the latest technologies in the energy sector.

Such an integrated approach to the development of business ecosystems of energy sector enterprises guarantees their competitiveness, sustainability, and ability to adapt to changes in the global energy sector. The definition of "business ecosystem" was first used by J.F. Moore (1993). The researcher suggested considering enterprises as components of a business ecosystem that extends to other sectors of the economy. He pointed out the need to create innovative products. Any company can achieve success in a more efficient way than competitors in the relevant market segment. According to A. Polyanska *et al.* (2021), a business ecosystem is a network of organisations, including manufacturers, suppliers, distributors, customers, competitors, government agencies, etc., that are involved in the production and promotion of a particular product or service through competition and collaboration. As of the 2020s, a business ecosystem is a platform with a set of solutions to value propositions that its participants can use to meet their own needs (Burbelo *et al.*, 2022; Pavelko, 2023). Business ecosystems consist of a group of companies that collaborate with each other to introduce product innovation (Espina-Romero *et al.*, 2023). Overall, business ecosystems offer three key benefits: access to a wide range of opportunities, fast scaling, flexibility, and stability. At launch, ecosystems can provide quick access to external innovations that would be too expensive or time-consuming to develop. Once launched, the ecosystem can scale much faster than companies with other management models. The ecosystem structure makes it easy and clear to add new entrants, and its simplified business model ensures rapid growth. Ultimately, part of the appeal of business ecosystems lies in their flexibility and stability.

An ecosystem has a central core or platform, a clear system for attracting new partners, and a modular structure where each component can be easily added or removed from the ecosystem. Therefore, such ecosystems provide more efficient work with consumers, in order to meet their most unpredictable needs, and with modern digital innovative technologies. N. Lyubomudrova & I. Sobol (2018) prove that in the conditions of the domestic economy, the innovation ecosystem is in its infancy, despite the presence of a significant number of technology parks, innovation centres, business incubators, venture funds, and start-ups. It is also necessary to consider the development of digital maturity of the enterprise in order to build a business ecosystem. A.Yu. Semenog (2019) proves that digitalisation encourages the creation of new value for consumers, which is manifested in financial savings, obtaining and implementing new experiences and the possibility of complicity in the creation of personal products and services.

The modern ecosystem is based on an idea. M.A. Teplyuk *et al.* (2020) prove that an ecosystem consists of a certain number of participants who have sufficient resources, capabilities, competence, and capital to implement the proposed idea. The idea has two main forms of manifestation: it either receives the support of the environment and is implemented practically, or it remains an "idea" without further implementation. The conceptual model of a business ecosystem consists of different layers, namely: leaders, contributors, users, and the environment. Notably, ecosystems are built for a fairly long period. It may take a decade or two to see the quality of the implemented ecosystem and the results obtained. Such a long time period is explained by the fact that the creation of a business and its level of efficiency is characterised by a long time period, and cultural changes occur rather slowly. Many modern business associations have elements of an ecosystem, but they remain not fully functional. Their structures may be small, isolated, or fragmented. Ecosystem developers actively work to expand opportunities and collaborate with others to build a common, unified business ecosystem. They are system entrepreneurs who work to improve their potential, while performing various roles: developer, intermediary, etc.

CONSTRUCTION OF A CONCEPTUAL MODEL OF THE BUSINESS ECOSYSTEM

Each ecosystem has key players, they can be the main enterprises that define the idea and generally accepted rules of operation in the market. There are also niche players that can be intermediaries, distributors, suppliers, etc. Operating as part of an ecosystem, businesses expand their capabilities by strengthening the protagonists. In

order to gain an advantage in the market, large players (enterprises) surround themselves with niche players (intermediaries, distributors, suppliers). Niche players ensure the implementation of the tasks set. Within the business ecosystem, small system players can also function, which are parts of the overall system, but at the same time cannot have information about the main purpose of the business ecosystem functioning, but perform a secondary role. For example, territory cleaners and their functions are secondary, but at the same time, the existence of a business ecosystem is impossible without them. Accordingly, provided that the interests of all business entities in the business ecosystem are balanced, the interest and mutual benefit of operating within such a system remains. Consequently, within an ecosystem, all structural actors are interconnected and interdependent. All participants understand their functions and benefit from their implementation (Fig. 1).

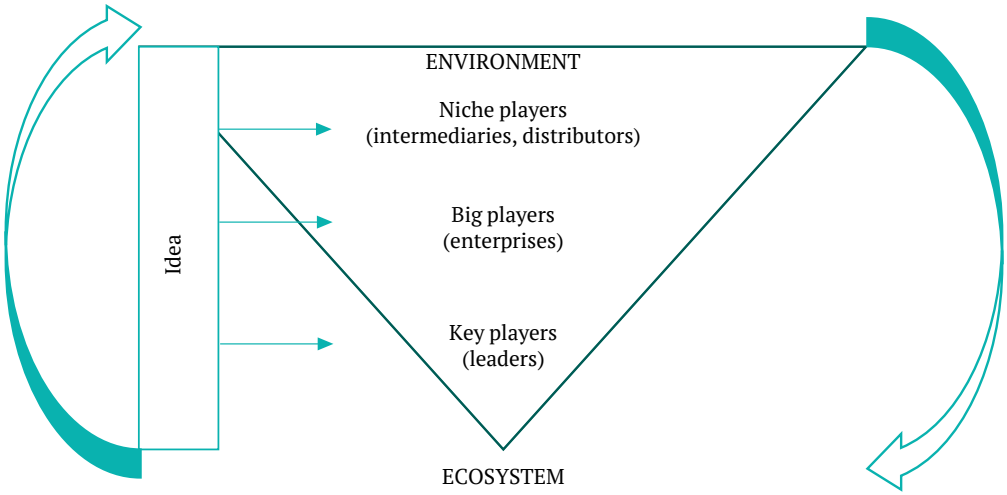

Figure 1. Conceptual model of the business ecosystem

Source: made by the authors

M. Peltoniemi & E. Vuori (2005) consider ecosystems as complex mechanisms consisting of interdependent components and characterised by the following features. Self-organisation is characterised by integrated dynamics that create systems and improve organisations. Emergency situation – the joint operation of interconnected system components creates qualitatively new and improved properties. Coevolution – a mechanism of interdependent changes caused by system components during development. Adaptability – the process by which the structure and properties of a system are purposefully changed in accordance with the influence of internal and external environmental factors. The ecosystem is endowed with the properties of stability, adaptability, coevolution, self-regulation, emergence, due to which its renewal and development is achieved (Lyubomudrova & Sobol, 2018). Thus, the ecosystem is characterised by the work of interdependent mechanisms that function effectively only if all of them simultaneously with one goal – to increase the profitability of all subjects of the ecosystem.

DEVELOPMENT AND STAGE-BY-STAGE IMPLEMENTATION OF THE BUSINESS ECOSYSTEM STRATEGY

The success of an ecosystem often depends on several agreements: revenue sharing agreements, joint venture agreements, controlling stakes, and mergers and acquisitions. To do this, it is necessary to focus on the internal key performance indicators of organisations involved in ecosystems to ensure strategy alignment (Business ecosystem…, 2019). Ecosystem logic allows high-tech businesses to maintain the required level of innovation and not lose ground. Ecosystem logic allows large holdings that have neither resources nor effective business models to be pulled out of the crisis (Demil *et al.*, 2018; Savruk, 2019). To implement a business ecosystem strategy, it is necessary to understand how it functions, i.e., not only to offer a perfect value proposition, but also to act as an intermediary in partnership agreements, which requires considerable effort. Such an offer should provide value to all parties to the transaction. The mechanism for implementing the business ecosystem strategy is presented in Figure 2. The goal of implementing a business ecosystem strategy is to formulate and effectively implement such a strategy. The strategy implementation is ensured by economic and organisational tools and the availability of investment, information, financial, credit, management, technological, human, and other types of resources. Based on the proposed conceptual and practical vision of the mechanism for implementing the business ecosystem strategy, the logic of implementing its tasks is proposed. The process of developing tools for implementing a business ecosystem strategy consists of organisational (ordinate) and economic (abscissa) directions (Fig. 3).

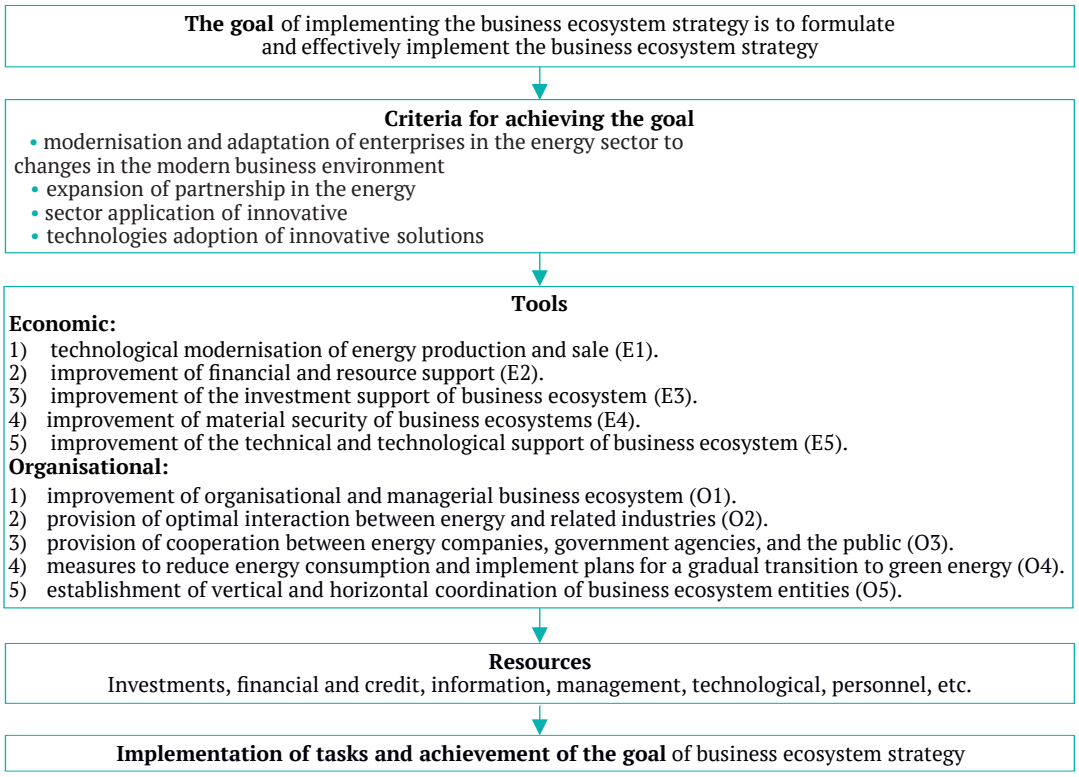

Figure 2. Mechanism for implementing the business ecosystem strategy

Source: made by the authors

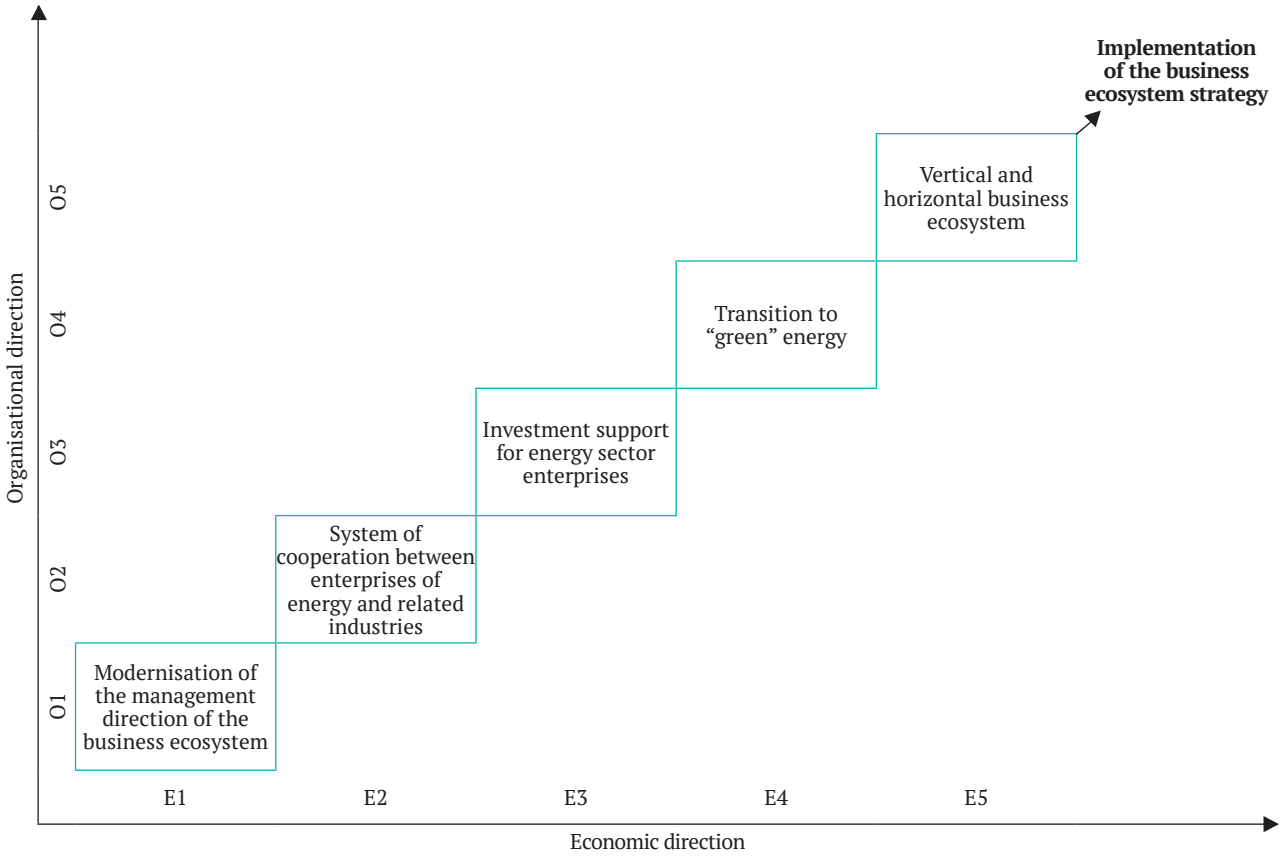

Figure 3. Logic for completing tasks in accordance with the implementation of the business ecosystem strategy

Source: developed by the authors

The success of implementing a business ecosystem strategy depends on the ability to effectively coordinate interaction between different participants in this ecosystem. Having supportive partnerships, mutual trust, and the ability to innovate resource sharing can determine the success of a strategy. The ability to adapt to changes in the internal and external environment, and to consider the needs and expectations of end users within the ecosystem, is also crucial. Notably, the success of implementing a business ecosystem strategy also often depends on existing agreements, including revenue sharing agreements, joint venture agreements, majority ownership, and mergers and acquisitions. And this requires focusing on the internal indicators of the ecosystem organisation in order to ensure strategic alignment. Companies cannot simply create systems that benefit their customers and meet the needs of their partners. Sooner or later, the organisers will also have to get additional value. Some companies focus on future success, which comes from increasing customer loyalty, driving growth, and increasing customer satisfaction. But ultimately, all ecosystems must create tangible value for their organisers. This requirement can be forgotten in a world of free finance, where private funds compete for investment and platforms are in full swing.

FEATURES OF THE TRANSFORMATION OF THE ENERGY SECTOR BUSINESS ECOSYSTEM

In the energy sector, business ecosystems of enterprises have their own characteristics, which are the need for energy and digital transformation, resilience to change, the need for partnership and cooperation, and improvement of energy efficiency. Energy transformation in the energy system consists of the transition to renewable energy sources, energy-efficient technologies, and other innovations that can affect enterprises in the industry. Energy transformation means the transition of the global energy sector from fossil-based energy production and consumption systems, particularly oil, natural gas and coal, to renewable energy sources such as wind and solar, and using lithium-ion batteries. First of all, it concerns alternative ways of supplying energy to consumers, for example, through autonomous solutions. It is necessary to highlight several options for energy transformation: at the level of government, local authorities, business, and consumers.

At the government level, energy transformation consists in the development and implementation of regulatory support for the energy industry and state development programmes. At the local level, these are measures to reduce energy consumption and implement plans for a gradual "green" transition of communities. In order to consume less and more efficiently, local energy managers are required to monitor energy use and know how to fix problems through effective measures. Business structures should provide themselves with access to facilities equipped with solar power plants with energy storage systems. This is ensured by forming a corresponding request for renewable energy projects.

Consumers should have more opportunities and incentives to install electricity generation systems to meet their basic energy needs. In general, this implies the development and implementation of energy-efficient policies at all levels, including the efficient use of local resources and a gradual increase in the share of energy production from renewable sources. In addition, the strategically proclaimed "green" transformation plays an important role in modern society, especially the decarbonisation of the energy sector, which will lead to the creation of small-scale decentralised electricity generation using renewable energy sources and high efficiency.

Digital transformation in the energy industry is characterised by the development of IoT, AI, data analysis, and other digital solutions to improve the efficiency and management of energy processes. Robotics, 3D printing, cloud computing, and advanced analytics play an important role in this process. Digital technologies are crucial for improving efficiency through better productivity and lower capital and operating costs. Resilience to change is determined by the adaptation of energy sector enterprises to various challenges, such as climate change, regulatory changes in legislation, and improvement of safety standards and sustainable technologies. Russia's full-scale invasion of Ukraine has made adjustments to the development of the energy industry, in particular, damage has been caused to many energy infrastructure facilities, enterprises that were located in the temporarily occupied territory have been destroyed, electricity and heat supply networks have been damaged, and it is impossible to extract energy resources from individual fields.

Consideration of the transition from simple energy production to the provision of integrated energy services is characterised by energy efficiency and energy consumption management. The importance of energy services is shown in their ability to provide comprehensive solutions aimed at optimising energy consumption, introducing the latest technologies and improving existing energy systems. This helps to reduce energy losses, increase productivity, and reduce emissions of harmful substances. In addition, energy services play an important role in the transition to renewable energy sources and support sustainable practices in production and living environments. These services provide businesses with the opportunity to use state-of-the-art technologies to ensure high efficiency and meet the requirements of sustainable development.

The importance of partnership and cooperation in the energy sector is reflected in the ability to combine resources, expertise, and innovative approaches to meet the challenges of ensuring a sustainable and reliable energy supply. Cooperation between energy companies, government agencies and the public is becoming a key factor in developing and implementing energy efficiency strategies, developing renewable energy sources, and reducing emissions. Therefore, the partnership in the energy sector allows joining forces to create integrated systems aimed at improving production efficiency, ensuring energy security, and implementing the transition to a sustainable energy future.

The study of energy efficiency during wartime goes beyond the usual conditions and has its own characteristics and important aspects. Research in this area is an important effort to ensure the sustainability and restoration of energy systems during a period of military conflict, and also has great potential to introduce new technologies and strategies during this difficult time; consider measures to optimise the use of energy production and consumption,

in particular, with the help of the latest technologies and engineering solutions; analyse the impact of changes in legislation and regulation ensures changes in the strategy and operational activities of energy enterprises.

DEVELOPMENT AND MANAGEMENT OF BUSINESS ECOSYSTEMS: FROM HISTORICAL ROOTS TO MODERN STRATEGIES

The study of the phenomenon of business ecosystem development is receiving more and more attention every year, both in scientific and practical aspects. The historical aspects and the origin of ecosystems was revealed in the paper by A.J. Willis (1997). In modern conditions, O. Tsyhanenko *et al.* (2022) prove that it is "a collection of elements that dynamically develop and interact with each other to achieve a single goal". Investigating the conceptual approach, G. Sarafin (2021) states that "an ecosystem is a concept that recognises that in any closed system; members of that system must work with and around each other to keep the system stable, ideally optimising collective benefits". E. Anggraeni *et al.* (2007) supporting the conceptual approach points to the prospects of ecosystem research to explore the relationships between firms and their business networks. At the same time, the process of creating an ecosystem is emergent, not linear and permanent. Ecosystem management mechanisms are implemented using roadmap by C.Y. Baldwin (2019). At its core, a roadmap is a form of technology that can form expectations about the behaviour of ecosystem participants and, consequently, the ecosystems themselves. It is a product of an ecosystem and reproduces it, confirms its boundaries, and connects the network connections that establish the same ecosystem.

Exploring the components of the business ecosystem, A. Hayes (2021) refers to a network of organisations, including suppliers, distributors, customers, competitors, government agencies, etc., that are involved in delivering a particular product or service through competition and collaboration. In this case, E.V. Zubko & M.A. Teplyuk (2020) argue that "...a well-organised business model can bring synergistic results when interacting with stakeholders, and the more involved they are, the stronger the system as a whole". P.W. De Langen *et al.* (2020) proved the cyclical nature of the business ecosystem, which is carried out through the development of synergy of industrial ecology and the education and attraction of new innovative companies. The cyclical transition leads to changes in the business model, with more attention being paid to new services that create synergy.

Modern approaches to the development of ecosystems are considered by various researchers. M.J. Spaniol & N.J. Rowland (2022) prove that ecosystems are important sources of innovation that can be applied in various industries. In particular, researchers focus on the need for corporate forecasting in the ecosystem. It is necessary to pay attention to the need to involve various ecosystem participants in the development of a common strategy by planning the collective application of innovations, policies, etc. L.C. Espina-Romero *et al.* (2023) prove that the study of business ecosystem has a significant impact on how companies interact with the environment and compete in the marketplace. Companies that innovate, collaborate, adapt to market conditions in a timely manner, create shared value, and perform better in a proactive and competitive business.

In particular, N.A. Tukhtenko *et al.* (2021) point out the need for digitalisation to develop modern business ecosystems. The vast majority of enterprises are aimed at building relationships with consumers of new quality within the framework of an ecosystem approach. J. Fuller *et al*. (2019) exploring the benefits of the ecosystem, point to the new opportunities they create for products and services that go beyond traditional boundaries, such as digital platforms, IoT technologies, and new tools for data collection and analysis. D. Wellers (2018) proves the profitability of creating ecosystems through the possibility of selling products and services that were impossible for a separate company on its own. It is their differences, their combined ability to learn, innovate, and perform, that make them successful. The growing interest in ecosystem development is also conditioned by the rapid pace of environmental change and the emergence of new opportunities.

Pointing out the need to modernise the principles of ecosystem management, N. Degtyar (2012) proves that such changes can occur only on the basis of Ukraine's involvement in international trends in the inclusion of natural ecosystem services in the mechanisms of economic development. The researcher argues that separate methodological approaches to evaluating some ecosystem services in Ukraine have already been created and applied in the context of using the Kyoto Protocol. L. Espina-Romero *et al*. (2022) investigated theoretical and methodological aspects of business ecosystems in the scientific environment during 2018-2022 and found that the topic is widespread and relevant. The researchers examined 96 documents based on the results of which they found that the annual growth rate of the topic under study is 13.21%. Therefore, this once again confirms the relevance of the subject matter and its prevalence in scientific discourse.

CONCLUSIONS

Businesses need to respond quickly to market changes in order to be competitive in today's fast-paced and changing world. Such competitiveness can be ensured through a social and technical corporation, scalability, integration into other businesses with unique and similar goals, sustainable development plans, and existing technological innovations. The dynamism of change also stimulates the development of business ecosystems, which is implemented through partnerships, the application of innovations, and their practical implementation. A characteristic element of the business ecosystem structure is high entry barriers that protect the knowledge accumulated in the ecosystem, its technologies, know-how, patents, research resources, and specific conditions for cooperation. It is the unique combination of the above elements that allows increasing the potential of the ecosystem, achieve synergy, and gain a competitive advantage.

The transformation of business ecosystems in the energy sector should be carried out at two levels. At the state level, within which it is advisable to focus on the development and implementation of regulatory support for the energy industry and state development programmes, and at the local level. At the local level, there is a need for rational energy consumption and implementation of plans for a

gradual "green" transition of communities. In order to consume less and more efficiently, local energy managers are required to monitor energy use and know how to fix problems through effective measures. Based on the proposed conceptual and practical vision of the mechanism for implementing the business ecosystem strategy, it is proposed to perform tasks in accordance with the implementation of the business ecosystem strategy in the following sequence: modernisation of the management vector of the business ecosystem, a system of cooperation between enterprises of the energy and related industries, investment support for enterprises of the energy sector, transition to "green" energy, vertical and horizontal business ecosystem.

The transformation of business ecosystems in the energy industry is associated with the use of renewable energy sources, energy-efficient technologies, and other innovations that can affect the enterprises of the industry. The role of energy companies is to expand business ecosystems through strategic partnerships and cooperation with other players in the energy sector and other related industries. Therefore, the transformation of business ecosystems of enterprises in the energy industry reflects the processes and challenges that are associated with the modernisation and adaptation of enterprises in the energy sector to changes in the modern business environment. It is important to understand the need to strengthen partnerships in the energy sector to promote the exchange of experiences, technologies and innovative solutions, which are important components for achieving global goals to reduce the carbon footprint and create a sustainable energy landscape. Prospects for further research in this area are to investigate the influence of external and internal factors on the development of business ecosystems in the energy industry.

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CONFLICT OF INTEREST

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Трансформація бізнес екосистем підприємств енергетичної галузі

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Анотація. Трансформація бізнес-екосистем підприємств енергетичної галузі є стратегічною необхідністю для їх сталої конкурентоспроможності в умовах змін у глобальному енергетичному ландшафті, що зумовлює актуальність досліджуваної теми. Метою дослідження було обґрунтування необхідності трансформації бізнес-екосистем підприємств енергетичної галузі. Було використано наступні методи: наукова абстракція – при обґрунтуванні значення «бізнес-екосистеми» та її визначення; індуктивний, дедуктивний – при зборі, систематизації та розробці концептуальної моделі бізнес-екосистеми; абстрактно-логічний – для теоретичних узагальнень і формування висновків; системний – для детальної розробки стратегії бізнес-екосистем підприємств енергетичної галузі. Запропоновано концептуальну модель бізнес-екосистеми, яка враховує взаємозв'язок та взаємозалежність великих, нішевих та ключових гравців. Запропоновано механізм реалізації стратегії бізнес-екосистеми. Встановлено, що успіх реалізації стратегії бізнес-екосистеми залежить від вміння ефективно координувати взаємодію між різними учасниками цієї екосистеми, а також від наявних укладених угод. Запропоновано механізм реалізації стратегії бізнес-екосистеми в наступній послідовності: модернізація управлінського напряму бізнес-екосистеми, система співпраці між підприємствами енергетичної та суміжних галузей, інвестиційне забезпечення підприємств енергетичної сфери, перехід до «зеленої» енергетики, формування вертикальної та горизонтальної бізнес-екосистеми. Виявлено особливості формування бізнес-екосистеми підприємств енергетичної галузі, це: енергетична та цифрова трансформація, стійкість до змін, енергетичні сервіси, партнерство та співпраця, підвищення енергетичної ефективності. Доведено, що бізнес екосистеми підприємств енергетичної галузі є комплексною та багатогранною категорією, яка формується під впливом сукупності переваг, поєднання яких формує для підприємства більш стійкі позиції на ринку. Практична значимість полягає в розробці рекомендацій, які зумовлюють трансформацію бізнес екосистем підприємств енергетичної галузі, та полягають у модернізації управлінського напряму бізнес-екосистеми, розвитку співпраці між підприємствами енергетичної та суміжних галузей, інвестиційному забезпеченні підприємств енергетичної сфери, та необхідності переходу до «зеленої» енергетики, вертикальної та горизонтальної бізнес-екосистеми

Ключові слова: інноваційна екосистема; концептуальна модель; бізнес-екоструктура; підприємство; платформа; енергетичний сектор

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