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MARKETING AND CONTROLLING IN STRATEGIC FORECASTING OF INNOVATIVE INDUSTRIAL DEVELOPMENT

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Introduction. Outlining the strategic vision of alternatives regarding the innovation development of industrial enterprises implies a multifunctional load on marketing and controlling support systems aimed at increasing the effectiveness of managerial influence to ensure the long-term sustainability and competitiveness of enterprises. Marketing and controlling support decision-making in developing the innovation potential of industrial enterprises to ensure their competitiveness in recovering and strengthening the national economy.

Aim and tasks. This study aims to develop and substantiate approaches to strategic forecasting regarding the innovation development of industrial enterprises in marketing and controlling support to modernise and accelerate national economy recovery.

Results. The study uses an economic and mathematical model to forecast industrial competitiveness by adjusting key innovation potential components. The model reveals that innovation potential depends significantly on prior investments in innovation made in the previous period, which requires sound management decisions regarding the choice of strategic alternatives for innovation development based on marketing and controlling support. An analysis of the forecasted competitiveness of industrial enterprises in 2023-2024 shows that innovative potential has the most significant impact on competitiveness, with R_3 parameter equal to 0.5472, which exceeds the value of R_2 parameter of 0.1180 for the competitiveness in the previous period. The proposed ADL model with fixed effects for panel data confirms the dependence of industrial competitiveness on innovation. In particular, a conditional increase in innovation potential of 10% leads to a 5.4% increase in the competitiveness of industrial enterprises during the forecast period.

Conclusions. Creating a marketing support system for the innovation development of industrial enterprises contributes to the adaptation of industrial enterprises to conditions of rapid technological processes within the industrial paradigm and enhances resilience to external challenges. Controlling makes it possible to optimise processes and increase the efficiency of management decisions to achieve innovation development's strategic goals and accelerate industrial enterprises' competitiveness. Analysing strategic alternatives for innovation development based on marketing and controlling enabled the formulation of strategies to increase industrial enterprises' development innovativeness and effectiveness.

Keywords: controlling, industrial enterprises, innovation development, marketing, strategic forecasting.

1. Introduction.

Developing an innovative economy and effectively utilising the potential of industrial enterprises in integration into the European region are the key factors in adapting to new economic realities. This is due to the increasing uncertainty of the market environment, progressive dynamics of technological changes, and the need to increase the competitiveness of the national industry. Innovation is crucial for profitability and long-term sustainability. Its effectiveness depends on the enterprises' ability to predict and adapt to external and internal changes. The strategy for innovation development defines the development of industrial enterprises as the basis for sustainable economic growth by creating favourable conditions for functioning and developing the national innovation ecosystem (Cabinet of Ministers of Ukraine, 2019).

Strategic implementation aims to increase the number of enterprises engaged in research and development (R&D) and innovation, enhancing their competitiveness in the international market. Implementing Industry 4.0 and other innovative technologies is a way to stimulate enterprises' innovation activities (Cabinet of Ministers of Ukraine, 2021). This approach gains relevance above is enhanced by achieving strategic goals of economic recovery and development (President of Ukraine, 2024), which requires measures to ensure financial stability and includes actions to support business and the economy.

Financial stability allows the creation of favourable conditions for enterprises' innovation development. The issue of creating a favourable environment for introducing innovations in the Ukrainian industrial sector is resolved nationally. Thus, it has been provided to achieve strategic goals such as building competitiveness, an innovative specialised spatial economy, and promoting an attractive investment climate and innovative investment infrastructure (Kharkiv Regional Administration, 2024).

Support for enterprise-level innovation can be achieved by developing an innovative investment infrastructure and using a cluster approach to create specialized clusters.

This will ensure the effective integration of innovative development into production processes, optimize resource use, strengthen enterprises' competitive position in the national and international markets, and increase adaptability to market changes. It permits obtaining long-term strategic benefits, minimising risks, and creating sustainability in the innovation system of project financing.

The combination of marketing analysis and control allows for effective planning, control, and adjustment of strategic alternatives, ensuring the balanced development of innovations in industrial enterprises. Nevertheless, Ukraine's industrial enterprises have a potential to attract resources for innovation, which allows the restoration of the economy and ensures sustainable and comprehensive development of the country (Cabinet of Ministers of Ukraine, 2021).

Therefore, a large-scale reinterpretation and change of approach allowed the identification of industrial enterprises' innovation development as a priority issue, the resolution of which is based on identifying strategic alternatives. This enables minimising the risks associated with implementing innovations, optimising costs, and achieving sustainable development (President of Ukraine, 2024).

Marketing support plays a crucial role in promoting innovations and scaling up the positive experience of implementing cutting-edge technologies, while controlling takes management to a qualitatively new level, allowing for a sound assessment of strategic decisions in the innovation sphere to be effective (Gonchar et al., 2024). Integrating marketing and controlling support in strategic innovation development on an industrial enterprise's innovation basis forms a substantiated ground for managing decisions aimed at sustainable growth and increasing the competitiveness of industrial enterprises. Thus, substantiating the innovation development in marketing and controlling support is crucial.

This study aims to define and substantiate an approach to strategically predicting industrial enterprises' competitiveness based on innovation potential in marketing and controlling support.

2. Literature review.

Theoretical and applied aspects of industrial enterprises' innovation development were studied by Shilova (2012), who analysed the essence of the innovation potential of an enterprise and the features of its management mechanism. Gonchar M. et al. (2024) emphasise the need for state regulation of industrial enterprises' investment activities as the basis of innovation development in Industry 4.0 conditions.

Armstrong (1983) studied approaches to strategic planning and forecasting, which substantiate the directions of industrial enterprises' innovation development. Certain aspects of strategic forecasting theory and its practical application for understanding forecasting processes in innovation development were substantiated by Hines (2003) and Duus (2013).

Vnukova N. et al. (2024) are devoted to defining technologies relevant to Industry 4.0 and their application for industrial sector innovative renovation. The role of control in creating prerequisites for industrial enterprises' innovation development was studied by Ghobakhloo et al. (2021). The features of marketing support for management decisions that aim to find strategic alternatives regarding industrial enterprises' innovation development were reflected in a study by Hajdú (2013).

The principles of innovation marketing were revealed by O'Dwyer et al. (2009), key principles and approaches for marketing support in strategic innovation decisions. Existing methodological approaches for researching industrial enterprises' innovation development require further improvement via a comprehensive approach, which becomes especially relevant in the context of dynamic market changes and the transformation of production relations (Prajogo, 2016; Corbo et al., 2023).

In particular, it is critically important to consider the increasing role of marketing and controlling support in developing strategic alternatives for the innovation development of enterprises operating under tough competition and significant technological shifts.

Adapting to current global transformational changes and challenges necessitates searching for effective scientific and practical approaches to justify strategic alternatives to industrial enterprises' innovation development. This is based on implementing integrated control and marketing support systems, which increase enterprises' flexibility and adaptability to changes in inconsistent external and internal environments.

3. Methodology.

Substantiating strategic alternatives for industrial enterprises' innovation development involves significant variability, instability, and high risk. Therefore, ensuring a compelling direction for industrial enterprises' innovation development requires combining modern management and marketing components (Duus, 2013). The combination of marketing principles and conceptual foundations of control aimed at achieving the goals set in this study allowed for the enhancement of the relevance of strategic and operational decisions in innovation development. Implementing the above approach contributes to the timely identification of problematic aspects, developing a set of measures to mitigate them, and providing marketing support for management decisions, which ultimately increases the effectiveness of innovation activities in industrial enterprises.

Among the components of the specified approach lies in forecasting industrial enterprises' competitiveness levels based on economic and mathematical modelling to substantiate and choose strategic alternatives for innovation development and make effective management decisions regarding investments in innovation (Davidson et al., 1978).

The outlined component of analysing industrial enterprises' activity is as significant as assessing their innovation development. It enables timely adjustment of the chosen development strategy and provides management information for informed decision-making with marketing support. Statistical data of industrial enterprises in the Kharkiv region (2017-2023) were used to forecast competitiveness based on changes in the main components of its innovative potential.

A hypothesis suggests a statistical relationship between investments in innovation and innovation potential, with its significance depending on the time lag. Many enterprises experience a time lag between investing in innovation, obtaining economic benefits, and increasing innovation potential. Analysing the annual reports of industrial enterprises confirmed the hypothesis regarding the statistical relationship between the level of investment in innovation and innovation potential, but also for the previous one.

The innovation potential is affected by the inertia of changes in a business entity's financial and economic activities and the time lag between innovation investments and their results, which should be considered in investment policy.

Suppose there are no extreme fluctuations in the external or internal environment, and the enterprise's condition is not critical. In this case, the transition from one level of innovation potential to another can be achieved only by evolutionary means. Therefore, it is proposed to use both current period indicators (for the analysed period) and indicators from previous periods when creating a model to predict innovation potential.

The basic forecasting model is based on an autoregressive equation with autoregressive distributed lags (ADL) that describe processes under conditions of relative stability. It is important to consider the values of previous periods because certain parameters are highly interdependent throughout events, which is inherent in innovation development processes.

In the proposed model for forecasting an integral indicator of industrial enterprises' innovation potential at a certain point in time t (PI_t), it is advisable to rely on the value achieved in the previous period PI_{t-1} and the value of the conditionally autonomous indicator of investment in innovation (IC_t), which also affects PI_t with distributed lags and helps to distinguish these dependencies and predict future changes.

The fundamental dynamic model included both dependent and independent variables in the form of an autoregressive equation with distributed lags (ADL(p,q)), which was applied to forecast the innovation potential of industrial enterprises. The proposed ADL (p,q) model can be generalised using several exogenous variables. This study uses ADL (p,q,k) markers, where k is the number of exogenous variables and q is the number of lags (Table 1).

Table 1. Basic and generalised dynamic model for forecasting innovation potential of industrial enterprises.

Basic dynamic model with distributed lags ADL (p,q)	Generalised dynamic model with distributed lags ADL (p, q, k)
$Y_t = \alpha + \sum_{i=1}^{p} \beta_i Y_{t-i} + \sum_{j=1}^{q} \gamma_j X_{t-j} + \varepsilon_t$	$Y_t = \alpha + \sum_{i=1}^{p} \beta_i Y_{t-i} + \sum_{j=1}^{q} \gamma_j X_{t-j} + \sum_{m=1}^{k} \delta_m Z_m + \varepsilon_t$
Y_t – predicted dependent variable (innovation potential); X – independent variable (investment in innovation); p – number of lags for the dependent variable; q – number of lags for the independent variable; Y_{t-i} – dependent variable with lags of p order; X_{t-j} – independent variable with lags of q order; $\propto, \beta_i, \gamma_j$ – coefficients for variables in ADL (p,q); ε_t – random error.	Y_t – predicted dependent variable (innovation potential); X – independent variable (investment in innovation); p – number of lags for the dependent variable; q – number of lags for the independent variable; Y_{t-i} – dependent variable with lags of p order; X_{t-j} – independent variable with lags of q order; Z_m – additional exogenous variables; $\propto, \beta_i, \gamma_j, \delta_m$ – coefficients for variables in ADL (p,q,k); ε_t – random error.

Industrial enterprises' innovation potential is assessed by considering investments in innovation with lags. This made it possible to consider the dynamic relationship between investments in innovation, the achieved level of innovation potential, and, ultimately, the level of competitiveness of industrial enterprises.

Moreover, when building ADL models, it is necessary to consider the principles for determining the number of lags (p and q) applied in the model. For this purpose, the study assessed different model variants, and the best option was selected. Model development begins with the most general model, which includes the maximum number of indicators and lags.

Then, the selected model was checked for autocorrelation, the absence of heteroscedasticity of residuals, and their compliance with the normal distribution law. One of the most common methods for estimating lag model parameters is the maximum likelihood (MLE) method, which provides effective and consistent parameter estimates and error distribution according to the normal distribution law. Under stationary conditions, this method allows one to obtain adequate estimates of the lag model parameters, which increases the accuracy of the results in modelling dynamic processes, such as industrial enterprises' innovation development.

4. Results.

The set of data on the activities of the studied enterprises (*n*) obtained during t periods is considered panel data, which provides for modelling the innovation development of the analysed enterprises over time. The data panel is balanced if it includes the necessary information on each studied enterprise at a certain point during the period.

This study uses balanced panel data on the activities of industrial enterprises, set as follows: $\{y_{it}, x_{kit}\}$, where *t* is an indicator of time points, *k* is the independent variable parameter; *i* is the number of studied objects. Therefore, on the basis of panel data, the following ADL variants (*p,q,k*) for innovation potential *PI* have been built based on the following combinations:

1) a model based on using investments in innovation for the current period IC_t and innovation for the previous period PI_{t-1};

2) a model based solely on investments in innovation for the previous period IC_{t-1};

3) a model that includes innovation investments IC_{t-1} and innovation potential PI_{t-1} for the previous period;

4) a model based solely on investments in innovation for the current period IC_t.

For instance, for a combination of investments in innovation for the current period IC_t and innovation potential of the previous period PI_{t-1}, the general analytical form of the ADL model (*p,q,k*) for predicting the value of the innovation potential indicator in the current period *t* looks as follows:

$$\mathrm{PI_t} = \propto + \beta \cdot \mathrm{PI_{t-1}} + \gamma \cdot \mathrm{IC}_t + \varepsilon_t, \quad (1)$$

where: $\mathrm{PI_{t-1}}$ is innovation potential of industrial enterprises in the previous period with a lag (-1); IC_t is investments in innovation in the current period; $\propto$ is ADL model constant (p,q,k); β is coefficient of influence of the previous value of industrial enterprises' innovation potential on the current level; γ is coefficient of influence of investments in innovation on innovation potential; ε_t is random (stochastic) error of the model.

At the preparation stage for building the ADL model for predicting the competitiveness level of industrial enterprises, it is important to check the compliance of the studied data sample (innovation potential and investments in innovation) with the normal distribution law. For this purpose, the study applied the Jarque-Bera (JB) criterion, which is used to test the hypothesis that the studied sample is a sample of a normally distributed random variable with unknown mean value and variance. This criterion was used to select a parametric statistical method that required normality of the studied random variables. The calculations performed lead to the conclusion that, according to the Jarque-Bera criterion, the total sample of innovation potential and investment in innovation indicators does not provide a normal distribution.

The test results, where JB equals 124.687 and 58.984, respectively, significantly different from zero. The panel data analysis for enterprise, particularly the JB value in the range of 3.66 to 3.73, indicates that the data more closely follows a normal distribution. This confirmed the possibility of using panel data to study innovation potential and supports the use of the ADL model to predict the competitiveness of industrial enterprises.

The most adequate model among the proposed options for building an autoregressive model with distributed lag ADL (p,q,k) turned out to be the one that describes the dependence of innovation potential indicator on investments in innovation in the previous period with a lag (-1) IC_{t-1}. Considering the need to consider the cross-section effect for the enterprise under study in the forecast model, which will make it more universal, the model is as follows:

$$PI_t = R_1 + R_2 \cdot IC_{t-1} + [CX{=}F], \quad (2)$$

where R_1, R_2 are the parameters of the forecast model, and *F* is the effect (model shift) for each enterprise studied.

As a result of the calculations performed using the ADL (p,q,k) model, a forecast model was developed to determine the innovation potential of industrial enterprises, outlining the dependence of its level on the amount of investment in innovation in the previous period.

$$PI_t = 0{,}01585 + 0{,}02787 \cdot IC_{t-1} + [F], \quad (3)$$

The results obtained permitted the identification of a significant impact of the volume of investments in innovation in the previous year on the level of innovation potential of an industrial enterprise in the studied (forecast) period.

When resources are limited and external and internal environments are generally unstable, needing accelerated recovery and development of the national industry, the revealed dependencies allow enterprise managers to determine the optimal investment in innovation. This depends on the approved development plans to achieve the required level of innovation potential. The results of the adequacy analysis of the proposed model are presented in Table 2.

Table 2. Analysing the relevance of ADL model for predicting the innovation potential of industrial enterprises.

Dependent Variable: PI
Method: Panel Least Squares
Periods included: 6
Cross-sections included: 10
Total panel (unbalanced) observations: 49
PI= R (1)+ R (2)* IC(-1)

	Coefficient	Std. Error	t-Statistic	Prob.
R(1)	0.015669	0.001835	8.537703	0.0000
R(2)	0.027563	0.013548	2.034455	0.0489

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.878709	Mean dependent var	0.012948
Adjusted R-squared	0.835800	S.D. dependent var	0.021709
S.E. of regression	0.008797	Akaike info criterion	-6.434146
Sum squared resid	0.002940	Schwarz criterion	-6.009452
Log likelihood	168.6366	Hannan-Quinn criter.	-6.273018
F-statistic	25.65471	Durbin-Watson stat	2.242230
Prob(F-statistic)	0.000000		

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The following conclusions can be drawn based on the data presented in Fig. 1.

1. The statistical significance of the model was tested using t-statistics. Despite the low values for individual coefficients, sufficient reliability and validity of the coefficients in the obtained equation were confirmed.

2. The determination coefficient (0.87) indicates a high overall quality of the regression equation. It allows one to conclude that the value of the endogenous (dependent) variable – innovation potential – depends on the exogenous (independent) variable value, investment in innovation, or its change. The F-statistic value was 25.65, indicating that the determination coefficient was important.

3. Another criterion for assessing model quality is the Durbin-Watson (DW) statistic, which enables one to check the validity of the selected form of the regression equation and ensure that all significant explanatory variables have been included in the model. It was found that DW is equal to 2.24, which indicates no autocorrelation of the residuals and proves compliance with the residual independence condition.

4. The relevance of the model was assessed using the Akaike (AIC = -6.43) and Schwarz (SC = -6.01) criteria, which show the correspondence of the residuals to their normal distribution and confirm the significance of the constructed dynamic model's parameters.

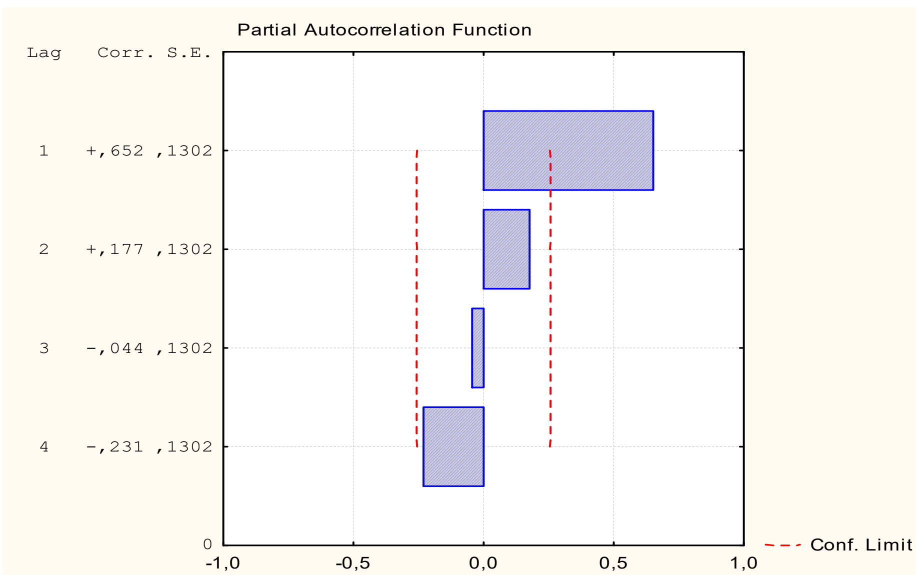

Fig. 1. Autocorrelation analysis of panel data to determine the competitiveness level of industrial enterprises.

Table 3 presents the results of calculating each industrial enterprise's effect [CX=F]. Among the studied enterprises, only enterprises 4 and 9 had positive effect values of 0.049737 and 0.01714, respectively. Negative values are typical for all other enterprises, indicating significant miscalculations in substantiating and selecting strategic directions of innovation development, inconsistency of resource and technological potentials, and failure to consider modern trends in informatization and developing Industry 4.0 technologies.

The importance of using control as a strategy tool is due to the need to substantiate the directions of innovation development. This will allow enterprise management to adaptively mitigate the adverse effects of the external environment to increase enterprise competitiveness.

The key role of investments in innovation proves a time lag between investments in innovation and achieving particular results, confirming the previously formulated hypothesis.

Table 3. The fixed effect value for the studied industrial enterprises.

Enterprises	Fixed Effect
№1	-0,010715
№2	-0,010402
№3	-0,012841
№4	0,048645
№5	-0,009094
№6	-0,013573
№7	-0,012160
№8	-0,002241
№9	0,015988
№10	-0,008472

Identifying the factors that determine the level of industrial enterprises' innovation potential is an important component in proving the assumption that competitiveness index dynamics depend on changes in the innovation potential index of an industrial enterprise and the general competitiveness index trend, which is determined by autocorrelation dependencies, and building the corresponding forecast model based on this theoretical basis. The autocorrelation results prove the panel data trend for this indicator: the autocorrelation for the first lag was 0.65. The number of lags, namely 4, is determined by the number of observations for each enterprise, which equals 6.

It can be claimed that C_t competitiveness index dynamics in the current period is determined by its previous C_{t-1} level. In addition, the study demonstrated a clear correlation between the enterprise competitiveness index and its innovation potential, which is illustrated by the data shown in Table 4 (performed using the STATISTICA 7.1 package). The correlation coefficient between these indicators is 0.865, which indicates significant connection density and gives a reason to consider that the current PI_t level of innovation potential also determines the dynamics of competitiveness index for industrial enterprises.

Table 4. Correlations between indicators of competitiveness and innovation potential of industrial enterprises.

Variable	Correlations			
	Means	Std.Dev	PI	C
PI	0,014267	0,024850	1,000000	0, 865413
C	0,070232	0,034761	0,865413	1,000000

The causal relations between the indicators were analysed using the Granger Causality Test, which determined that the value of the time series of innovation potential (in case it causes a change in the time series of an industrial enterprise's competitiveness level) must precede the change in competitiveness time series and therefore has a significant impact on its forecast values (Fig. 2). In particular, the correlation coefficient proves the assumption that innovation potential has a significant influence on the competitiveness of industrial enterprises.

The ADL model was chosen to build the basic forecast model.

According to a preliminary analysis of the factors affecting the competitiveness level of industrial enterprises, it was established that it is necessary to consider the time lag and factor characteristics that contain the previous values of the resulting variable. The model for predicting the competitiveness of industrial enterprises is as follows, and the lag for the competitiveness of industrial enterprises is considered C_{t-1}:

$$C_t = R_1 + R_2 \cdot C_{t-1} + R_3 \cdot PI_t + [CX=F], \quad (4)$$

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where R_1, R_2, R_3 are the forecast model parameters, and *F* is the effect (model shift) for each enterprise under study.

In addition, when building a forecast model to determine the innovation potential of industrial enterprises, the cross-section effect was also taken into consideration, which provides for the adequacy and universality of the model:

$$C_t=0{,}0727+0{,}1180\cdot C_{t-1}+0{,}5472\cdot PI_t+[F], \quad (5)$$

It has been found that this innovation potential has the most significant impact on the competitiveness of industrial enterprises since R_3 parameter is equal to 0.5472, which exceeds the value of R_2 parameter of 0.1180 for competitiveness in the previous period. The results of the model relevance analysis are presented in Table 5.

Table 5. Analysing the relevance of ADL model for predicting the competitiveness level of industrial enterprises.

Dependent Variable: C
Method: Panel Least Squares
Periods included: 6
Cross-sections included: 10
Total panel (unbalanced) observations: 49
$C_t = R_1 + R_2 \cdot C_{t-1} + R_3 \cdot PI_t$

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.072011	0.012014	5.994047	0.0000
C(2)	0.116880	0.158973	1.735216	0.0466
C(3)	0.541819	0.211325	2.563915	0.0145

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.905716	Mean dependent var	0.070607
Adjusted R-squared	0.886462	S.D. dependent var	0.034471
S.E. of regression	0.012056	Akaike info criterion	-5.847535
Sum squared resid	0.005378	Schwarz criterion	-5.326336
Log likelihood	153.8462	Hannan-Quinn criter.	-5.670010
F-statistic	32.63507	Durbin-Watson stat	1.530350
Prob(F-statistic)	0.000000		

It is possible to conclude the significance of the calculated parameters of the model based on the data in Table 5. The determination coefficient is 0.88, which indicates the proposed model's high quality for predicting industrial enterprises' competitiveness level. The F-statistic is 32.635, and the tests according to the Akaike (AIC = 5.84753) and Schwarz (SC = -5.67001) criteria also confirm that the obtained model is correct. The calculations prove that the above model is statistically significant, relevant, and appropriate for predicting the competitiveness level of industrial enterprises based on the current innovation potential and volume of investment in innovation for the previous period. Table 6 shows the results of calculating the effect value for each industrial enterprise and firm studied. The obtained data allowed for the development of an individual forecasting model for each industrial enterprise included in the panel data sample. In general, the results of calculating the fixed effects show that among the studied industrial enterprises, №4, №8, №9 have positive effect values, emphasising the importance of implementing innovations and Industry 4.0 technologies to increase the competitiveness level of these enterprises.

Table 6. The fixed effect value for the studied industrial enterprise.

Enterprises	Fixed Effect
№1	-0,013938
№2	-0,009435
№3	-0,033940
№4	0,036217
№5	-0,005672
№6	-0,017763
№7	-0,016943
№8	0,014951
№9	0,046822
№10	-0,006871

The forecast results based on the proposed model are listed in Table 7. Analysing the forecasts obtained for the competitiveness level of industrial enterprises in 2023-2024, provided that the level of innovation potential is stable, indicates significant inertia in the competitiveness indicator over time. The current competitiveness of industrial enterprises depends on their level in the previous period and their investments in innovation for the same period.

Table 7. Results of forecasting the competitiveness level of industrial enterprises based on ADL model with fixed effect.

Enterprises	Fixed Effect	Competitiveness Level (2023)	Innovation Potential Indicator (2024 forecast)	Competitiveness Level (2024 forecast)	Competitiveness Level (2025 forecast)
№1	-0,01509647	0,059792	0,008888	0,059792	0,074841
№2	-0,00853147	0,012797	0,011009	0,002121	0,006767
№3	-0,0331684	0,017372	0,002121	0,040501	0,076356
№4	0,04667816	0,136148	0,071104	0,096758	0,122614
№5	-0,00660742	0,045248	0,010605	0,06566	0,07474
№6	-0,01683064	0,053025	0,003232	0,060297	0,078073
№7	-0,01701244	0,038178	0,006161	0,056863	0,076053
№8	0,01540654	0,063933	0,022422	0,083426	0,070599
№9	0,04223921	0,094132	0,03737	0,105747	0,105343
№10	-0,0068478	-0,004444	-0,008989	-0,004343	-0,003333

It should be noted that the model's predictive ability is quite reliable because the error does not exceed 10% when comparing the obtained results with the actual sample data (Fig. 2). The results show that investments in innovation and innovation development are important components for ensuring the competitiveness of industrial enterprises. This is confirmed by the study's outcomes, namely, by building the corresponding correlation matrix, which shows a clear relationship between competitiveness indicators and innovation potential. The innovation potential of industrial enterprises has been proven to depend significantly on the volume of investments made in the previous period.

Thus, a time lag requires informed management decisions regarding strategic alternatives for innovative development.

In addition, the time inertia of industrial enterprises' competitiveness level is revealed, which is manifested when the current level of competitiveness depends on its previous value, confirmed by panel data autocorrelation analysis of the competitiveness indicators of the studied enterprises.

The identified feature makes it possible to define the basis for developing and implementing effective management influences for industrial enterprises with different levels of innovation development and to determine the period for achieving the strategic goals set.

Fig. 2. Predictive ability of the propose model for forecasting competitiveness level of industrial enterprises.

It is proposed that the ADL model with fixed effects, which includes indicators with a time lag, be used universally for the studied enterprises whose activity results are included in the panel data sample to forecast the competitiveness of industrial enterprises (Epo et al., 2024). The developed forecasting model proves that the competitiveness level of industrial enterprises depends on their innovation activity, which is based on innovation potential. In particular, according to the proposed model, a conditional increase in innovation potential by 10% leads to an increase in the competitiveness level of industrial enterprises by 5.4%.

Thus, management decisions in innovation development should be based on marketing support to study current market trends and the competitive environment where industrial enterprises are operating. Additionally, it should focus on developing a system for promoting and supporting the processes of introducing innovative technologies and products.

In its turn, controlling support provides for tracking the effectiveness of investments in innovation, optimizing the distribution of limited financial resources between alternative areas of innovation development and minimizing the risks associated with the long-term return on investment in the latest Industry 4.0 technologies in conditions of uncertainty and variability of the external environment.

5. Discussion

In the current political instability, economic crisis, and worsening socioeconomic situation in the country, short-term solutions to increase the efficiency of using available resources in the industrial sector have limited potential. Findings confirm that the stratification of alternatives regarding industrial innovation development of enterprises has a delayed effect, which requires marketing and controlling support for developing and implementing management decisions regarding technologies and innovative products (Qamruzzaman & Wei, 2018).

The identified time lag between investments in innovation and their impact on industrial enterprises' innovation potential indicates the need for long-term planning and implementing flexible mechanisms for controlling and marketing support, which will enable timely adjustment of the enterprise's development vectors through changes in the external environment.

Solving the tasks outlined in the study requires not only applying a balanced management approach but also creating a favourable environment for marketing and controlling the support of management decisions to stimulate the innovation activity of industrial enterprises for national economy restoration and sustainable development (Kuzmynchuk et al., 2024).

Marketing support for the innovation development of industrial enterprises is the key element for the successful commercialisation of new products and technologies and includes various strategies and tools that help enterprises adapt to the rapidly changing market environment. Marketing support for the innovation development of industrial enterprises includes preliminary data collection on potential innovations and free niches in the market with the search for innovative ideas and technologies.

At the product development stage, testing samples in the market is important to identify shortcomings for the successful launch of innovative products and develop an effective pricing policy at the market entry stage. At the growth stage, analysing current demand will make it possible to justify management decisions on expanding market share. The search for new opportunities to maintain market positions is implemented at the innovative product maturity stage. This allows producers to significantly increase their chances of success for new products and technologies.

Marketing support for innovation development is a complex and multifaceted process that requires a comprehensive approach and controlling support for management decisions on choosing strategic alternatives to ensure the successful commercialisation of innovative products.

Controlling support for the innovation development of industrial enterprises allows them to ensure the successful implementation of innovation projects, as it includes monitoring, analysis, and active participation in planning and correcting the project goals. Controlling the key parameters of innovation projects makes it possible to adapt innovation development strategies by changing the conditions of an enterprise's external environment and internal needs, ensuring their successful implementation.

6. Conclusions.

The study confirms the key role of marketing and controlling support in identifying strategic alternatives for industrial enterprises' innovation development. It has been found that industrial enterprises' innovation potential level is primarily determined by the volume of investment in innovations made in the previous period, which proves the time lag to exist and requires informed management decisions regarding the choice of development directions, risk assessment, and feasibility of introducing new technologies.

The proposed model for predicting industrial enterprises' innovation potential based on the ADL methodology allows one to assess the long-term consequences of enterprises' investment policy more accurately. It has been established that effective marketing support, including the analysis of market trends, competitive environment and consumer needs, plays an important role in stimulating the innovation activity of industrial enterprises, increasing their competitiveness and obtaining additional competitive advantages.

Controlling support enables monitoring the effectiveness of investments in innovation, carrying out adaptive resource planning, and minimising risks in conditions of variability and instability of the external environment. Therefore, effective marketing and controlling support are integral parts of the adaptive strategy for sustainable innovation development of industrial enterprises, especially given global challenges and the need to restore the national economy.

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