

<https://doi.org/10.31891/2307-5740-2025-338-34>

UDC: 332.1:004.056.5

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EFFECTIVENESS OF DIGITAL TOOLS FOR ANALYSIS AND FORECASTING IN THE FIELD OF INTERNATIONAL ECONOMY

Digital tools for analysis and forecasting in the international economy [1] are a set of technological solutions based on the processing of large amounts of data, mathematical models and artificial intelligence that allow studying the dynamics of economic processes on a global scale and predicting future trends. They combine modern data processing technologies such as machine learning, Big Data, artificial intelligence algorithms and econometric models to analyse complex economic relationships and interactions between countries, multinational companies and financial markets. In this context, these tools are becoming the basis for strategic decision-making by governments and businesses, helping to better understand global economic processes and predict future market changes.

Digital analytics and forecasting tools allow modelling various scenarios for the global economy, taking into account a wide range of factors, such as changes in global trade, currency fluctuations, redistribution of investment flows and political events. As such, these tools allow for the efficient use of data to assess potential risks and opportunities, making them extremely useful in times of global economic uncertainty. In addition, they help optimize evidence-based economic decisions by providing more accurate and informed forecasts.

Keywords: Digital tools Big Data technologies Interpretability digital technologies

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ЕФЕКТИВНІСТЬ ЦИФРОВИХ ІНСТРУМЕНТІВ ДЛЯ АНАЛІЗУ ТА ПРОГНОЗУВАННЯ В ГАЛУЗІ МІЖНАРОДНОЇ ЕКОНОМІКИ

Цифрові інструменти для аналізу та прогнозування в міжнародній економіці — це набір технологічних рішень, заснованих на обробці великих обсягів даних, математичних моделях та штучному інтелекті, які дозволяють вивчати динаміку економічних процесів на глобальному рівні та прогнозувати майбутні тенденції. Вони поєднують сучасні технології обробки даних, такі як машинне навчання, Big Data, алгоритми штучного інтелекту та економетричні моделі для аналізу складних економічних взаємозв'язків та інтеракцій між країнами, транснаціональними компаніями та фінансовими ринками. У цьому контексті ці інструменти стають основою для стратегічного прийняття рішень урядами та бізнесом, допомагаючи краще розуміти глобальні економічні процеси та прогнозувати зміни на ринках у майбутньому. Цифрові аналітичні та прогнозувальні інструменти дозволяють моделювати різні сценарії для глобальної економіки, враховуючи широкий спектр факторів, таких як зміни в міжнародній торгівлі, валютні коливання, перерозподіл інвестиційних потоків та політичні події. Таким чином, ці інструменти дозволяють ефективно використовувати дані для оцінки потенційних ризиків та можливостей, що робить їх надзвичайно корисними в умовах глобальної економічної невизначеності. Крім того, вони допомагають оптимізувати економічні рішення, що базуються на доказах, надаючи більш точні та обґрунтовані прогнози.

Ключові слова: цифрові інструменти, технології Big Data, інтерпретованість цифрових технологій

INTRODUCTION

Econometric models are the main tool for analysing and forecasting economic processes based on statistical methods and mathematical equations. Such models allow for a detailed study of economic trends by using historical data to develop accurate forecasts. Econometric models are effectively used to forecast macroeconomic indicators, such as gross domestic product, inflation and unemployment, and to assess the impact of economic policies on these indicators.

This category includes methods such as regression analysis, vector autoregressive (VAR) models, and time series models such as ARIMA [164]. Due to their ability to reveal the dependencies between variables, econometric models provide important information for economic strategy.

Machine learning and artificial intelligence are the next stage in the evolution of digital analysis and forecasting tools.[2] Machine learning includes a variety of techniques, including classification, clustering and regression. These methods allow creating models that are trained and improved based on new data. Artificial intelligence, in turn, uses such models to process complex data sets and perform detailed analyses, enabling accurate financial market forecasts, credit risk assessment and the detection of potential economic anomalies.

The importance of these tools lies in their ability to integrate diverse data sources and adapt to changing conditions in a timely and rapid manner, which significantly increases the accuracy of forecasts and the effectiveness of decisions.

Social media and text data analysis is also an essential category of digital tools that provides information on public opinion, consumer sentiment and current political trends.

And decision support systems (DSS) act as an integration platform that combines different types of data and models to provide recommendations for economic strategies, investments or political decisions. DSSs provide users

with interfaces for interactive data analysis and visualization to help them better understand economic phenomena and scenarios. For example, platforms such as Tableau or Microsoft Power BI allow for the creation of interactive reports and dashboards that facilitate informed decision-making based on comprehensive data analysis. DSSs are able to integrate different data and models, which allows strategic decisions to be made taking into account many economic factors and scenarios.

Thus, digital tools for analysis and forecasting in the international economy are a set of technological solutions that contribute to a deeper understanding of global economic processes and provide highly accurate forecasts in the face of constant change. Each of these categories has its own specific advantages and limitations, and their effective use is possible only through the integration and combination of different approaches and methods.

Summarizing, it is necessary to mention that the effectiveness of digital analysis and forecasting tools in the international economy is based on their ability to quickly process large amounts of data, identify complex patterns, and provide accurate forecasts in dynamic global markets.

REVIEW

Modern digital tools allow economists and analysts to analyse complex relationships between macroeconomic variables, market trends and political events, which significantly improves the accuracy of forecasting economic processes at the international level.

Nevertheless, taking into account the issue of accuracy, it should be noted that the accuracy of forecasts depends on a number of factors that can both increase and decrease the reliability of these forecasts. A positive aspect of forecast accuracy is that modern digital tools allow analysing huge amounts of data at high speed, which opens up opportunities to identify patterns that were previously difficult to identify due to the limitations of traditional methods. They make it possible to create models that consider a wide range of factors affecting the global economy, which increases the accuracy of forecasts in the short and medium term. Machine learning and artificial intelligence are also able to adapt to new data in a timely manner, improving their forecasting capabilities.[3]

However, the accuracy of forecasts is not always guaranteed. One of the key negative aspects is related to the quality and completeness of the data on which the analysis is based. For example, imperfections in the data collected and used, omissions of information, or distorted data can lead to serious errors in forecasts. There are often significant gaps in data from international markets due to differences in the level of digital infrastructure development between countries, which leads to inaccurate forecasts. Despite the general availability of modern technologies, the level of their integration and application can vary significantly by region, due to technical, economic and social factors. Digital tools may also perform differently in different parts of the world due to uneven development of digital infrastructure, differences in access to high-quality data, and differences in digital literacy levels.

Highly developed countries, such as the US, Japan, or the EU, have significant advantages in the use of digital technologies for economic analysis and forecasting due to their strong infrastructure, large amounts of data, and experienced professionals. This allows them to use sophisticated analytical tools to maximum effect, providing more accurate forecasts and enabling more informed decision-making in international trade, investment and economic policy. However, in developing countries, the use of digital tools is limited due to a lack of infrastructure, low levels of digital literacy, or insufficient data quality. In such regions, forecasting of economic processes remains less accurate, which can lead to instability of economic management and ineffective response to global economic changes, as well as significantly complicate the process of integration of these countries into the international economic sphere and become a barrier to cooperation.

In addition, regional differences can also be manifested in the specifics of economic models and policies. In different parts of the world, economic processes vary considerably, depending on the structural features of the market, the degree of global integration and foreign economic relations. For example, machine learning models developed to predict financial markets in the EU may be less accurate in analysing markets with low liquidity or unstable political situations. This means that digital tools that work well in developed economies may not always be adequately adapted to the realities of emerging economies.

Another negative factor is the so-called data noise problem. Large volumes of information processed by digital tools often contain not only useful data, but also a large amount of information that has no significant impact on the processes being analysed. Incorrect interpretation of such data or insufficient filtering can also lead to forecasting errors when the system detects patterns where they do not exist or, conversely, ignores relevant trends.

Furthermore, the risk of dependence on the models used for forecasting should be considered. Econometric models, although they provide accurate forecasts based on mathematical equations, have their limitations when markets change in unpredictable ways or under the influence of new factors that were not taken into account in previous models. For example, economic crises or political upheavals (such as the coronavirus epidemic or a full-scale war in Ukraine) can throw models out of balance, making forecasts much less accurate.

RESEARCH METHODOLOGY

This study aims to assess the potential of modern digital tools to enable economists and analysts to analyze complex relationships between macroeconomic variables, market trends, and political events, thereby significantly improving the accuracy of forecasting economic processes at the international level.

PAPER OBJECTIVE

The complexity of digital analysis and forecasting tools often makes their results difficult to interpret, affecting user trust and practical application. This opacity makes economists and policymakers skeptical of forecast results, especially in international economic decision-making that requires clear arguments. Even if the forecasts are accurate, the lack of transparency will limit the use of these tools in international governance.

The interpretability of results is key to wise decision-making, especially when it comes to major decisions such as economic policy, international trade and financial markets. Although traditional econometric models are easy to interpret, they still face challenges when dealing with complex phenomena. At the same time, the privacy risks and ethical issues brought about by processing massive amounts of data cannot be ignored, especially when complying with data protection regulations in different countries.

The ethical use and transparency of digital tools have become important issues in international economic cooperation. The potential bias of algorithms may affect the fairness of economic forecasts and, in turn, affect international relations and policies. Therefore, ensuring ethical regulation and transparency of digital tools is key to balancing economic interests and personal privacy.

Despite the challenges, digital tools have great potential to reveal trends that are difficult to detect with traditional methods. With technological advances, data interpretation and transparency issues are gradually being addressed, providing new opportunities for global economic forecasting and management.[4]

The effectiveness of digital tools depends on their ability to provide adaptive forecasts based on multi-dimensional data. This adaptability is achieved through advanced technology, which enables the model to learn and improve its forecasts in real time, bringing far-reaching impacts to international economic processes.

RESULTS AND DISCUSSION

Typically, these models are powered by machine learning, where algorithms are continuously trained on new data and improve their predictions with each cycle of analysis. This is not just an update of historical data, but rather a dynamic process in which models take into account new factors that can have a significant impact on economic processes. For example, during financial crises or global market disruptions, such models are able to quickly adapt to new conditions, incorporating previously unforeseen variables into the current analysis.

Precisely rapid response is one of the main advantages of such adaptive models. For example, during the COVID-19 pandemic, many traditional models were not flexible enough to predict the consequences of changes such as disruptions in global supply chains or changes in consumer behaviour, and the latest digital models have become effective forecasting and analysis tools.

Another important aspect of autonomous adaptation that should be noted is the use of forecasting methods with a high degree of detail. Such approaches allow modelling various scenarios and assessing their impact on the economic situation. In particular, the integration of big data and machine learning allows for the inclusion of numerous factors that were not previously included in standard models. These may include consumer behavioural patterns, labour market dynamics, political risks, and even social and environmental trends. In this way, adaptive models not only adjust to changes but also create forecasts that consider the multidimensional impact of various factors on economic processes.

Nevertheless, despite their many advantages, adaptive forecasting models also have their challenges. One of the main ones is the need to ensure the proper quality of the data on which they are trained. In addition, despite their autonomous adaptation, these models still require human control and verification of results to avoid erroneous predictions.

However, a key perspective that significantly increases their effectiveness is the comprehensive integration of various digital tools. Such integration allows harnessing the power of different technologies simultaneously, creating a deeper and more comprehensive understanding of complex economic processes.

The promise of such integrated approaches is that they can overcome the limitations of individual tools. Comprehensive integration also allows for greater adaptability and flexibility of digital tools, which is critical in an international economy where changes can occur rapidly and unpredictably. And the use of different approaches allows for the creation of multifactor models that can respond instantly to new challenges, which increases not only the efficiency of economic forecasting, but also the accuracy of strategic decisions based on these forecasts.

In addition, the role of comprehensive integration goes beyond simple technical interaction between different tools. It also involves the integration of interpreted results into global decision-making processes. This is particularly important in the area of international trade and investment, where risks can be very high and uncertainty about future conditions is often considerable. The integration of different tools can help reduce this uncertainty and, as a result, reduce potential economic losses.

Thus, the prospects and effectiveness of digital tools for analysis and forecasting in the international economy depend not only on their individual capabilities, but also on the level of their comprehensive integration.

Digital tools. Digital tools for analysis and forecasting in the international economy can be classified according to several criteria, including: the type of technology; the data used; and the purpose of application (Figure 1)

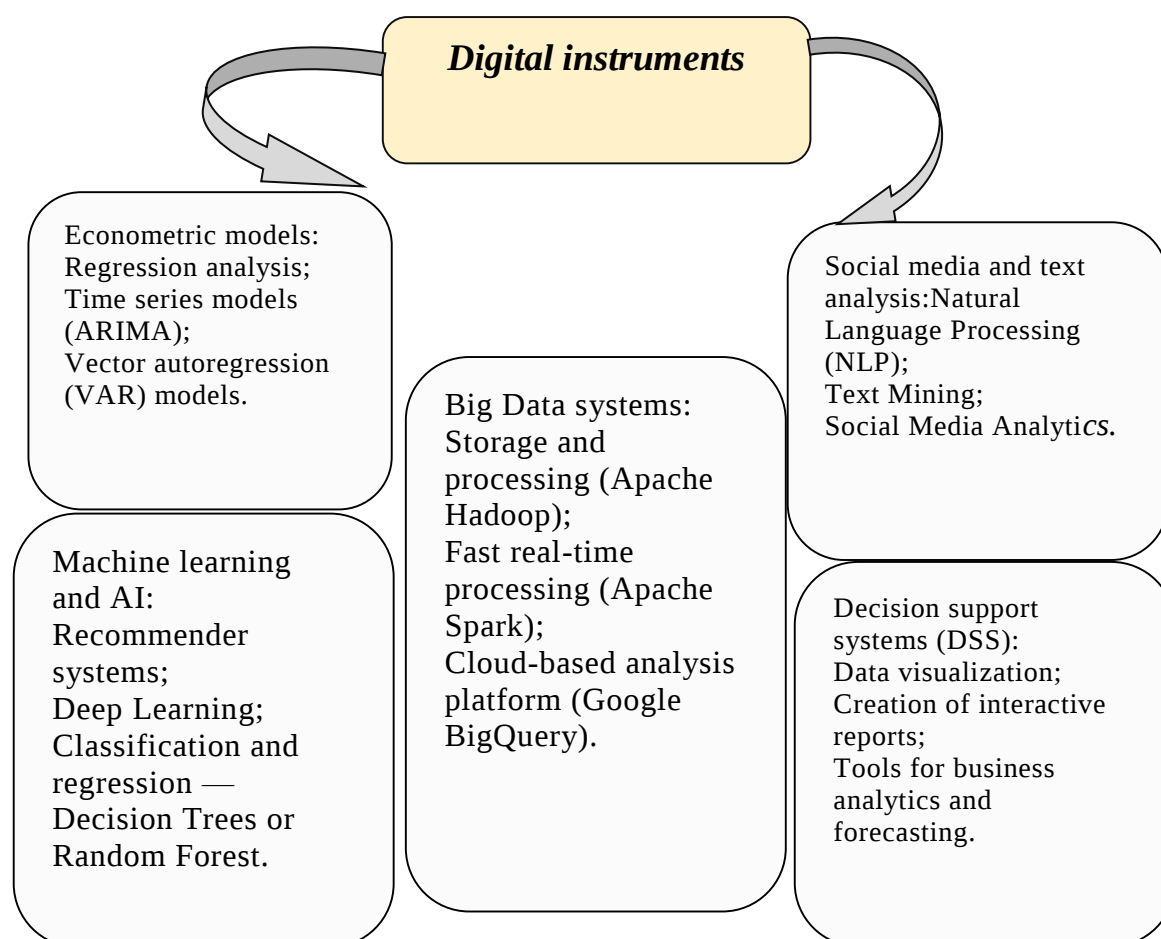


Fig. 1. Classification of analysis and forecasting tools in the field of international economics

Big Data technologies. At the same time, in today's environment, when data volumes have increased dramatically, Big Data systems play a major role in complementing traditional econometric models. Big Data tools are able to process huge amounts of information coming from various sources, including transactions, social media, news, and other unstructured data.

Big Data technologies use special algorithms to identify new trends and patterns that are not always visible in traditional data sets. For example, the analysis of consumer behavioural patterns and financial market dynamics can be significantly improved by integrating data from social media and news sources, allowing for real-time tracking of economic and social trends, which is a critical criterion for responding quickly to changes in the global economic environment.

Interpretability. the interpretability of the results directly affects the ability to make informed decisions. For example, DSSs, which often use data from multiple sources, provide recommendations based on complex models, but without a proper level of interpretability, these recommendations may not be convincing enough for government officials or international organizations. This becomes especially critical when decisions relate to key aspects of economic policy, international trade or financial markets, where it is necessary to understand the logic and mechanisms behind the proposed actions.

At the same time, the problem of interpretability applies not only to complex AI models, but also to more traditional econometric models. While econometric models are generally easier to interpret, they can still pose challenges when it comes to applying them to complex global economic phenomena. For example, choosing the wrong variables or misinterpreting correlations between variables can lead to incorrect conclusions, even if the model is mathematically correct. This requires economists and analysts to have a deep understanding of both the models and the economic processes themselves.

Digital technologies. Digital technologies play a crucial role in the modernization of modern economic models by introducing new mechanisms for managing resources, business processes and interaction between countries.[5] It is determined that they provide an opportunity to increase the efficiency of national economies by promoting deeper integration into global markets and providing access to new technological solutions. Another crucial aspect is that digital tools allow not only to optimize processes but also to reduce costs, accelerating economic activity and contributing to the growth of competitiveness.

Digital technologies are also having a significant impact on supply chain management and international transactions. The use of innovations such as blockchain and AI helps ensure transparency, efficiency, and accuracy of

economic transactions. It also reduces the risks of fraud and loss, which is critical for international companies and countries that actively cooperate in global markets.

CONCLUSIONS

In the field of international economy, the application of digital tools has become an important means of analyzing and predicting economic trends. These tools use advanced information technology and algorithms to process large amounts of complex data and provide decision makers with accurate and real-time economic information. Through the discussion in this article, we can draw the following conclusions:

First, the effectiveness of digital tools in analyzing and predicting the international economy has been widely recognized. They can improve the accuracy of predictions, conduct in-depth analysis of historical and real-time data through algorithms, and discover economic trends and market laws. This accuracy is extremely important for companies to formulate strategic plans, investors to make investment decisions, and governments to formulate macroeconomic policies.

Second, the real-time nature of digital tools makes economic analysis and forecasting faster and more efficient. In today's global economic integration, the market changes rapidly, and being able to obtain and analyze data in a timely manner is of great significance for seizing market opportunities and avoiding risks. Digital tools can help companies monitor market dynamics in real time and respond quickly to market changes, thereby gaining an advantage in competition.

In addition, digital tools can provide companies with in-depth market insights and personalized decision support through intelligent analysis. These tools can process not only structured data, but also unstructured data, such as text and images, so as to analyze market information more comprehensively. This intelligent analysis capability enables enterprises to make more scientific and reasonable decisions when facing a complex and changing economic environment.

At the same time, the application of digital tools has also brought new challenges and problems. For example, data security and privacy protection have become the focus of attention. In the process of using digital tools, how to ensure that data is not abused and how to protect the privacy of individuals and enterprises are issues that must be faced and solved. In addition, the popularization and application of digital tools have also had an impact on the labor market, with an increasing demand for high-skilled talents and a possible decrease in demand for low-skilled jobs.

In the future, with the continuous advancement of technology, the effectiveness of digital tools will be further enhanced. The development of technologies such as artificial intelligence, big data, and cloud computing will promote the continuous improvement of digital tools in analysis and prediction. Enterprises should actively embrace these changes and use digital tools to improve their competitiveness and adaptability.

In summary, the effectiveness of digital tools in the analysis and prediction of the international economic field has not only been verified, but also has broad application prospects. As technology continues to develop and improve, digital tools will play an increasingly important role in international economic activities and make greater contributions to promoting the development and prosperity of the global economy. Therefore, the conclusion is that the effectiveness of digital tools in the analysis and forecasting of the international economy is significant. They are indispensable tools for enterprises, investors and governments, and play an irreplaceable role in improving the level of economic management and the quality of decision-making.

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