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ASSESSING ECONOMIC POTENTIAL: FOCUS ON THE CIRCULAR ECONOMY

The article presents a comprehensive study of theoretical, methodological and applied aspects of assessment. economic potential in the context of the transformation of economic systems to a model of sustainable development and a circular economy. The relevance of the topic is due to the intensification of global environmental challenges, increasing resource constraints, aggravation of socio-economic disparities, as well as the need to form a new paradigm of economic growth, focused not only on quantitative indicators of production, but also on qualitative parameters of development, resource efficiency and long-term sustainability. Economic potential in the article is considered as an integral characteristic of the capabilities of the socio-economic system to ensure reproductive processes, generate added value, adapt to external shocks and implement strategic priorities of sustainable development. Particular attention is paid to the transformation of the content of the concept of economic potential in the context of the transition from the linear model of "take - produce - consume - dispose" to a circular model based on the principles of closed material flows, waste minimization, resource reuse and ecodesign. The aim of the study is to substantiate the conceptual foundations and develop a methodological approach to assessing economic potential taking into account the principles of the circular economy and the goals of sustainable development. The article systematizes modern approaches to interpreting economic potential (resource, functional, systemic, effective), identifies their advantages and limitations in the conditions of the "green" transformation of the economy. It is proven that traditional assessment methods, focused mainly on the volume of resources and production capacities, do not fully reflect the ability of the economic system to achieve sustainable and inclusive growth. An expanded vision of the structure of economic potential is proposed, which includes, along with production, financial, labor and innovation components, also environmental and circular potential. Circular potential is interpreted as the ability of the economic system to ensure a reduction in material and energy intensity of production, form closed cycles of resource use, integrate environmental innovations and stimulate the development of "green" markets. The methodological part of the study is based on a combination of systemic, institutional and interdisciplinary approaches. The article proposes a multi-level model for assessing economic potential, covering macro-, meso- and micro-levels of analysis and providing for the use of integral indices, benchmarking, multi-criteria optimization methods and econometric modeling. The feasibility of using circular economy indicators (level of material reuse, share of secondary raw materials in production, waste generation intensity, carbon intensity of GDP, etc.) as components of the economic potential assessment system is substantiated. The practical significance of the results lies in the possibility of using the proposed approach by state authorities and local governments in the formation of regional development strategies, economic recovery programs in the post-crisis period, as well as by enterprises in the development of corporate strategies for sustainable development and ESG-oriented management. The conclusions obtained can serve as a basis for improving the system for monitoring socio-economic development taking into account the requirements of the European Green Deal and the UN Sustainable Development Goals.

Keywords: circular potential, sustainable development, "green" transformation, resource efficiency, ESG, integrated assessment.

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ОЦІНЮВАННЯ ЕКОНОМІЧНОГО ПОТЕНЦІАЛУ: АКЦЕНТ НА ЦИРКУЛЯРНУ ЕКОНОМІКУ

У статті здійснено комплексне дослідження теоретико-методологічних і прикладних аспектів оцінювання економічного потенціалу в умовах трансформації економічних систем до моделі сталого розвитку та циркулярної економіки. Актуальність теми зумовлена посиленням глобальних екологічних викликів, зростанням ресурсних обмежень, загостренням соціально-економічних диспропорцій, а також необхідністю формування нової парадигми економічного зростання, орієнтованої не лише на кількісні показники виробництва, а й на якісні параметри розвитку, ефективність використання ресурсів та довгострокову стійкість. Економічний потенціал у статті розглядається як інтегральна характеристика можливостей соціально-економічної системи забезпечувати відтворювальні процеси, генерувати додану вартість, адаптуватися до зовнішніх шоків та реалізовувати стратегічні пріоритети сталого розвитку. Особливу увагу приділено трансформації змісту поняття економічного потенціалу в контексті переходу від лінійної моделі «взяти – виробити – спожити – утилізувати» до циркулярної моделі, заснованої на принципах замкнених матеріальних потоків, мінімізації відходів, повторного використання ресурсів та екодизайну. Метою дослідження є обґрунтування концептуальних засад та розроблення методичного підходу до оцінювання економічного потенціалу з урахуванням принципів циркулярної економіки та цілей сталого розвитку. У статті систематизовано сучасні підходи до трактування економічного потенціалу (ресурсний, функціональний, системний, результативний), визначено їх переваги та обмеження в умовах «зеленої» трансформації економіки. Доведено, що традиційні методи оцінювання, орієнтовані переважно на обсяг ресурсів та виробничі потужності, не відображають у повній мірі здатність економічної системи до сталого та інклюзивного зростання. Запропоновано розширене бачення структури економічного потенціалу, яке включає, поряд із виробничим, фінансовим, трудовим та інноваційним компонентами, також екологічний та циркулярний потенціал. Циркулярний потенціал інтерпретується як спроможність економічної системи забезпечувати зниження матеріало- та енергоємності виробництва, формувати замкнені цикли використання ресурсів, інтегрувати екологічні інновації та

стимулювати розвиток «зелених» ринків. Методологічна частина дослідження ґрунтується на поєднанні системного, інституціонального та міждисциплінарного підходів. У статті запропоновано багаторівневу модель оцінювання економічного потенціалу, що охоплює макро-, мезо- та мікрорівні аналізу та передбачає використання інтегральних індексів, бенчмаркінгу, методів багатокритеріальної оптимізації та економетричного моделювання. Обґрунтовано доцільність застосування показників циркулярної економіки (рівень повторного використання матеріалів, частка вторинної сировини у виробництві, інтенсивність утворення відходів, вуглецева інтенсивність ВВП тощо) як складових системи оцінювання економічного потенціалу. Практичне значення результатів полягає у можливості використання запропонованого підходу органами державної влади та місцевого самоврядування при формуванні стратегій регіонального розвитку, програм відновлення економіки у післякризовий період, а також підприємствами при розробленні корпоративних стратегій сталого розвитку та ESG-орієнтованого управління. Отримані висновки можуть слугувати підґрунтям для вдосконалення системи моніторингу соціально-економічного розвитку з урахуванням вимог Європейського зеленого курсу та Цілей сталого розвитку ООН.

Ключові слова: циркулярний потенціал, сталий розвиток, «зелена» трансформація, ресурсоефективність, ESG, інтегральна оцінка.

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STATEMENT OF THE PROBLEM IN GENERAL AND ITS RELATIONSHIP WITH IMPORTANT SCIENTIFIC OR PRACTICAL TASKS

The current stage of the world economy is characterized by the deepening of systemic crisis phenomena, manifested in the depletion of natural resources, the intensification of climate change, the growth of social inequality and the instability of financial markets. In these conditions, the traditional linear model of economic growth is increasingly losing its effectiveness, and the concept of sustainable development is gaining the status of a key reference point for the formation of economic policy at the global, national and regional levels. For Ukraine, these challenges are of particular relevance in connection with the need for post-crisis and post-war economic recovery, modernization of the production base, integration into the European economic space and adaptation to the requirements of the European Green Deal. Under such conditions, the question arises not only of increasing production volumes, but also of ensuring a qualitative transformation of economic potential aimed at increasing resource efficiency, environmental safety and social inclusiveness of development.

Traditional approaches to assessing economic potential, based mainly on the analysis of quantitative parameters of resource provision and production capacities, do not meet the modern requirements of sustainable development. They do not sufficiently take into account environmental constraints, institutional factors, innovative capacity and the ability of the economic system to transition to circular business models. As a result, a gap is formed between formal indicators of economic potential and real opportunities for ensuring long-term development. In this context, the need to rethink the methodology for assessing economic potential, taking into account the principles of the circular economy, which involves minimizing waste, reusing resources, developing environmental innovations and forming new business models focused on creating shared value for the economy, society and the environment, becomes particularly important.

ANALYSIS OF RESEARCH AND PUBLICATIONS

The issue of economic potential has long been in the focus of attention of domestic and foreign scientists. In classical works, economic potential is considered as a set of resources and opportunities for their use in order to ensure economic growth [1]. Within the resource approach, the emphasis is on the quantitative assessment of production, labor, financial and natural resources that form the basis of economic development. Further development of the theory led to the formation of functional and systemic approaches, within which economic potential is interpreted as the ability of the economic system to realize its capabilities in a dynamic external environment [2; 3]. In such studies, attention is focused on the efficiency of resource use, the level of institutional development, innovative activity and competitiveness.

At the same time, over the past decade, scientific discourse has increasingly focused on the problems of sustainable development and the "green" transformation of the economy. Ellen's works MacArthur Foundation, M. Geisdorf and colleagues [4; 5], as well as research by the European Commission [6], laid the theoretical and practical foundations of the concept of a circular economy as an alternative to the traditional linear development model.

At the same time, the analysis of scientific publications shows that the problem of assessing economic potential in the context of a circular economy remains underdeveloped. Most existing methods either focus on macroeconomic indicators of sustainable development or consider individual aspects of resource efficiency without forming a holistic system of indicators of economic potential adapted to the requirements of the "green" transformation. Thus, despite the presence of significant theoretical achievements in the field of economic potential and sustainable development, the scientific literature lacks a unified approach to a comprehensive assessment of economic potential taking into account the principles of a circular economy, which necessitates further research in this area.

Most existing methods for assessing economic potential focus on traditional resource and functional indicators, such as the volume of production capacities, the number of labor resources, the financial condition of

enterprises and regions. They do not take into account the systemic interrelationships between economic, social and environmental components, which is critically important in the context of the circular economy. In particular, the lack of integration of indicators of resource reuse, environmental efficiency and innovation potential negates the possibility of obtaining an objective assessment of the economic capacity of the system to ensure sustainable and inclusive growth. Methods for integrating circular potential into macro-, meso- and microeconomic levels of analysis remain insufficiently developed. Existing approaches are usually fragmented: individual studies consider environmental aspects at the level of individual enterprises or industries, but do not offer a systematic approach to assessing the potential of the region or the national economy as a whole. This creates a gap in the scientific support of regional and national development strategies focused on closed resource cycles and "green" innovations. There is a need to form comprehensive indicator systems that combine traditional indicators of economic potential and indicators of the circular economy. Modern integral indices available in the practice of the European Union, OECD and other international organizations are designed to assess economic efficiency taking into account sustainability, but they are not adapted to the specifics of national economies with a post-crisis and post-war context, which is especially relevant for Ukraine. Insufficient attention is paid to the dynamic assessment of economic potential, i.e. the ability of the system to adapt to changes in the external environment, introduce technological and social innovations, reduce the material and energy intensity of production, and also form competitive advantages based on environmentally friendly business models. Traditional static methods do not reflect the real ability of the economic system to transition to circular principles.

Given the above, a key unsolved part of the problem is the search for a comprehensive approach to assessing economic potential that combines traditional economic indicators and circular economy indicators, ensuring the possibility of objectively assessing the sustainability of economic development at all levels of governance. This determines the need to develop a new methodology that integrates economic, social and environmental aspects into a single system for assessing potential.

FORMULATION OF ARTICLE OBJECTIVES

The purpose of this article is to develop a comprehensive methodological approach to assessing the economic potential of an economic system, taking into account the principles of a circular economy and sustainable development, as well as to identify key indicators that allow integrating traditional economic, social, and environmental aspects into a single assessment system.

PRESENTATION OF THE MAIN MATERIAL

Economic potential is considered as a multi-component characteristic of an economic system, reflecting its ability to produce material goods and services, effectively use resources, adapt to external changes and implement strategic goals of sustainable development. In modern conditions of economic transformation, special attention is paid to the integration of the principles of the circular economy into the structure of economic potential, which allows assessing not only quantitative indicators of production capabilities, but also their environmental and resource efficiency.

Based on a systematic approach and analysis of modern research [1-3], the following main components of economic potential have been identified:

1. Production potential is a set of material and technical resources, fixed assets, production capacities and technologies that ensure the production of products and services. Key indicators are the volume of production capacities, the level of technological equipment, and the degree of utilization of enterprises.
2. Labor potential - the number, qualifications and efficiency of the workforce. Includes indicators of demographic composition, level of education and professional training, and motivation of personnel.
3. Financial potential – the availability of financial resources capable of ensuring reproductive processes and investment activities. This includes the volume of capital, liquidity of assets, and creditworthiness of enterprises and regions.
4. Innovation potential is the ability of an economic system to introduce new technologies, products, business models, and create competitive advantages. It is assessed through R&D spending, the number of patents, the level of technological readiness, and cooperation with scientific institutions.
5. Natural potential – the volume and quality of natural resources (land, water, minerals, bioresources) used in production. Includes indicators of resource renewal and the impact of production activities on the ecological state of the territory.

Taking into account the principles of the circular economy, it is advisable to add a new component to the traditional structure of economic potential - circular potential, which characterizes the ability of the economic system to ensure efficient, environmentally safe and closed use of resources.

Therefore, the main components of circular potential will include:

1. Resource efficiency of production – the degree of reduction in material and energy intensity of products, use of secondary raw materials, minimization of waste.
2. Environmental innovations – the introduction of "green" technologies, eco-design, renewable energy sources and cleaning technologies.

3. Closed resource cycles – integration of reuse, recycling and waste treatment systems into production and consumption processes.

4. Social and institutional component – the level of environmental culture, legislative support for the circular economy, participation of communities and enterprises in sustainable development programs.

5. Monitoring and adaptability – the ability of an economic system to respond to external changes, track sustainable development indicators, and adapt production and business models to changing conditions.

The integration of circular potential allows for the formation of a multi-level assessment system that includes the macroeconomic level (national economy), the meso-level (regional and sectoral economic systems) and the micro-level (individual enterprises). This provides a comprehensive assessment of the economic potential and the capacity of the economy for sustainable development.

For clarity, a diagram of the integrated structure of economic potential with the allocation of the circular component is proposed (*Figure* 1). *The diagram presents the traditional components of economic potential – production, labor, financial, innovation, natural – and additionally highlighted circular potential with five subcomponents : resource efficiency, environmental innovations, closed resource cycles, social and institutional component, monitoring and adaptability* (adapted from [4; 5]).

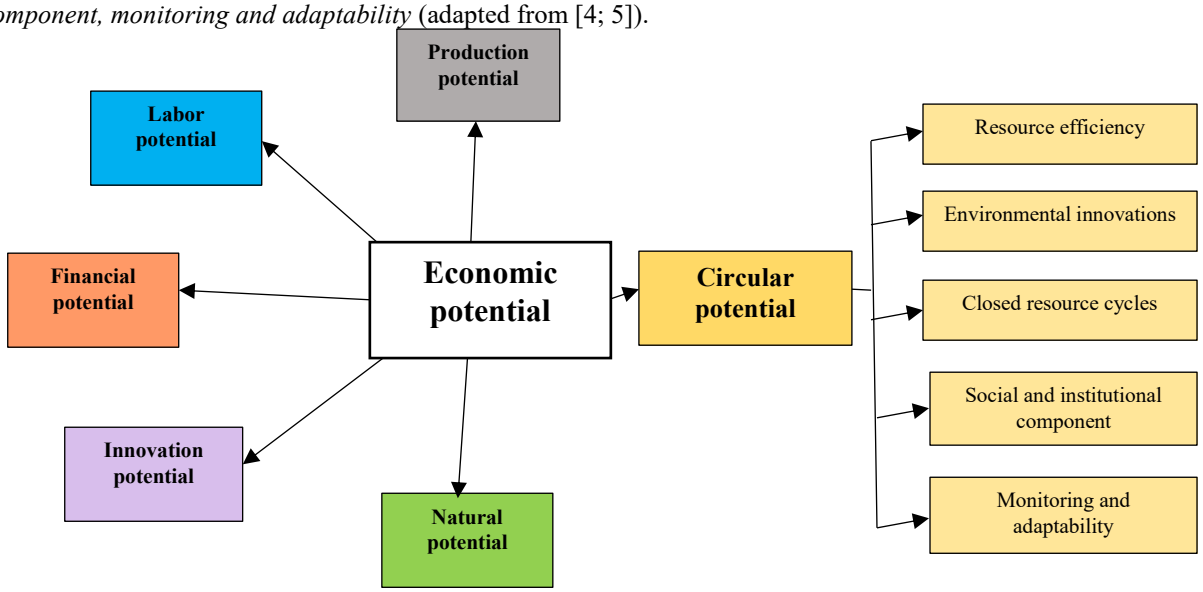

Fig. 1. Structure of economic potential with a circular component

Assessing economic potential in a circular economy requires a comprehensive and multi-level approach that combines traditional macroeconomic and microeconomic indicators with indicators of resource efficiency, environmental innovation, closed material cycles and social adaptability. Such methods allow not only to obtain a quantitative assessment of potential, but also to track its dynamics and predict the effect of implementing the principles of a circular economy. Let us consider the most widely used methods of assessing economic potential today.

Integral methods are the most common tool for comprehensive assessment of economic potential, as they allow combining quantitative and qualitative indicators into a single index that takes into account all key components of economic potential: production, labor, financial, innovation, natural and circular [2; 4; 5].

The most common method of integral indexing involves normalizing indicators and their weighted sum :

$$EP = \sum_{i=1}^{n} w_i \cdot X_i \quad (1)$$

where:

EP – integral indicator of economic potential;

X_i – normalized indicator of the i component (component of economic potential;

w_i – weight coefficient reflecting the relative importance of the component;

n – total number of components.

For circular potential, it is proposed to integrate the following key indicators [4; 5]:

1. Material reuse rate (RRM), % :

$$RRM = \frac{M_{\text{secondary}}}{M_{\text{total}}} \cdot 100\% \quad (2)$$

where:

$M_{secondary}$ – the volume of secondary raw materials;

M_{total} – total volume of materials in production.

2. Waste generation intensity (WI), kg/UAH

$$WI = \frac{W_{\text{total}}}{GR} \quad (3)$$

where:

W_{total} – volume of waste generated, kg (ton);

GR – comparison base (macro level – GDP, meso level – regional GDP, micro level – revenue), UAH.

3. Carbon intensity (CI), t CO_2/thousand UAH:

$$CI = \frac{CO_2}{GR} \quad (4)$$

where:

CO_2 is the volume of carbon emissions, tons.

The integration of these indicators into the general index does not cause difficulties [7], it is only necessary to take into account that WI and CI are disincentives, which must be taken into account when normalizing them.

This methodological approach allows for an objective and comparative assessment of the economic potential of different enterprises, regions and sectors of the economy; provides the possibility of integrating new indicators when expanding statistical and analytical data. The most significant limitation is a certain subjectivity in determining weighting factors for all components (components of economic potential), and normalization of indicators requires unified methods and reliable data.

Another direction is multi-criteria assessment, which is necessary to take into account competitive and trade-off indicators of economic potential, especially when traditional and circular components have different scales and nature [9]. The most commonly used approaches are:

1. TOPSIS (Technique) for Order Preference by Similarity this Ideal Solution) – a method of ranking alternatives based on the distance to the best and worst value of the indicator. For calculation, you can use the formula:

$$C_i = \frac{D_i^{min}}{D_i^{max} - D_i^{min}} \quad (5)$$

where:

D_i^{max}, D_i^{min}– distance to the best and worst value of the indicator.

The method allows integrating both quantitative and qualitative indicators of circular potential, for example, the level of environmental certification of enterprises, the share of secondary raw materials, the energy efficiency index, etc.

2. DEA (Data Envelopment Analysis) is a method for assessing the efficiency of resource use in enterprises or regions. DEA allows you to determine efficiency compared to the best practices in the industry and integrate environmental and social indicators into the analysis of productivity [10; 11]. In this case, an approach similar to the benchmarking method is used.

The advantages of multi-criteria methods are the integration of heterogeneous indicators, ranking of alternatives and the possibility of modeling "what if" scenarios for circular strategies. However, the method requires reliable information on all criteria and is sensitive to weighting coefficients and normalization factors. methods. Also, the result will vary depending on the sample of objects within which the evaluation is carried out.

Regression models allow us to assess the impact of circular indicators on the overall economic potential and predict its change. For example, the multiplicative regression model for assessing the dynamics of the economic potential of a region can be studied in [12; 13]. Regression models allow us to determine the significance of each indicator of circular potential, predict the effect of introducing new technologies and policies, and analyze scenarios for sustainable development of regions. However, for high accuracy, they require significant amounts of initial homogeneous information about the objects of assessment.

To demonstrate the practical applicability of the proposed approach to assessing economic potential taking into account the circular economy, the methodology was tested using the examples of regions of Ukraine and individual enterprises in the industrial sector. The purpose of the analysis is to assess the level of integration of circular economy principles and compare the potential of different economic entities.

For regional assessment, the EPCE integral index was used, which includes traditional components of economic potential and indicators of circular potential: the rate of reuse of materials (RRM), waste generation intensity (WI), carbon intensity (CI) – Table 1.

Table 1

Integral economic potential of the regions of Ukraine (2024)

Region	Production potential	Labor potential	Financial potential	Innovation potential	Circular potential	EPCE
Dnipropetrovsk region	0.78	0.76	0.74	0.73	0.72	0.75
Kyiv region	0.80	0.78	0.76	0.75	0.70	0.76
Lviv region	0.72	0.74	0.70	0.68	0.65	0.69
Kharkiv region	0.75	0.72	0.71	0.70	0.67	0.71

Data source: [13], adapted from [4; 5].

The highest EPCE index is observed in Kyiv region, which is due to a high level of material reuse and lower waste generation intensity. The lowest EPCE is in Lviv region, which reflects the need to develop environmental innovations and improve closed resource cycles.

At the enterprise level, an integrated approach allows us to assess the effectiveness of implementing circular technologies in the production process. As an example, three enterprises in the food and furniture industries are considered (Table 2).

Table 2

Integral economic potential of enterprises (2024)

Region	Production potential	Labor potential	Financial potential	Innovation potential	Circular potential	EPCE
Company A (food industry)	0.78	0.76	0.74	0.72	0.68	0.74
Enterprise B (food industry)	0.75	0.73	0.72	0.71	0.73	0.73
Enterprise C (furniture industry)	0.72	0.70	0.71	0.68	0.70	0.70

Data source: internal enterprise statistics; adapted from [4].

Enterprises that actively implement secondary materials and recycling technologies demonstrate higher circular potential and, accordingly, increased integrated EPCE. Comparison of enterprises in different industries shows that even with high production and financial potential, a low level of circular practices reduces the overall economic potential.

Therefore, complex methods of integrating traditional and circular indicators allow obtaining an objective and comparative assessment of the potential of the economic system at all levels. Multi-criteria methods (TOPSIS, DEA) provide tools for ranking alternatives, taking into account the heterogeneity of indicators. Regression-econometric methods allow predicting the dynamics of potential and the effect of the implementation of "green" innovations, which is critically important for planning sustainable development. Practical testing of the methodology confirms its ability to identify weaknesses in circular practices and form priorities for strategic changes both at the regional and enterprise levels.

CONCLUSIONS FROM THIS RESEARCH AND PROSPECTS FOR FURTHER RESEARCH IN THIS DIRECTION

The conducted research allows us to formulate a number of key conclusions regarding the assessment of economic potential in the conditions of a circular economy and its role in ensuring sustainable development. The integration of traditional and circular components of economic potential allows us to obtain a more objective assessment of the resource, financial, labor and innovation capacity of the economic system. The inclusion of indicators of material reuse, environmental intensity and closed resource cycles increases the accuracy of forecasts and strategic planning. The methodology of multi-level integrated assessment (macro-, meso-, micro-level) allows us to assess the economic potential of the national economy and individual regions, identify industries and enterprises with high or low circular potential, and form priorities for the development of "green" innovations, recycling and energy efficiency. Practical testing of the methodology on the example of regions of Ukraine and enterprises of the industrial sector confirmed that regions with a high level of circular practices demonstrate a greater integrated potential, enterprises that actively implement the reuse of materials and reduce the energy and material intensity of production increase their economic potential by 2–5% compared to their counterparts, the methodology allows identifying weaknesses in the structure of potential and forming priority areas of investment and state support. Methods of multi-criteria optimization and econometric modeling provide the ability to predict changes in economic potential depending on the implementation of circular technologies, the development of "green" infrastructure and the stimulation of innovations. This is important for state policy, which is focused on sustainable development and economic recovery after crisis periods.

Further prospects for the application of the methodology include: the development of integrated models for assessing potential based on big data (Big Data) and artificial intelligence for more accurate forecasting; adaptation of circular potential indicators to the specifics of different industries and regions; development of policies to stimulate investment in "green" technologies and innovations; use of methodology to assess the impact of regional and corporate strategies on achieving the Sustainable Development Goals (SDGs) and reducing the ecological footprint.

Thus, the proposed methodology is a scientifically sound tool for a comprehensive assessment of economic potential in a circular economy and can be used in both national and regional strategic plans, as well as in corporate governance to increase competitiveness and environmental efficiency.

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