THE IMPACT OF MODERNIZATION ON THE COMPETITIVENESS INCREASE OF THE ENTERPRISE AND PROVISION OF ITS ECONOMIC SECURITY

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ABSTRACT

Within the article, it is proposed to model of the modernization factor impact on the competitiveness and economic security of the enterprise. For economic modeling of enterprise behavior, the authors propose that the key parameters of the analysis of changes in the level of competitiveness include the speed of modernization, the stability of competitive positions and the scope of modernization changes. The sequence of formalization of the economic-mathematical model of factor analysis of the integration impact of modernization on the competitiveness of the enterprise and ensuring its economic security includes the stage of formalization of parameters, and then determines their weight and gradation; the next stage determines the reference or industry average values. At the penultimate stage of modeling the tools, the general formula of integrated indicators is formalized, based on the importance of parameters. The last stage of factor analysis is to adjust the tools for estimating the parameters of the 3S model, which is focused on taking into account market, sectoral and technological specifications of products or services.

Keywords: Competitiveness, Integration Influence, Speed of Implementation, Stability of Innovations, Space of Modernization, 3S Model, Cognitive Analysis, Enterprises.

INTRODUCTION

Modern challenges to the development of economic systems in the context of globalization put new demands on enterprises. This is due to the emergence and rapid advancement of innovative technologies that ensure the competitiveness of enterprises in both domestic and foreign markets. On the other hand, the development of technology requires companies to pay more attention to ensuring their economic security.

The functioning of each enterprise depends on the state and dynamics of the national economy and global challenges in general. The development of enterprises is very important for

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the state, they are the most productive part of the national economy, because they produce goods, services; carry out research and innovation, providing a competitive space. Given the importance of enterprise development for the economy, an important aspect is to ensure their economic security. The system of economic security of enterprises contributes to the establishment of self-reproduction of enterprises as a system that finds itself in bifurcation conditions of development. The system of economic security allows companies to develop dynamically and efficiently, solving complex problems of socio-economic development, efficient use of resources, resist the negative effects of endogenous and exogenous nature and ensure the competitiveness of enterprises in both domestic and foreign markets. The above and other principles of ensuring the competitiveness of enterprises and their economic security require the acceleration of modernization processes of economic systems at the macro level.

The aim of the study is to develop a methodological approach to modeling the factor impact of modernization on competitiveness and economic security of the enterprise using the model "3S".

LITERATURE REVIEW

Many domestic and foreign scientists have devoted their research to studying the issues of increasing the competitiveness of the enterprise and ensuring its economic security, among which: Aleksandrov et al. (2020), Azhaman et al. (2020), Belyakov et al. (2020), Gonchar et al. (2020), Korepanov et al. (2020), Krawczyk-Sokolowska et al. (2021), Rementsov et al. (2019), Solosich et al. (2021), Vovk et al. (2021) and others.

The results of the study Azhaman et al. (2020) can be of significant practical importance for the operation of newly established enterprises for road transport services, in terms of identifying and setting out the fundamental principles that affect the formation of their economic potential and improve the quality of their work as a whole. In the research of Gonchar et al. (2020), the main factors influencing financial security are grouped, and are the object of the process assessment by managing enterprise potential.

A comparative analysis Belyakov et al. (2020) of foreign trade operations of the countries against the background of scientific and technical development is carried out, and the importance of forming production potential of the machine-building enterprise, which takes into account scientific and technical innovations and shows the rate of economic growth, is emphasized. In the scientific work Krawczyk-Sokolowska et al. (2021), the formulated conclusions are a qualitative diagnosis of the activities of Polish enterprises in terms of the development and implementation of innovations, as well as the economy assessment in terms of innovation potential on a macro scale.

The article (Rementsov et al., 2019) presents current economic content of the concept of production and technological potential of energy companies based on the revision of modern approaches to defining this concept, as well as indicators of the production system implementation. In the study (Aleksandrov et al., 2020), the proposed approach assumes that the assessment of the company's potential should take into account the sum of the net present values of the most desirable projects and the potential residual value of the entity at the end of the project-planning period. In the article (Korepanov et al., 2020), it is noted that the object of

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managerial influence of the crisis enterprise should be the financial stability potential, the settlement of which provides a positive financial balance of the enterprise.

METHODICAL APPROACH

In the study, a factor approach was used to substantiate the areas of the modernization impact of the enterprises competitiveness and ensuring economic security. Subsequently, the factors were formalized through the use of integration technologies and functional dependence. Thus, the factor analysis allowed determining many economic parameters that affect the speed, stability and spaciousness of modernization to increase the competitiveness of enterprises and to ensure its economic security (Popelo et al., 2021).

The study used a heterogeneous mathematical apparatus, which includes the establishment of weighting factors, correlation analysis of calculation parameters, modeling of expert judgments using cognitive analysis, ranking and concordance of evaluation parameters (Tulchynska et al., 2021).

RESULTS

During the period of active reforming state programs and strategies, which is taking place in the Ukrainian economy in recent years, to ensure the competitiveness of enterprises it is necessary to implement modernization in the following areas and subjected to the following conditions:

Complexity of the strategic concept of reform: restrictions on the list of reforms and their timely implementation, the relationship between legal and economic support, assessment of real investment and institutional, labor and technological opportunities for modernization;

Clarity of tactical actions of modernization: failure to fulfill some tasks may lead to the devaluation of the next stages of modernization, while the success of reforms is determined by the sequence of tasks and the heredity of reform;

Rapid adaptation of the modernization process: appropriate changes in strategies and objectives for international and domestic unforeseen impacts must be effective and ensure the continuity of reforms, while reserves must be reconciled between threats of negative impacts and excessive capital accumulation;

Modernization changes in the institutional environment require international support and perception on the external circuit, within the country - to satisfy the population and ensure the coherence of reform directions.

Thus, modernizations affect the competitiveness of enterprises and ensure its economic security through the complexity, coherence, space and sustainability of reforms. The impact of modernization factors on the competitiveness of Ukrainian enterprises, which ensure their economic security in certain areas of management, are described in details (Figure 1).

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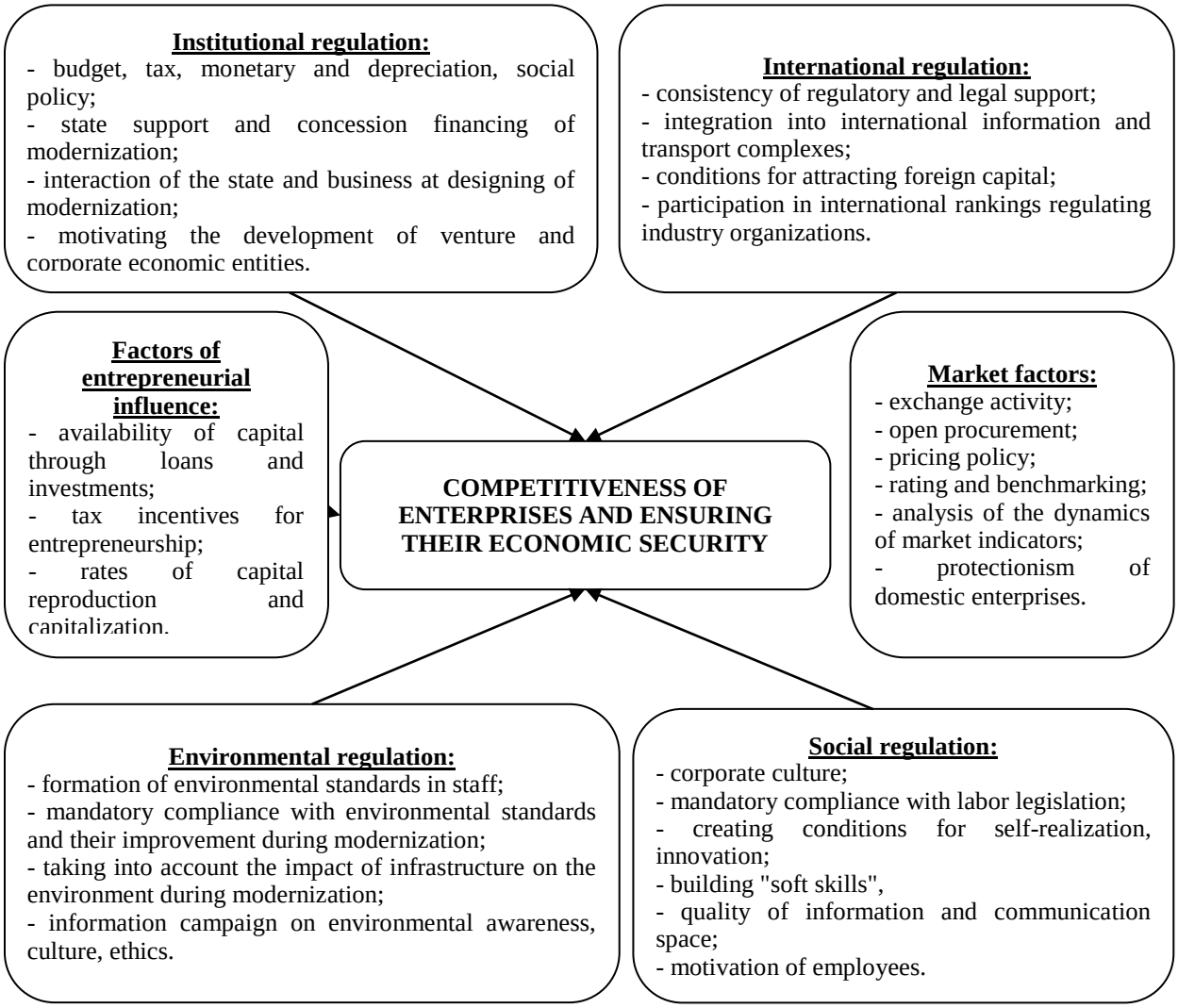

Source: described by the authors.

FIGURE 1
DESCRIPTION OF THE FACTORS OF MODERNIZATION, ENSURING THE COMPETITIVENESS AND ECONOMIC SECURITY OF ENTERPRISES

In the opinion of the authors to assess the impact of modernization on the competitiveness of enterprises and their economic security, it is necessary to use a comprehensive, generalized integrated index, which includes estimates of speed, stability and spaciousness of modernization (hereinafter 3S), which can be expressed through the following functional dependence:

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$$f(C) = (S_p, S_t, S_n), \quad (1)$$

Where *f(C)* – the function of the dependence of competitiveness and economic security of the enterprise;

S_p - the rate of impact of modernization changes on increasing the competitiveness of the enterprise and ensuring its economic security;

S_t - increasing the stability of the competitive position of the enterprise in the market where it operates;

S_n - the scope of modernization of the existing competitive advantages of the enterprise to ensure its economic security.

In order to establish the sequence of analysis, mathematical tools of the factor analysis are used, which is based on determining the set of indicators and indicators that form them. This will determine the optimized number of indicators in each group of factors and their impact on the final result.

These functional parameters of the integration impact on competitiveness must be formalized through a set of their indicators and agree on their weight, correlation and other mathematical forms of feasibility in the model. Therefore, first, the basic conditions for the use of mathematical tools in the construction of the "*3S*" model considering the need to justify the use of many indicators, to establish their weight and consistency, expert assessments, ranking and analysis of deviations, etc., are established.

Formalizing the process of integration impact of modernization on the competitiveness of the enterprise and ensuring its economic security, it is necessary to set modeling goals: in accordance with the task, the main goals are to formalize the system of indicators of speed, stability and spaciousness. And in addition to the purposes of modeling, the universality of the model application to the enterprises of the infrastructural sphere for comparability of the competitiveness between participants of one market or sector are related.

In economic-mathematical modeling of relative complex criteria, different groups of indicators are used: normative, technical or cost, measuring or evaluation, qualitative or quantitative, and so on. For the initial coordination of all indicators in the model, exclusively coefficient indicators that will allow estimating both quantitative, and cost, and qualitative and technical characteristics of modernization process will be used.

To determine a comprehensive integrated indicator of the impact of modernization changes on the competitiveness and economic security of enterprises, we use the method of correlation of the calculated value with the reference value, as well as use weights for groups of calculations.

To model the factor impact of modernization on the competitiveness and economic security of enterprises, we propose to use the following sequence.

At the first stage we will form the list of the basic indicators on each of three parameters.

Firstly, indicators of the speed of the potential implementation and renewal of the enterprise include: the rate of investment; the rate of modernization; dynamics of expenses for

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innovative activity of the enterprise; dynamics of changes in the capitalization rate of the enterprise; changing the duration of the innovation and investment process.

Secondly, indicators of stability of the modernization vector of the enterprise are as follows: resource intensity of the innovation and investment process; speed of development of a new market or technology; the level of the technologies digitalization; the level of the intellectual potential activation; the share of highly qualified staff in the total number of employees.

The third group of indicators evaluated in the parameter of spatiality includes; scale of modernization (share of coverage of enterprise assets); rate of change in the potential value of the enterprise; profitability of the implementation of innovation and investment projects; return on investment; change in market share.

At the second stage of formalization of the model is the establishment of the weight of indicators in the evaluation system using the tools of cognitive judgments (Table 1)

Table 1
ESTABLISHING THE WEIGHT OF INDICATORS IN THE "*3S*" MODEL USING THE TOOLS OF COGNITIVE JUDGMENT, %

Indexes	Cognitive judgments of experts											Average value
	1	2	3	4	5	6	7	8	9	10	11	
1. Speed:	25	25	20	30	20	20	25	30	20	35	20	23,6
1.1. rate of investment	15	25	30	20	20	25	20	20	25	25	20	22,3
1.2. pace of modernization	20	20	40	25	30	25	20	40	15	25	25	25,9
1.3. dynamics of innovation costs	30	20	10	20	25	30	20	10	30	10	20	20,5
1.4. dynamics of changes in the capitalization rate of the enterprise	25	15	10	25	10	10	20	15	20	10	20	16,4
1.5. change in duration	10	20	10	10	15	10	20	15	10	10	15	13,2
2. Stability:	40	40	40	35	40	35	40	45	35	20	40	37,3
2.1. resource consumption	25	25	25	20	15	15	25	20	25	35	25	23,2
2.2. speed of development of a new market or technology	20	15	20	15	25	20	20	20	20	30	20	20,5
2.3 level of digitalization of technologies	15	15	15	10	20	20	15	15	15	10	20	15,5
2.4. level of the activation of intellectual potential	25	25	25	30	20	30	25	30	25	10	25	24,5
2.5. share of highly qualified staff in the total number of employees	15	20	15	25	20	15	15	15	15	15	10	16,4
3. Spatial:	35	35	40	35	40	45	35	25	45	45	40	39,1
3.1. scale of modernization	20	15	25	25	25	30	25	25	5	5	15	19,5
3.2. rate of change in the value of the potential of the enterprise	20	25	15	20	20	30	25	30	25	25	15	22,7
3.3. profitability of the project implementation	20	25	30	25	20	10	25	20	25	35	30	24,1
3.4. return on investment	15	25	15	15	20	15	20	20	35	15	20	19,5
3.5. change in market share	25	10	15	15	15	15	5	5	10	20	20	14,1
The total weight of the parameter, h.	100	100	100	100	100	100	100	100	100	100	100	

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At the third stage of modeling the factor impact of modernization on the competitiveness and economic security of the enterprise is the establishment of reference values of sound evaluation indicators.

At the final fourth stage we carry out the final calculations of the integrated impact assessment according to the formula:

$$C = S_p * q_p + S_t * q_t + S_n * q_n \quad (2)$$

where S_p, S_t, S_n - respectively, the parameter of speed, stability of the impact of modernization on increasing competitiveness and ensuring the economic security of the enterprise and the scope of modernization of the existing competitive advantages;

q_p - respectively, the weight of the parameter of speed, stability and spatial impact of modernization.

Modeling the dependence of the enterprise competitiveness on the integrated parameters of modernization in the "3S" model is implemented through the consistency of quantitative, cost and regulatory indicators, which together allow a comprehensive analysis of the dynamics, cost, and direction of the modernization process.

At the last stage of modeling it is expedient to carry out the gradation of quantitative expression of the criterion of the modernization impact on competitiveness that in the future will allow to apply the developed "*3S*" model in the strategic analysis of the enterprises. To meet strategic goals of modernization, two descriptive characteristics should be considered, namely: sufficient or insufficient impact of modernization in the process of increasing competitiveness, which is performed through a system of conditions:

$0 < C < 1$ - insufficient impact of modernization on increasing the competitiveness and economic security of enterprises in the infrastructure sector;

$C > 1$ - sufficient integration impact of modernization, which provides increasing competitiveness and economic security of the enterprise and new competitive advantages.

Such requirements are basic when deciding on the modernization implementation using qualitatively new technologies or commercialization of innovations.

To test the proposed modeling of the factor impact of modernization on the competitiveness and economic security of enterprises using the model "3S" were selected the most powerful enterprises in the infrastructure market in Ukraine, including the following enterprises: JSC Ukrzaliznytsia, KP Kyivpastrans, SE MA Boryspil. The results of the calculations of modeling the factor impact of modernization on the competitiveness and economic security of selected enterprises are presented in Table 2.

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Table 2
THE RESULTS OF CALCULATIONS OF THE IMPACT OF MODERNIZATION ON THE COMPETITIVENESS AND ECONOMIC SECURITY OF ENTERPRISES SELECTED FOR THE STUDY USING THE MODEL "3S"

Enterprises	Analyzed period					Dynamics of the indicator change, 2019/2015
	2015	2016	2017	2018	2019	
JSC "Ukrzaliznytsia"						
The level of competitiveness and economic security	1.619	1.748	1.198	1.232	1.262	1.619
including speed coefficients	0.479	0.588	0.061	0.051	0.073	0.478
stability	0.221	0.251	0.277	0.314	0.334	0.219
spatiality	0.929	0.909	0.861	0.873	0.852	0.933
SE "MA "Boryspil"						
The level of competitiveness and economic security	1.173	1.254	1.361	1.703	1.359	1.158
including speed coefficients	0.143	0.169	0.154	0.206	0.129	0.901
stability	0.279	0.367	0.432	0.534	0.273	0.980
spatiality	0.752	0.718	0.775	0.963	0.957	1.273
KP "Kyivpastrans"						
The level of competitiveness and economic security	1.067	1.041	1.029	1.221	0.118	0.110
including speed coefficients	0.055	0.122	0.142	0.044	0.005	0.084
stability	0.212	0.166	0.182	0.222	0.018	0.083
spatiality	0.800	0.752	0.705	0.956	0.095	0.119

Source: constructed by the authors based on the evaluation results.

Presented in Table 2 results of modeling the factor impact of modernization on the competitiveness and economic security of all enterprises using the model "*3S*" proved that there is a direct dependence of competitiveness of enterprises on the existing institutional and market environment, dynamic innovation and investment support, and the level of staff competence.

CONCLUSION

The assessment of the impact of modernization on competitiveness and economic security among the studied enterprises proved the existing monopoly position among certain sectors of the infrastructure sector, which shows the overall picture of the competitive position. Updating of technologies, innovative orientation of the enterprise, maintenance and infrastructural objects.

The application of the "*3S*" model for both the studied and other enterprises will provide an opportunity to determine the change in the market position of the enterprise and its competitiveness due to the realization of modernization potential. This is especially important for infrastructure companies, as international cooperation in the field of transportation and services

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is not just a way to ensure technical compliance with ever-increasing international standards, but also a tool for integrated strategic management of enterprise development and profitability.

The scientific novelty of this study is to develop a methodological approach to modeling the factor impact of modernization on competitiveness and economic security of the enterprise using the model "3S", which takes into account the impact of modernization changes on increasing the competitiveness of the enterprise and ensuring its economic security, the market where it operates and the scope of modernization of the existing competitive advantages of the enterprise to ensure its economic security.

Further research in the direction of modeling the factor impact of modernization on the competitiveness and economic security of the enterprise requires the provision of innovation and investment components of the economic security of enterprises to increase their competitiveness in the market.

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