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Valentyna Levchenko

D.Sc., Professor, Kyiv National University of Technologies and Design, Ukraine

Anton Boyko

Ph.D., Associate Professor, Sumy State University, Ukraine

Taras Savchenko

D.Sc., Professor, Sumy State University, Ukraine

Victoria Bozhenko

Ph.D., Associate Professor, Sumy State University, Ukraine

Yuliia Humenna

Ph.D., Associate Professor, Sumy State University, Ukraine

Ruslan Pilin

Senior software developer, Openlink Financial, USA

STATE REGULATION OF THE ECONOMIC SECURITY BY APPLYING THE INNOVATIVE APPROACH TO ITS ASSESSMENT

Abstract. *Given the current integration processes of the world economies, the issue of economic security of the state is extremely acute. The openness of markets facilitates the free flow of resources but also threatens the rapid transfer of crisis phenomena from one economy to another. There is a need to develop an innovative methodological tool for assessing the level of economic security in the country based on the calculation of a generalized indicator that will serve as a benchmark in the formation of state economic policy in the context of ensuring its sustainable growth and countering internal and external threats. The methodological tools of the study are methods of normalization, Fishburn's rule, multiplicative model. Assessment of economic security level in the article is carried out in the following logical sequence: formation of an extended list of indicators characterizing the economic security of the state; characteristics of indicators in terms of opportunities and risk; determining the priority of indicators in the summarizing indicator; bringing indicators to a single measurement system; calculation of the integral indicator of economic security by constructing a multiplicative model; qualitative interpretation of the integral indicator of economic security. The results of the selection of relevant factors influencing the economic security of the state revealed that the selected determinants confirm the hypothesis of financialization of all economic processes in Ukraine and the need for state regulation of the financial system in order to ensure economic security. Empirical calculations have shown that during 2008–2018, Ukraine's level of economic security can be assessed as medium or low, and its dynamics correlate with crisis processes in the financial and economic sector and exacerbation of political instability in the country. Taking into account the low level of economic security in Ukraine, the authors elaborated a set of measures to improve the state regulation of economic security within the institutional, procedural and functional elements of it, as well as substantiate the impact of the proposed innovations on the economic security of the state. The results of the research can be useful for governments in order to adequately respond to destabilizing factors in the national economy.*

Keywords: economic security, integral indicator, innovation, money laundering, state regulation.

Introduction. The state of national economic security plays a key role in the sustainable development of society, providing conditions for economic growth, increasing the level of investment attractiveness and competitiveness of the country in the international arena, and the formation of the proper quality of social standards for the population. The consistent increase of globalization and integration processes, liberalization and openness of financial systems in the world, rapid development of the cryptocurrency market and limited opportunities to accurately predict further trends in the development of the global financial system risks that accompany the companies' activities, and increase the internal and external threats have a negative impact on the economic security of the state. Therefore, the development of the methodological framework for assessing the level of economic security should base on the use of the latest approaches to the definition of an integral indicator. An effectively calculated level of economic security of the state is a kind of benchmark in the formation

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of state economic policy in the context of ensuring its sustainable growth and countering internal and external threats.

Literature Review. Scientific literature extensively studies the issue of the relationship between economic security and the consequences of globalization and liberalization of relations in society. Countries struggle to gain access to natural, intellectual, financial and other types of resources (Renner, 2002). Globalization has transformed the traditional understanding of economic security and now provides for constant monitoring of risks associated with cross-border networks and the volatility of the financial sector (Kahler, 2004). According to (Bergeijk et al., 2009), the economic security of the state largely depends on the level of economic diplomacy, i.e. ways of organizing international economic relations, as well as means of implementing foreign economic policy. When analyzing the financial systems of developing countries, Fujing (2007) highlights the need to create a mechanism to support the financial and economic security of such countries from the danger of the openness of their economies.

Considering the shadow economy as a key threat to the economic security of the state, Bilan et al. (2019) estimated its scale based on such groups of indicators as the tax system, labour system, trade openness, banking system, quality of state regulations, and industry development. Moreover, the authors revealed a significant disincentive effect of the shadow economy on the level of demand in the investment market in the country. Chistnikova (2017) has identified the negative impact of corruption on the economic security of the country.

The activity of financial and credit institutions is an important element in the system of economic security of the state. In particular, Tvaronavičienė et al. (2018) the activity of banks is highlighted among many of the factors that affect the economic security of the euro area. Having built a regression model with a fixed effect for the UK and Germany, the authors found that there was a significant relationship between the level of liquidity in the banking sector and the economic security of the state.

It is advisable to take anti-money laundering measures to increase the economic security of the state. It is feasible to apply high-quality informational support based on the system model in DFD notation to reveal suspicious banking operations in a timely manner and minimize the human factor in transaction verification (Leonov, 2019).

All developed countries of the world and most developing countries have enshrined national methods for assessing the economic security of the state in law. The main objective of these methods is the formation of an analytical framework, which acts as the basis for the adoption of strategic management decisions. These decisions in most cases are aimed at achieving public interests, the sustainability of financial and economic development and the independence of the national economy from external interventions.

At the same time, the development of innovative technologies in 2010-2018 has led to a radical transformation of the financial sector and business conditions for business entities. Financial institutions transfer all business processes to the digital plane, changing the services themselves, actively use blockchain technology to solve managerial issues; and business entities can both use new financial tools of banks, insurance companies and other financial intermediaries and carry out settlements outside the financial sector of the state using cryptocurrency.

Thus, despite the individual interpretation of economic security in each country and the different approaches to the mechanism for ensuring it, the change in the methods for the quantitative determination of the integral indicator of the economic security of the state is becoming urgent. At the same time, changes should affect both the indicators that form the input array of information for a comprehensive assessment of economic security and the method of taking into account the features of these indicators. This is due to the fact that economic processes under modern business conditions are already taking place in completely different scenarios than five or ten years ago, the development of derivative financial tools and the free movement of funds reduce the critical level of public debt for the national economy, the difficulty of obtaining credit resources by business entities complicates the control of inflation and regulation of the process of dollarization of the economy, etc.

An innovative solution for stabilizing the financial system and ensuring a high level of economic security of the state involves taking into account public trust in financial institutions, which is determined based on a combination of regulatory rules and the behaviour of economic agents (their feelings, emotions and other subjective characteristics) (Bilan et al., 2019).

Particular attention should be paid to the methodological framework for determining structural changes in the functioning of the national economy and identifying key threats based on the bifurcation theory premises, which makes it possible to establish the points of transition into a crisis state (Vasilyeva et al., 2019). Grigoreva and Garifova (2015) justified that the level of economic security of the country depends on the economic cycles.

In foreign practice, the concepts of country stability, reliability, country risk, stability are applied to determine the level of economic security of the state, and two approaches are mainly used to evaluate it: 1) calculation of the state's reliability (Brown et al., 2015; Pappu et al., 2010; Pereira et al., 2005); 2) assessment of country risks (Nordal, 2001; Oetzel et al., 2001; Schroeder, 2008; Timurlenk et al., 2012; Wagner, 2012).

IMF (2017) experts quantify countries' overall vulnerability to a broader range of crises, including those to fiscal, financial, growth (AEs and EMs), and food supply (LICs). Brown et al. (2015) proposed managerial tool to measure Robinson Country Risk Index which incorporates four broad dimensions-governance, economics, operations, and society. Nordal (2001) estimated country risk using a valuation model based on the contingent claims valuation methodology, where country risk indices are used as state variables.

Methodology and research methods. Based on the study of theoretical principles of the formation and ensuring the economic security of the state, we propose to consider it as a state of dynamic equilibrium of the economic system, in which the organizational and functional architecture of the institutional environment of the system of state regulation of the economy is built on the principles of non-discretion and allows detecting endogenous and exogenous threats in advance, minimizing the negative effects they provoke, adapting quickly to changes in the external and internal environment, taking into account supranational, national and local targets for sustainable economic development and based on balancing the interests of different groups of economic agents. This approach, unlike the existing ones, systematically combines the individual elements of opportunistic, progressive, stakeholder, institutional, and basic contextual approaches, determines the specific features of building a system for ensuring economic security, namely: taking into account existing, potential, hidden, and under-received financial resources, ensuring objectivity and adaptability of regulatory interventions in accordance with the dynamic context in the formation of drivers and inhibitors of economic security, prioritizing preventive measures over reacting ones.

Therefore, determining the integral indicator for assessing the level of economic security of the state involves the gradual implementation of the following steps:

- formation of an extended list of indicators characterizing the economic security of the state;
- characteristics of indicators in terms of opportunities and risk;
- determining the priority of indicators in the summarizing indicator;
- bringing indicators to a single measurement system;
- calculation of the integral indicator of economic security by constructing a multiplicative model;
- qualitative interpretation of the integral indicator of economic security.

Based on critical analysis and generalization of existing scientific and methodological approaches to the quantitative measurement of this indicator, a grouping of indicators was carried out within two vectors of impact on the economic security of the state: direct and indirect. The principal component analysis was used to determine that the most relevant indicators in the formation of the economic security of the state were 11 indicators of direct impact: the state budget deficit (% of GDP), the level of redistribution of GDP through the consolidated budget, the volume of transfers from the state budget (% of GDP), the volume of total debt (% of GDP), the ratio of total payments for servicing external debt to state budget revenues, the volume of loans to the real sector of the economy by banks (% of GDP), the share of foreign capital in the authorized capital of banks, the country's international reserves in months of imports, the level of

dollarization, the share of foreign currency in the money supply; the volume of domestic investment in GDP, the volume of foreign direct investment in GDP, and 11 indicators of indirect impact: corruption control, government efficiency, political stability and the absence of violence/terrorism, the quality of regulation, the rule of law, transparency and accountability, inflation, unemployment, nominal wages (US dollars), Gini coefficient, the level of the shadow economy, (% of GDP)). The State Statistics Service of Ukraine was selected as the source of information for determining the level of economic security. The selected relevant determinants of the economic security of the state confirm the hypothesis of the financialization of the Ukrainian economy and the need for state regulation of the financial system in order to ensure the economic security of the state.

The next stage of the proposed methodology for a comprehensive assessment of the economic security of the state includes the innovative component that allows obtaining adequate results in the most recent economic conditions. Thus, it is proposed to characterize selected indicators for 2008-2018 both in terms of opportunities (which they can provide for economic security) and in terms of risk (which they can create for economic security). Accomplishing this task requires the following: the nature of the relevant indicator within its incentive or disincentive effects; splitting the interval between the minimum and maximum possible values for the studied time interval into 11 intervals; the transition to binary quantities occurs based on the entry of each indicator for the corresponding year in a certain interval; generalization of the unit weight of binary indices with a single value within 11 confidence levels.

Practical implementation will better illustrate the above steps of the methodology for evaluating the integral indicator for assessing the level of economic security of the state. Thus, firstly, we will divide the interval between the minimum possible and maximum possible values of each of the indicators of direct and indirect impact for 2008-2018 into 11 intervals of various levels of confidence using the following formulas (we will demonstrate an example of direct impact indicators):

interval 1 – 0% risk and 100% opportunity:

$$\min_t k_{pdit} \quad (1)$$

where k_{pdit} is the actual value of the i -th disincentive indicator for the t -th year;

interval 2 – 10% risk and 90% opportunity:

$$\left(\min_t k_{pdit}; \min_t k_{pdit} + \frac{\max_t k_{pdit} - \min_t k_{pdit}}{9} \right] \\ = \left(\min_t k_{pdit}; \frac{\max_t k_{pdit} + 8 \cdot \min_t k_{pdit}}{9} \right] \quad (2)$$

interval 3 – 20% risk and 80% opportunity:

$$\left(\frac{\max_t k_{pdit} + 8 \cdot \min_t k_{pdit}}{9}; \min_t k_{pdit} + 2 \cdot \frac{\max_t k_{pdit} - \min_t k_{pdit}}{9} \right] \\ = \left(\frac{\max_t k_{pdit} + 8 \cdot \min_t k_{pdit}}{9}; \frac{2 \cdot \max_t k_{pdit} + 7 \cdot \min_t k_{pdit}}{9} \right] \quad (3)$$

interval 4 – 30% risk and 70% opportunity:

$$\left(\frac{2 \cdot \max_t k_{pdit} + 7 \cdot \min_t k_{pdit}}{9}; \min_t k_{pdit} + 3 \cdot \frac{\max_t k_{pdit} - \min_t k_{pdit}}{9} \right] \\ = \left(\frac{2 \cdot \max_t k_{pdit} + 7 \cdot \min_t k_{pdit}}{9}; \frac{3 \cdot \max_t k_{pdit} + 6 \cdot \min_t k_{pdit}}{9} \right) \quad (4)$$

This calculation logic is preserved up to interval 10:
interval 10 – 90% risk and 10% opportunity:

$$\left(\frac{8 \cdot \max_t k_{pdit} + \min_t k_{pdit}}{9}; \min_t k_{pdit} + 9 \cdot \frac{\max_t k_{pdit} - \min_t k_{pdit}}{9} \right) \\ = \left(\frac{8 \cdot \max_t k_{pdit} + \min_t k_{pdit}}{9}; \max_t k_{pdit} \right) \quad (5)$$

interval 11 – 100% risk and 0% opportunity:

$$\max_t k_{pdit} \quad (6)$$

Formulas similar to those described above (1) - (6) are used within the incentive indicators of direct and indirect impact, but they have an inverse indicator of risk and opportunity.

The next step in this stage is to make the transition to binary values based on the entry of each indicator for the corresponding year in a certain interval of confidence level – a single value if the actual value for a certain year enters the interval between the minimum and maximum values and zero in the other case.

The final step is summarizing the unit weight of binary indices with a single value within eleven confidence levels as an estimate of opportunity (by summing the binary indices defined in the previous step), followed by paying attention to ten and the difference between 100%.

The third stage of the proposed method involves determining the priority of indicators using the Fishburn's formula (in terms of direct impact indicators) and the priority of indirect impact indicators:

$$w_{pi} = \frac{2 \cdot (N - n_i + 1)}{N \cdot (N + 1)} \quad (7)$$

where w_{pi} – the weight factor of the i -th direct impact indicator;
 N – the total number of direct impact indicators;
 n_i – a rank of the considered i -th indicator;

Moreover, given the hypothesis of the different degree of impact of direct and indirect indicators on the overall assessment of the economic security of the state, 70% and 30% respectively, there is a need to adjust the calculated weights and obtain the final levels.

The fourth step involves normalizing the inputs by a relative method in terms of those time series that are only non-negative. Negative values of the indicators require additional intermediate adjustments by adjusting to the minimum possible module level and the root-mean-square deviation over the considered period.

- normalization of direct impact indicators:

$$n_{pit} = \frac{k_{pit}}{\max_t k_{pit}} \quad (8)$$

where n_{pit} – the value of the i -th direct impact indicator for the t -th year that is normalized by the relative method;

- normalization of indirect impact indicators:

$$n_{oit} = \frac{k_{oit} - \min_t k_{oit} + \sigma_{ot}}{\max_t (k_{oit} - \min_t k_{oit} + \sigma_{oit})} \quad (9)$$

where n_{oit} – the value of the i -th indirect impact indicator for the t -th year that is normalized by the relative method; σ_{ot} – the root-mean-square deviation of the indirect impact indicators.

The next step is the calculation of the integral indicator for assessing the economic security of the state by constructing a multiplicative nonlinear model (a combination of a step function and the Harrington method) of the convolution of indicators of the direct and indirect impact that were normalized by the relative method:

$$ES_t = \sqrt{\frac{\exp\left(-\exp\left(-\prod_i \left(n_{dit} \cdot \frac{r_{di}}{100}\right)^{w_{di}} \prod_i \left(n_{mit} \cdot \frac{r_{mi}}{100}\right)^{w_{mi}}\right)\right)}{\exp\left(-\exp\left(\prod_i \left(n_{dit} \cdot \frac{m_{di}}{100}\right)^{w_{di}} \prod_i \left(n_{mit} \cdot \frac{m_{mi}}{100}\right)^{w_{mi}}\right)\right)}} \quad (10)$$

where ES_t – the level of economic security of the state; n_{pit} – the value of the i -th direct impact indicator for the t -th year that is normalized by the relative method; r_{pi} – a fuzzy-logical risk assessment of the i -th direct impact indicator; w_{pi} – a weight factor of the i -th the direct impact indicator; n_{oit} – the value of the i -th indirect impact indicator for the t -th year that is normalized by the relative method; r_{oi} – a fuzzy-logical risk assessment of the i -th indirect impact indicator; w_{oi} – a weight factor of the i -th indirect impact indicator; m_{pi} – a fuzzy-logical opportunity assessment of the i -th indicator of direct impact; m_{oi} – a fuzzy-logical opportunity assessment of the i -th indirect impact indicator;

Certain complications in the interpretation of a comprehensive assessment of the economic security of the state may result from a high concentration of quantitative assessment levels of the integrated indicator of economic security. It is proposed to solve this problem as follows:

$$ES_{qt} = \frac{ES_t - \min_t ES_t + \sigma_{ES}}{\max_t ES_t - \min_t ES_t + 3 \cdot \sigma_{ES}} \quad (11)$$

where ES_{qt} – the adjusted level of economic security of the state for the t -th year.

The values obtained as a result of the practical implementation of formula 11 allow for a qualitative interpretation of the integral indicator of the economic security of the state within the following levels: high [0.75-1.00]; medium [0.50-0.75]; low [0.25-0.50]; critical [0.00-0.25].

Diagram 1 shows the level of economic security of Ukraine for 2008-2018.

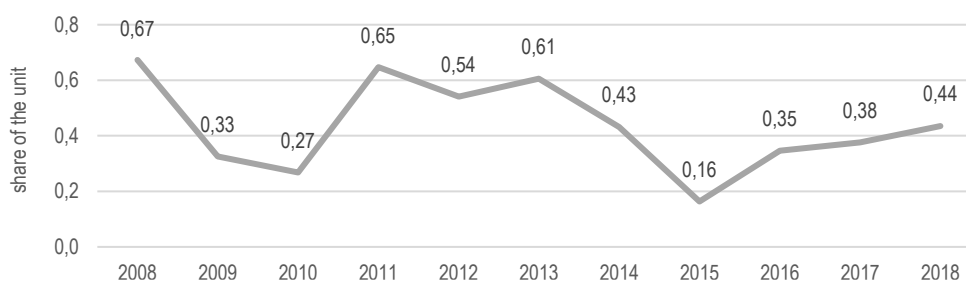


Figure 1. Dynamics of the level of economic security of Ukraine during 2008-2018

Sources: compiled by authors

Results. The results of the calculations show that the dynamics of the integral indicator of economic security fully correspond to the trajectory of financial and economic turmoil and temporary stability in Ukraine during 2011–2018. Thus, the banking crisis of 2008-2009 characterized the rapid decline in the level of economic security of the state to the critical one in 2010; the political crisis of 2014, which affected primarily the financial system, led to a further reduction of the integral indicator of economic security to a critical level in 2015; some stability of the integral indicator of economic security was observed in 2011-2013 when it was at the average level and short-term financial stability was observed in Ukraine.

Given the sufficiently low level of economic security of Ukraine, it is advisable to identify a set of priority areas for improving the existing system of regulation of economic processes in Ukraine within three key elements (table 1): institutional (aimed at improving the anti-money laundering infrastructure, improving the effectiveness of the activities of regulatory agencies), functional (formation of a legal environment that minimizes the risk of crisis situations, financial instability, etc.) and process (focused on technology and methodological aspects of using banks or other institutions for money laundering, for shadow schemes).

Table 1. Areas for improvement of state regulation of economic security

Priority areas of activity of public authorities	Impact on the economic security of the state
<i>Institutional elements</i>	
Improvement of interagency relationships by combining the efforts of representatives from the financial sector, government agencies, regulators and supervisors	- reduction of the volume of fictitious transactions in foreign trade and investment spheres; - intensification of the fight against smuggling and customs offenses;
Deepening cooperation and ensuring coordination between states	- termination of conversion centers
Creation of national financial intelligence agency and ensuring its financial and political independence	- reducing cybercrime; - ensuring fair competition rules; - counteracting fraudulent accounting and financial reporting that aims to minimize/evade taxes and budgetary payments
Introducing a cross-sectoral approach to control over the business reputation of top managers of financial and credit institutions	leveling the conflict of interests between actors representing the state and private business
Improvements based on the latest methodological support for the educational process of professional development programs for employees whose functional responsibilities relate to the anti-money laundering	ensuring timely identification of risk of money laundering or effective localization of consequences of a risky situation with the least financial and reputational losses
<i>Functional elements</i>	
Continuous implementation of the recommendations of the FATF, the Egmont Group, UNODC, IMF, NATO MONEYVAL, OSCE, PACE and other in national legislation	reducing the risk of using a variety of tools by business entities and citizens within the country for money laundering
Establishing a legal regime for regulating virtual assets and virtual currency	de-shadowing of mining revenues, asset purchase and sale operations on cryptocurrency exchanges
Strengthening the control and supervision of markets for precious metals and precious gems, the market for works of art, as well as for activities in the field of sports and other pari-mutuel betting	- reduction of capital withdrawal through these activities; - increase in tax revenues to the budget due to the de-shadowing of these activities
<i>Process elements</i>	
Use of technology-oriented products and solutions to monitor businesses and citizens in the context of their potential involvement in criminal proceeds	accelerates the detection of illegal or questionable financial transactions through the use of machine learning algorithms and artificial intelligence
Updating the methodology for assessing the risk of money laundering and changes in the external environment	improving the efficacy of internal state control and supervision of the entities of the primary financial monitoring

Sources: compiled by authors

Conclusions. Implementation of the above measures to improve the anti-money laundering system will allow in the near future to achieve an increase of investment attractiveness of the country due to the better image of the country, increase of revenues to the budgets of different levels due to the de-shadowing of tax bases, creation of conditions for attracting funds from the legalization of cryptocurrency from neighboring countries by providing legal status to this type of activity, reduction of the outflow of national capital outside the country, decriminalization and the de-shadowing of the national economy, etc. The prospect of further research is to determine the effectiveness of regulatory state measures on improving the level of economic security of the national economy.

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В. Левченко, д.е.н., доцент, Київський національний університет технологій та дизайну (Україна);

А. Бойко, к.е.н., доцент, Сумський державний університет (Україна);

Т. Савченко, д.е.н., професор, Сумський державний університет (Україна);

В. Боженко, к.е.н., доцент, Сумський державний університет (Україна);

Ю. Гуменна, к.е.н., Сумський державний університет (Україна);

Р. Пілін, компанія «Oreplink Financial» (США).

Державне регулювання економічної безпеки шляхом застосування інноваційних підходів до її оцінювання

За сучасних інтеграційних процесів світових економік надзвичайно гострим є питання економічної безпеки держави. Відкритість ринків сприяє вільному перетіканню не лише ресурсів, а і несе загрозу швидкого перенесення кризових явищ із однієї економіки в іншу. Постає необхідність у розробці методичного інструментарію для оцінювання рівня економічної безпеки в державі на основі розрахунку узагальнюючого показника, що слугуватиме бенчмарком при формуванні державної економічної політики у контексті забезпечення її стійкого зростання й протидії внутрішнім та зовнішнім загрозам. Методичним інструментарієм проведеного дослідження є: методи нормалізації, правило Фішберна, мультиплікативна модель. Оцінювання рівня економічної безпеки в статті здійснено в наступній логічній послідовності: формування розширеного переліку індикаторів, що характеризують економічну безпеку держави; характеристика показників з точки зору можливостей та ризику; визначення рівня пріоритетності індикаторів в узагальнюючому показнику; приведення показників до єдиної системи вимірювання; розрахунок інтегрального показника економічної безпеки шляхом побудови мультиплікативної моделі; якісна інтерпретація інтегрального показника економічної безпеки. За результатами відбору релевантних факторів впливу на економічну безпеку держави встановлено, що обрані детермінанти підтверджують гіпотезу про фінансіалізацію усіх економічних процесів в Україні та необхідність державного регулювання саме фінансової системи з метою забезпечення економічної безпеки. Емпіричні розрахунки засвідчили, що протягом 2008–2018 рр. рівень економічної безпеки України можна оцінити як середній чи низький, а його динаміка корелює з кризовими процесами у фінансово-економічному секторі та загостренням політичної нестабільності в країні. Беручи до уваги низький рівень економічної безпеки в Україні, авторами розроблено комплекс заходів щодо удосконалення державного регулювання економічної безпеки в межах інституційного, процесного, функціонального її елементів, а також обґрунтовано вплив запропонованих новацій на економічну безпеку держави.

Ключові слова: економічна безпека, інтегральний показник, інновації, легалізація кримінальних доходів, державне регулювання.

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