

From raw material dependency to stability: The role of economic diversification

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ABSTRACT

Economic diversification is a crucial response to the risks associated with resource dependence under conditions of global market volatility, geopolitical instability, and financial uncertainty. The study aims to identify the determinants of economic resilience and analyze diversification mechanisms in resource-dependent economies. The empirical analysis is based on panel regressions and descriptive indicators. The findings demonstrate that diversification based solely on expanding production sectors is insufficient without institutional quality, economic complexity, and digital governance. Evidence from Chile and Kazakhstan confirms the positive role of institutional reforms in structural modernization, while Saudi Arabia and Nigeria remain vulnerable due to persistent rentier economic structures. Integration into global value chains provides opportunities for technological development but also increases exposure to external risks. Investments in green energy and digital innovation are identified as key drivers of long-term sustainability. The study offers practical recommendations for designing national diversification strategies focused on resilience, competitiveness, and socio-economic stability.

Keywords: waste-to-resource, economic diversification, resource-dependent countries, economic complexity, institutional quality, digital governance, green/clean energy, circular economy

INTRODUCTION

The current global economic environment increasingly demonstrates the vulnerability of countries with a high dependence on raw material exports. Fluctuations in energy prices, geopolitical crises, and financial market volatility mean that even countries with rich natural resources often find themselves trapped in instability and slow development. This gives rise to the notion of the “resource curse”, which is widely accepted in academic circles and explains why resource wealth does not always translate into long-term economic growth. In this context, economic diversification emerges as a key strategy for increasing the resilience and competitiveness of national economies. The scientific literature offers several approaches to overcoming resource dependence. Abdelkawy (2024) and Chairul et al. (2025) show that diversification can ensure industrialization and reduce dependence on global market changes. Li et al. (2024) and Olaniyi and Odhiambo (2024) emphasize the importance of economic complexity, which forms the basis for the production of technology-

intensive goods and services. At the same time, the institutional dimension, as noted by Delechat et al. (2024), creates conditions for transparent governance and efficient redistribution of rents. Integration into global value chains, as analyzed by DeRemer et al. (2025), opens the way for countries to enter high-tech production segments.

Despite a significant body of research, there are still gaps in the scientific literature. In particular, the relationship between digital governance, the green economy, and the qualitative parameters of diversification has not been sufficiently studied. There is also a limited understanding of how the combination of institutional reforms, social investment, and participation in global production networks affects long-term economic sustainability. Imran et al. (2025) and Kilian et al. (2024) emphasize volatility risks, while Sultanova and Naser (2025) and Wei et al. (2025) draw attention to the environmental constraints that accompany diversification. Thus, there is a need for a comprehensive analysis that takes into account not only econometric factors but also the socio-environmental dimension of development.

The aim of this paper is to study the mechanisms of economic diversification in resource-dependent countries, identify the key factors of their resilience to external shocks, and characterize the possibilities of transition from a raw material to an innovative model of development. The objectives of the study are to systematize existing theoretical approaches, assess the dynamics of diversification processes on the example of selected countries, and develop practical recommendations for improving economic sustainability.

The study fills an identified gap in the literature by providing a broader coverage of economic diversification, which is a crucial response to the risks associated with resource dependence in the face of global market volatility, geopolitical instability, and financial uncertainty. The structure of the article involves reviewing relevant industry publications, selecting a research methodology, presenting the actual results obtained, and comparing them with the findings of other researchers, after which final conclusions were drawn.

Conceptual Framework

Modern theoretical approaches to economic diversification are formed at the intersection of several scientific schools that combine the classical provisions of political economy, institutional theory, and the latest concepts of economic complexity. Most studies are based on the so-called *resource curse hypothesis*, which explains the instability of raw material export-oriented economies by their low capacity for innovation and high dependence on global markets. In this context, diversification is seen as a strategy to get out of the mono-economy trap, which increases resilience to external shocks and creates new opportunities for industrialization (Abdelkawy, 2024; Chairul et al., 2025).

One of the leading directions is the economic complexity approach, which emphasizes the development of industries with high added value and technological potential. Scientists believe that countries that invest in production with more complex technologies eventually gain not only a diversified export structure but also higher labor productivity growth (Li et al. 2024; Olaniyi & Odhiambo, 2024). Thus, the key task of public policy is to create institutional and digital preconditions for the transition from raw material sectors to knowledge economies.

An important theoretical direction is also the *institutional paradigm*, which emphasizes that diversification cannot take place without quality reforms in governance, transparency, and the rule of law. Countries that rely on strong institutions demonstrate more successful diversification outcomes, even in the face of high resource dependence (Delechat et al., 2024). In this case, institutions play the role of a catalyst that channels resources into innovative and industrial projects.

Another promising model is the global value chain approach, which explains diversification through the integration of national economies into international production networks. Studies show that countries that have managed to gain a foothold in higher value chain segments adapt more quickly to external shocks and have more sustainable development dynamics (DeRemer et al., 2025). Thus, participation in global production networks becomes a mechanism that allows diversifying the economy not only

through internal resources, but also through external relations.

To summarize, there are several models that have proven to be effective for resource-dependent countries: the economic complexity model, the institutional model, the global value chain approach, and the innovation and industrial transformation model. Each of them has its own advantages and limitations, but they all emphasize the importance of strategic governance, digital transformation, and investment in high value-added sectors as key conditions for successful diversification (Goldani & Tirvan, 2024; Timbe et al., 2024).

LITERATURE REVIEW

The issue of economic diversification is central to contemporary scholarly debates. Key issues include economic complexity, institutions and rentier states, digital governance, and green and social dimensions.

The development of the concept of economic complexity suggests that only diversification into technologically sophisticated sectors can ensure long-term growth (Awoa Awoa et al., 2024; Li et al., 2024; Olaniyi & Odhiambo, 2024; Timbe et al., 2024). Some studies emphasize the importance of global value chains and international production networks, which act as a catalyst for diversification by integrating resource-dependent countries into high-value-added sectors (DeRemer et al., 2025; Olvera & Spinola, 2025; Yeon et al., 2022).

In parallel, an institutional approach is developing that emphasizes transparency, good governance, and the fight against corruption as conditions for industrial transformation (Delechat et al., 2024; Mishrif & Al Balushi, 2014; Zafar & Ali, 2025). Views on the resource curse remain mixed: some studies demonstrate the risks of volatility and geopolitical factors (Imran et al., 2025; Kilian et al., 2024; Sumets et al., 2022), while others emphasize the potential of resources in the presence of appropriate institutions (Chairul et al., 2025; Owjimehr & Jamshidi, 2024). The success of transformation strategies depends on the ability of states to combine internal reforms with external integration, taking into account global challenges and national specificities (Abdelkawy, 2024; DeRemer et al., 2025; Olaniyi & Odhiambo, 2024; Zafar & Ali, 2025).

Digital governance plays an important role in diversification processes, contributing to resource efficiency and policy transparency (Li et al., 2024; Wei et al., 2025). Regional studies confirm the impact of digital solutions and innovative policies on economic modernization (Jolo et al., 2022; Meyer, 2023).

The emphasis on green transformation is also important: clean energy investments are growing faster than fossil fuel financing, as confirmed by the IEA (2022, 2023). Systematic literature reviews emphasize that diversification should be not only quantitative but also qualitative, integrating the principles of sustainable development (Dias Paião Júnior & Ferraz, 2024; Hidalgo, 2022; Mia et al., 2022; Prasad et al., 2025; Voronina et al., 2024). Research shows that resource dependence can hinder development and reproduce the

“resource curse”, especially in countries with insufficient institutional support (Abdelkawy, 2024; Alrubaye et al., 2025; Lashitew et al. 2021). Scholars also emphasize the paradox of natural resource endowment: resource-rich countries often face instability in financial markets and dependence on global conditions (Imran et al., 2025; Kilian et al., 2024). In this context, the analysis of the drivers of diversification shows that political will, industrial policy and innovation remain the main factors (Jolo et al., 2022; Meyer, 2023). Studies of countries dependent on oil and gas show that only a combination of macroeconomic stability and institutional support creates the conditions for qualitative changes (Mishrif & Al Balushi, 2014; Zafar & Ali, 2025). At the same time, some authors draw attention to the “green” component of diversification, indicating that an export structure that does not take into account the impact on the environment can increase pressure on it (Sultanova & Naser, 2025; Wei et al., 2025).

A special place is occupied by studies of the social dimension of diversification: the importance of developing human capital, reducing inequality and building social resilience is emphasized (Goldani & Tirvan, 2024; Sultanova & Naser, 2025). Examples from Latin America confirm that industrialization and targeted policies provide the basis for the transition from an agro-commodity model to a high-tech one (Farnsworth, 2023; Le Clech, 2025; Mazzucato, 2023; Reuters, 2024). In turn, the African context demonstrates the need for regional integration and coordination of strategies (African Union, 2009; Choramo et al., 2024; ECOWAS, 2024).

Thus, the literature demonstrates the multidimensionality of diversification processes: from institutional reforms and digital governance to the development of social and environmental dimensions. However, the problems of aligning national policies with global challenges and ensuring qualitative, not just quantitative, diversification remain unresolved. Furthermore, there is a lack of empirical research that comprehensively examines the interactions between economic complexity, social justice, and environmental sustainability.

MATERIALS AND METHODS

The study used a quantitative approach with econometric modeling and panel data analysis for a group of resource-dependent countries, including Saudi Arabia, Kazakhstan, Nigeria, Qatar, and Chile. The data sources were official international statistical databases and analytical reports, including data from the International Energy Agency (IEA, 2022, 2023), regional organizations, and economic indices. The time period covered by the empirical panel is 2021–2024. Circular economy and waste-to-energy variables are not included in the empirical dataset, and that this component is considered a qualitative, conceptual extension of the policy.

In our own study, the authors applied panel analysis to a group of resource-dependent countries (including oil economies and energy-dependent economies). The following variables were used: *dependent variables*: export diversification rate, share of net investment in new sectors (in particular, in GDP), GDP growth. *independent variables*: level of

energy volatility (annual standard deviation of oil and gas prices), dummy variables for geopolitical events (e.g., energy shocks), level of investment in clean energy; *analytical methods*: ARDL models to estimate short- and long-term effects, regressions with panel data to assess the response to shocks. The empirical analysis is based on panel regressions and descriptive indicators. The results are summarized in the form of tables and graphs showing the dynamics of the diversification index, economic complexity and GDP growth in the selected countries.

Diversification (or concentration) indices quantify how evenly resources, assets, or shares are distributed across different entities (industries, customers, suppliers). The Herfindahl-Hirschman index (HHI) and its modifications are most commonly used for this purpose. Historically, it is an indicator of monopolization. It is calculated as the sum of the squares of the shares of all market participants (or assets in the portfolio). High concentration (less diversification): the value approaches $\frac{1}{n}$ (or 10,000 in percent) – the market is monopolized by a single player. Low concentration (more diversification): the value approaches $\frac{1}{n}$ (many small, equal entities).

RESULTS

Empirical Results

The resilience of economies dependent on natural resources is determined by a combination of a number of internal and external factors that shape the state’s ability to adapt to fluctuations in global markets and ensure long-term growth. Current research shows that three areas play a key role: *economic complexity* as an indicator of the ability to produce innovative goods and services, *institutional quality* as the basis for effective policy and governance, and *digital governance* as a new driver of development that optimizes resource use and increases transparency (Li et al., 2024; Olaniyi & Odhiambo, 2024). To systematize these approaches, **Table 1** summarizes the main factors of sustainability of resource-dependent economies and their manifestations. See **Table 1** for a summary of the key factors of economic sustainability.

Thus, the factors of economic sustainability in resource-dependent countries go beyond the traditional notion of the “resource curse” and include multidimensional aspects of development. The combination of economic complexity, quality institutions, and digital governance creates the conditions for a transition from raw material dependence to a balanced growth model. At the same time, social investments and integration into global value chains play an important role in ensuring the economy’s adaptability and resilience to global crisis impacts.

Global external challenges, such as energy price volatility (due to the 2021–2023 energy crisis), globalization shocks, and geopolitical risks, are significantly slowing down diversification processes in resource-dependent countries. For example, during the energy crisis in 2021–2023, countries with significant dependence on energy imports faced delays in clean energy investments, reduced production, and increased

Table 1. Key resilience factors of resource-dependent economies

Factor	Content and characteristics	Examples of manifestation
Economic complexity	Expanding the range of high-value-added production; development of technologically sophisticated sectors.	Diversification of exports through innovative products; growth in labor productivity (Li et al., 2024).
Institutional quality	Effective governance mechanisms, rule of law, fight against corruption.	Direction of rent revenues in development strategies; successful implementation of industrial policy (Delechat et al., 2024).
Digital governance	The use of digital technologies to monitor resources, increase transparency, and improve management efficiency.	Implementation of digital platforms for the public sector; online tools for monitoring and evaluating policies (Olaniyi & Odhiambo, 2024).
Social and economic integration	Creating jobs, reducing inequality, and developing human capital.	Investments in education, healthcare, and social programs that reduce dependence on raw materials (Abdelkawy, 2024).
Participation in global value chains	Inclusion in international production networks with higher added value.	Anchoring in high-tech production segments (DeRemer et al., 2025).

Created by the authors, based on Abdelkawy (2024), Delechat et al. (2024), Li et al. (2024), Olaniyi and Odhiambo (2024), DeRemer et al. (2025)

Table 2. External shocks and responses of resource-dependent economies

Indicator	2021	2022	2023
Volatility of energy prices, %.	18.24	27.50	21.30
GDP change, pp (%)	-0.80	-3.10	-1.90
Increase in the share of export diversification, p.p.	0.60	-1.50	-0.50
Change in investment in clean sectors, p.p. (%)	+2.40	-2.80	+1.10

Created by the authors, based on the data from IEA (2022, 2023)

instability in public finances (IEA, 2023). On the other hand, in 2021-2023, investments in clean energy grew by 24%, surpassing the 15% increase in fossil fuel financing (IEA, 2022). This uneven market response slows down diversification, especially in countries that do not have the financial buffers to quickly transition to new sectors.

Although these terms are often used synonymously to describe clean electricity, there are important differences between them: “renewable energy” is energy from natural sources that are constantly replenished (sun, wind, water, biomass, geothermal sources), the main criterion being inexhaustibility in nature; “clean energy” is energy that does not emit greenhouse gases and other pollutants during its production (in particular, some large hydroelectric power plants are considered renewable, but not clean, as they can harm river ecosystems); “green energy” is the most environmentally friendly subspecies of clean energy. It comes exclusively from renewable sources that have the least impact on the environment. These are solar and wind power plants.

In our own study, the authors applied panel analysis to a group of resource-dependent countries. The variables in **Table 2** were used, described in the methodology section.

The results show that the highest level of volatility in 2022 (~27.50%) coincided with the worst indicators - a drop in GDP (~3.10 percentage points), a decline in diversification (~1.50 percentage points) and a sharp decline in investment in clean sectors (~2.80 percentage points). In 2021 and 2023, when volatility was lower, more favorable reactions were observed, with gains in diversification and positive changes in the direction of net investment. This shows that high price volatility does indeed undermine the diversification of resource-dependent economies. For a country seeking to reduce its resource dependence, policies that minimize price volatility, stimulate investment in new sectors (especially

Table 3. Quantitative analysis of economic diversification in selected countries (panel data, 2021-2024)*

Country	Year	Diversification index (0-1)	Real GDP growth, %	Economic complexity index
Saudi Arabia	2021	0.42	3.10	-0.85
	2022	0.45	2.20	-0.78
	2023	0.48	1.90	-0.74
	2024	0.50	2.80	-0.70
Kazakhstan	2021	0.47	4.50	-0.40
	2022	0.50	3.10	-0.35
	2023	0.52	3.40	-0.32
	2024	0.55	3.90	-0.28
Nigeria	2021	0.38	2.40	-1.20
	2022	0.40	1.50	-1.18
	2023	0.42	2.10	-1.15
	2024	0.45	2.70	-1.10
Qatar	2021	0.46	4.80	-0.62
	2022	0.48	3.70	-0.58
	2023	0.50	3.20	-0.55
	2024	0.53	4.10	-0.50
Chile	2021	0.55	11.70	-0.05
	2022	0.57	2.40	-0.02
	2023	0.59	1.90	0.00
	2024	0.61	3.00	0.05

* Diversification index values correspond to greater diversification
Created by the authors, based on Chairul et al. (2025), Delechat et al. (2024), DeRemer et al. (2025), Olvera and Spinola (2025)

clean technologies), and ensure fiscal stability to offset cyclical shocks are critical.

Quantitative analysis of economic diversification in the selected countries allows us to assess the dynamics of changes in the structure of their economies and identify the factors that contribute to the transition from resource dependence to a multi-sectoral development model. The use of econometric modeling and panel data analysis methods makes it possible not only to trace differences between countries but also to identify long-term patterns. Of particular importance in this context is the consideration of economic complexity, institutional quality, and investment flows that determine the pace of diversification (Chairul et al. 2025; Delechat et al., 2024). To illustrate the results, a table with panel data of five resource-dependent countries is constructed, showing the Herfindahl-Hirschman Index (inverse indicator), GDP growth rate, and economic complexity index for 2021-2024. See **Table**

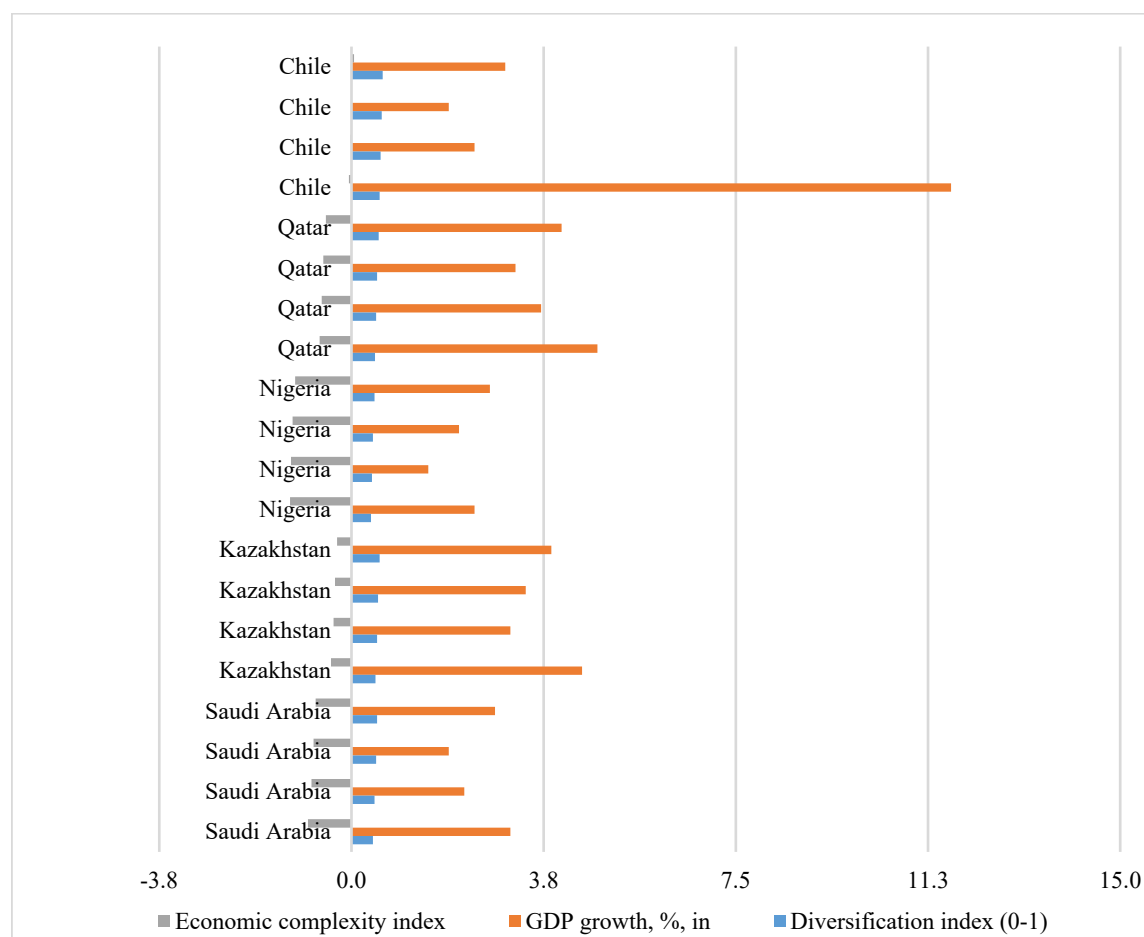


Figure 1. Comparison of key indicators of diversification and economic resilience in selected countries (2021-2024) (Source: Authors' own elaboration)

3 for a summary of quantitative indicators of economic diversification in the selected countries.

The results of the analysis show that countries demonstrate different rates of diversification. For example, Chile and Kazakhstan are gradually increasing their diversification index, which is accompanied by stabilization of economic complexity. At the same time, Nigeria and Saudi Arabia remain more vulnerable, as despite the growth of the diversification index, their economic complexity scores remain negative. This means that diversification is mostly quantitative rather than qualitative. In general, the data confirm the findings of previous studies: effective diversification is only possible with institutional support and integration into global production networks (Olaniyi & Odhiambo, 2024; Timbe et al., 2024).

To illustrate the dynamics of economic diversification indicators in the selected countries, **Figure 1** shows the correlation between the diversification index, GDP growth, and the economic complexity index.

An analysis of the data shows that among all countries, Chile demonstrated the most significant fluctuations, with GDP growth reaching 11.7% in 2021, while in subsequent years there was a sharp decline to 2.4% in 2022 and 1.9% in 2023, with a partial recovery to 3.0% in 2024. At the same time, the diversification index increased from 0.55 to 0.61, and the economic complexity index entered the positive zone, indicating qualitative structural changes. Kazakhstan and

Qatar have shown a gradual increase in diversification (by +0.08 and +0.07 points, respectively, in 2021-2024), with relatively stable GDP growth rates of 3-4%, which confirms the balance of their development models. Saudi Arabia and Nigeria, on the other hand, remain vulnerable: their economic complexity index remains negative, and GDP growth does not exceed 3% in most years. The growth in the diversification index for these countries is positive (+0.08 in Saudi Arabia and +0.07 in Nigeria), but it is accompanied by only a slight improvement in the structure of the economy. In general, the analysis shows that even at low GDP rates diversification can take place, but its effectiveness depends on a qualitative increase in economic complexity and resilience to external shocks.

Practical recommendations on diversification policies to increase economic resilience should be based on global indices and the international experience of countries that have successfully transformed from resource-based to innovation-based economies. The use of indicators such as the Global Economic Diversification Index and indicators of economic complexity allows for an objective assessment of progress and identification of critical areas of development. It is important to create systems for monitoring diversification processes that would identify weak sectors and allow for prompt adjustment of economic policy. At the same time, institutional strengthening is a key task: the formation of transparent industrial policy mechanisms aimed at attracting investment,

Table 4. Waste utilization as a factor of economic diversification

Waste utilization direction	Economic effect	Social effect	Environmental effect	Country examples
Recycling	Creation of new industries, reduction of raw material imports	New jobs in waste management and logistics	Reduction of landfill waste volumes	Germany, South Korea
Energy recovery (Waste-to-Energy)	Additional source of energy, reduced fuel import costs	Improved energy security, regional development	Reduction of methane emissions, optimization of carbon balance	Sweden, Denmark
Use of organic waste in bioenergy	Development of biogas and biofuel sector	Support for rural areas and farming households	Reduced soil and water pollution	Brazil, Netherlands

Created by the authors

supporting small and medium-sized enterprises, and creating a level playing field. Such measures ensure investor confidence and reduce the risks associated with the cyclical nature of global commodity markets. **Figure 1** visualizes the relationship between diversification, GDP growth, and economic complexity for five countries over 2021–2024.

Another important step is the development of innovative and high-tech sectors capable of generating new sources of economic growth. Investments in digital technologies, green energy, and biotechnology create a long-term basis for reducing resource dependence and enhancing competitiveness in global markets.

Macroeconomic diversification relies on circular economy sectors by defining them as specific high-value, innovation-oriented activities that complement traditional sectoral diversification. This is an additional policy direction that is not empirically captured in the data set of this study. The notion of the circular economy is acquiring a special significance in the context of a shift towards an innovation-based development model. Recycling of waste, reuse of waste, and energy recovery of waste can provide more ways of economic diversification. This is not only a way of decreasing the environmental burden but also new industries are formed, employment is generated and energy security is enhanced (**Table 4**). It should be noted that the table is illustrative and conceptual.

Countries such as Saudi Arabia and Nigeria can implement waste-to-energy (WtE) technologies in line with their own infrastructure through public-private partnerships (PPPs), the establishment of RDF (solid recovered fuel) plants and the integration of informal waste collection systems. In particular, Saudi Arabia can focus on the use of organics and plastics, as more than 50% of municipal waste is food waste. It is also advisable to use them as fuel for industry: for example, through the company SIRC (Saudi Investment Recycling), the state recycles millions of tons of municipal waste into fuel for cement plants. For Nigeria, local WtE plants in regions with high levels of waste generation (e.g. Lagos) and interaction with international companies such as Bioenergy News (Harvest Waste Consortium) to build plants on landfills that will supply electricity to the power grid are relevant.

Therefore, the recycling and waste-to-energy technologies can be incorporated into the economic diversification strategies, which will allow combining the economic viability with socio-environmental advantages. To resource-dependent countries, it can turn out to be a major path towards decreasing exposure to external shocks and establishing a more robust development paradigm.

The concept of integration involves: resource recovery (instead of accumulating waste in landfills, it is considered as a secondary raw material or energy source); WtE technologies (include incineration of non-recyclable residues with generation of heat and electricity), as well as anaerobic biogas collection or gasification; value chain (energy obtained from waste replaces traditional fossil resources (coal, gas), protecting critical infrastructure).

In addition, regional integration and active participation in global value chains allow resource-based countries to engage in high-tech production segments, which contributes to job creation and economic sophistication. Taken together, these approaches form a balanced diversification strategy that ensures not only a quantitative expansion of the economic structure but also its qualitative transformation.

DISCUSSION

The results of the study confirmed that the process of economic diversification in countries with high resource dependence is multidimensional and is determined by a combination of economic complexity, institutional quality and integration into global value chains. Export diversification and the economic complexity index in Chile and Kazakhstan indicate qualitative structural changes, while Saudi Arabia and Nigeria have seen a quantitative expansion of production, without a shift to more sophisticated technological sectors. This is consistent with the position of those authors who believe that the resource curse cannot be overcome without the development of knowledge industries (Li et al., 2024; Olaniyi & Odhiambo, 2024), but partially contradicts the works that prove that even in conditions of a low technological base, diversification can bring short-term economic benefits (Alrubaye et al., 2025; Imran et al., 2025).

The institutional aspect also showed mixed results. In countries with relatively strong institutions and political will (Kazakhstan, Chile), diversification processes were more sustainable, which confirms the findings of Delechat et al. (2024) and Zafar and Ali (2025). At the same time, the examples of Nigeria and Saudi Arabia show that institutional reforms are limited in cases where the rent economy reproduces dependence on commodity revenues, which is consistent with the arguments of Mishrif and Al Balushi (2014) and Lashitew et al. (2021). Thus, our own results confirm the thesis of the crucial role of institutional quality, but at the same time demonstrate its insufficiency without innovation policy and investment in human capital.

Interestingly, participation in global value chains proved to be a significant factor for increasing economic resilience, which is in line with the findings of DeRemer et al. (2025) and Olvera and Spinola (2025). However, our analysis shows that integration into international production networks can also have risks, as it makes countries more dependent on global conditions, which is consistent with the warnings of Kilian et al. (2024) about the impact of geopolitical shocks on price volatility. This suggests that diversification through global chains should be combined with domestic reforms to minimize external risks.

Our results also point to the growing role of digital governance and the green economy. The introduction of digital platforms and increased investments in renewable energy create the basis for qualitative diversification, as confirmed by Wei et al. (2025) and Sultanova and Naser (2025). At the same time, IEA data (2022; 2023) showed that energy price volatility in 2021-2023 slowed clean energy investments, highlighting the vulnerability of countries without financial buffers. This partly contradicts the optimistic conclusions of Dias Paião Júnior and Ferraz (2024), who viewed diversification as a linear process of sustainable development.

An analysis of the data shows that among all countries, Chile demonstrated the most significant fluctuations, with GDP growth reaching 11.7% in 2021, while in subsequent years there was a sharp decline to 2.4% in 2022 and 1.9% in 2023, with a partial recovery to 3.0% in 2024. At the same time, the diversification index increased from 0.55 to 0.61, and the economic complexity index entered the positive zone, indicating qualitative structural changes. Kazakhstan and Qatar have shown a gradual increase in diversification (by +0.08 and +0.07 points, respectively, in 2021-2024), with relatively stable GDP growth rates of 3-4%, which confirms the balance of their development models. Saudi Arabia and Nigeria, on the other hand, remain vulnerable: their economic complexity index remains negative, and GDP growth does not exceed 3% in most years. The growth in the diversification index for these countries is positive (+0.08 in Saudi Arabia and +0.07 in Nigeria), but it is accompanied by only a slight improvement in the structure of the economy. In general, the analysis shows that even at low GDP rates diversification can take place, but its effectiveness depends on a qualitative increase in economic complexity and resilience to external shocks. This significantly expands previous achievements in industry research.

To summarize, the results of our study support the hypothesis of the multidimensionality of economic diversification and its dependence on a combination of institutions, economic complexity, digitalization, and environmental transformation. Limitations of the study include a limited number of countries and time period, as well as insufficient coverage of qualitative indicators of social and environmental sustainability. Further research should focus on comprehensive modeling of the interrelationships between institutional reforms, human capital, and the green economy, as well as on assessing the effectiveness of mission-oriented industrial strategies in different regions of the world. Further research should combine quantitative and qualitative analysis, include a broader time horizon, and include more socio-environmental indicators. This would allow for a better

understanding of the long-term effects of diversification and the justification of comprehensive strategies for resource-dependent economies.

CONCLUSIONS

This study has shown that economic diversification in resource-dependent countries is not an automatic process, but requires a combination of technological upgrading, institutional capacity, and integration into global production networks. The results showed that although it was expected to confirm only the role of economic complexity as the main driver of sustainability, in fact, digital governance and socio-environmental factors turned out to be no less important, which is the scientific novelty of the study. The study's findings show that diversification based solely on expanding productive sectors is insufficient without institutional quality, economic sophistication, and digital governance. Integration into global value chains provides opportunities for technological development, but also increases the impact of external risks. Investment in green energy and digital innovation are identified as key drivers of long-term sustainability.

It is important to deepen interdisciplinary approaches that will allow the integration of econometric methods with the analysis of political and social processes that shape the long-term sustainability of economies.

Political Consequences

The main political consequences concern stabilization in the face of price volatility, supporting institutional reforms, investing in digital governance, green energy, and developing circular economy sectors. For a country seeking to reduce its resource dependence, policies that minimize price volatility, stimulate investment in new sectors (especially clean technologies), and ensure fiscal stability to compensate for cyclical shocks are critical.

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AI statement: The authors stated that no AI tools were used in the preparation of the work.

Declaration of interest: No conflict of interest is declared by the authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from corresponding author.

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