



INNOVATION-LED PATHWAYS FOR EXPORT DIVERSIFICATION IN UZBEKISTAN: EVIDENCE FROM RCA AND PRODUCT SPACE ANALYSIS

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Abstract. This article examines the current state of export diversification in Uzbekistan and explores opportunities for innovation-driven export transformation. The study employs export diversification indicators, Revealed Comparative Advantage (RCA), and Product Space methodology to identify existing comparative advantages and future diversification opportunities. The findings reveal that Uzbekistan's exports remain concentrated in traditional sectors; however, substantial opportunities exist for upgrading toward more sophisticated and higher-value-added products through innovation, human capital development, and productive capacity enhancement. The study provides policy recommendations for strengthening export competitiveness and accelerating structural transformation.

Keywords: export diversification, innovation, Product Space, revealed comparative advantage, economic complexity, productive capacities, Uzbekistan.

O'ZBEKISTONDA EKSPORT DIVERSIFIKATSIYASINI RIVOJLANTIRISHNING INNOVATSION YO'LLARI: RCA VA PRODUCT SPACE TAHLILI ASOSIDA

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Annotatsiya. Mazkur maqolada O'zbekiston eksport diversifikatsiyasining joriy holati va uni innovatsiyalar orqali rivojlantirish imkoniyatlari tahlil qilinadi. Tadqiqotda eksport diversifikatsiyasi indeksleri, "Revealed Comparative Advantage" (RCA) va "Product Space" metodologiyalaridan foydalanilgan. Tahlil natijalari O'zbekiston eksportida an'anaviy mahsulotlar ustunligini saqlab qolayotganini, biroq innovatsion rivojlanish, inson kapitali va ishlab chiqarish salohiyatini kuchaytirish orqali yuqori qo'shilgan qiymatli mahsulotlarga o'tish imkoniyatlari mavjudligini ko'rsatadi. Tadqiqot natijalari eksport siyosatini takomillashtirish va innovatsiyalar asosida tarkibiy transformatsiyani jadallashtirish bo'yicha amaliy tavsiyalar ishlab chiqishga xizmat qiladi.

Kalit so'zlar: eksport diversifikatsiyasi, innovatsiya, "Product Space", RCA, iqtisodiy murakkablik, eksport tarkibi, ishlab chiqarish salohiyati, O'zbekiston.

ИННОВАЦИОННЫЕ ПУТИ РАЗВИТИЯ ДИВЕРСИФИКАЦИИ ЭКСПОРТА В УЗБЕКИСТАНЕ: НА ОСНОВЕ АНАЛИЗА RCA И PRODUCT SPACE

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Аннотация. В статье анализируется текущее состояние диверсификации экспорта Узбекистана и возможности её развития посредством инноваций. В исследовании используются индексы диверсификации экспорта, методология Revealed Comparative Advantage (RCA) и Product Space. Результаты показывают, что экспорт страны по-прежнему концентрируется на традиционных товарах, однако существуют значительные возможности для перехода к более технологически сложной и высокодоходной продукции за счёт инноваций, развития человеческого капитала и укрепления производственного потенциала.

Ключевые слова: диверсификация экспорта, инновации, Product Space, RCA, экономическая сложность, экспортная структура, производственный потенциал, Узбекистан.

Introduction.

Export diversification has become one of the most important priorities of economic development policy in both developed and developing countries. In the context of increasing globalization, geopolitical uncertainty, technological transformation, and changing patterns of international trade, countries are increasingly seeking to reduce dependence on a narrow range of export products and markets while enhancing economic resilience through diversification (Hausmann et al., 2007; WTO, 2024).

The experience of successful emerging economies demonstrates that sustainable economic growth is strongly associated with the ability to diversify production structures and export portfolios. Countries that successfully move from resource-based exports toward technologically sophisticated products generally achieve higher productivity growth, stronger innovation performance, and greater integration into global value chains (Hidalgo and Hausmann, 2009).

Uzbekistan has implemented substantial economic reforms since 2017, including foreign exchange liberalization, trade facilitation measures, industrial modernization programs, and policies aimed at promoting export-oriented production. These reforms have contributed to significant growth in merchandise exports and broader integration into the global economy (World Bank, 2024b).

Despite these achievements, several structural challenges remain. The country's export basket continues to be concentrated in agricultural commodities, textiles, metals, and other resource-based products. Although these sectors provide important export revenues, excessive dependence on a limited number of products may increase vulnerability to external shocks, price fluctuations, and changes in international demand (UNCTAD, 2024a).

Recent studies suggest that innovation plays a crucial role in enabling countries to diversify exports and move toward higher value-added activities (Aghion and Howitt, 1992). Innovation enhances productivity, facilitates technological upgrading, and creates opportunities for entering new markets. Consequently, innovation-led export diversification has emerged as a key component of contemporary development strategies.

Another important perspective is provided by Product Space theory, which argues that countries diversify more successfully when new products are closely related to their existing

productive capabilities (Hidalgo and Hausmann, 2009). The framework enables researchers to identify realistic pathways for structural transformation and export upgrading.

Given these considerations, understanding the relationship between innovation, productive capacities, and export diversification is particularly important for Uzbekistan. The country's long-term development strategy emphasizes industrial modernization, technological advancement, and increased competitiveness in international markets. Achieving these objectives requires a comprehensive understanding of existing comparative advantages and future diversification opportunities.

The main purpose of this study is to assess the current state of export diversification in Uzbekistan and identify innovation-driven pathways for export transformation using RCA and Product Space methodologies.

The study seeks to answer the following research questions:

- What is the current level of export diversification in Uzbekistan?
- Which sectors demonstrate revealed comparative advantages?
- What opportunities for export upgrading can be identified through Product Space analysis?
- How can innovation and productive capacities contribute to sustainable export diversification?

The remainder of the article is organized as follows. The next section reviews the theoretical and empirical literature on export diversification, innovation, and economic complexity. The third section describes the research methodology and data sources. The fourth section presents empirical findings based on RCA and Product Space analyses. The final sections discuss policy implications and provide conclusions and recommendations.

Literature Review.

Export diversification has become one of the most widely discussed topics in international trade and development economics because of its contribution to sustainable economic growth, economic resilience, and structural transformation. While classical trade theories emphasize specialization according to comparative advantage, contemporary studies suggest that excessive dependence on a limited number of export products may increase vulnerability to external shocks, commodity price fluctuations, and unstable export earnings (Imbs and Wacziarg, 2003). Consequently, export diversification is increasingly viewed as an important mechanism for reducing economic risks and strengthening long-term development prospects.

The existing literature generally distinguishes between horizontal and vertical export diversification. Horizontal diversification refers to the expansion of exported products and destinations, whereas vertical diversification involves moving toward products with higher technological content and greater value added (Cadot et al., 2011). Empirical studies indicate that countries with diversified export structures tend to achieve higher economic growth and greater macroeconomic stability. Hesse (2008) and Agosin et al. (2012) demonstrate that export diversification positively affects long-term economic performance, particularly in developing economies.

Innovation has been identified as one of the key drivers of export diversification. According to Schumpeter (1934), innovation serves as the main force behind structural change and economic development. More recent studies emphasize that technological progress, research and development activities, human capital accumulation, and digital transformation enhance firms' ability to produce sophisticated goods and compete in international markets (Grossman and Helpman, 1991; Aghion and Howitt, 1992). Countries with stronger innovation systems generally exhibit higher levels of export sophistication and economic complexity, enabling them to diversify beyond traditional products and enter high-value-added industries (Fagerberg et al., 2010).

Another important concept in the literature is productive capacities, which UNCTAD defines as the productive resources, entrepreneurial capabilities, and institutional conditions that determine a country's ability to produce goods and services competitively (UNCTAD, 2022). Productive capacities include human capital, infrastructure, institutional quality, technological capabilities, and private sector development. The centrality of institutional quality in this framework is consistent with a broader body of research showing that the quality of a country's economic and political institutions is a fundamental determinant of long-term productive performance and structural transformation (Acemoglu and Robinson, 2012). Research suggests that improvements in productive-capacity areas facilitate export diversification by increasing productivity, reducing transaction costs, and supporting innovation activities (Rodrik, 2008). This view is closely aligned with the New Structural Economics framework, which argues that industrial policy is most effective when it is designed to follow, rather than override, a country's evolving comparative advantage (Lin, 2012).

The relationship between productive capabilities and export diversification is further explained by Economic Complexity Theory and Product Space methodology developed by Hidalgo and Hausmann (2009). Economic complexity reflects the amount of productive knowledge embedded within an economy, while Product Space analysis illustrates how countries can diversify into new products based on existing capabilities. According to this approach, countries are more likely to succeed in producing goods that are technologically related to their current export basket. Therefore, diversification opportunities depend not only on comparative advantages but also on the accumulation of productive knowledge and innovation capabilities.

Recent studies on developing economies confirm that innovation, productive capacities, and economic complexity are among the most important determinants of successful export diversification (Parteka and Tambari, 2013; OECD, 2023). However, despite growing interest in export diversification, relatively limited research has examined the combined role of innovation, revealed comparative advantages, and Product Space opportunities in the context of Uzbekistan. Therefore, this study seeks to address this gap by integrating RCA analysis, Product Space methodology, and innovation-based perspectives to identify potential pathways for export diversification and structural transformation in Uzbekistan.

Research Methodology.

This study employs a quantitative and descriptive research approach to assess the current state of export diversification in Uzbekistan and identify potential pathways for export upgrading through innovation and productive capacity development. The research combines statistical analysis with Revealed Comparative Advantage (RCA) and Product Space methodologies to evaluate the country's export structure, comparative advantages, and diversification opportunities.

The study relies primarily on secondary data collected from internationally recognized databases, including the United Nations Conference on Trade and Development (UNCTAD), the World Integrated Trade Solution (WITS), the Observatory of Economic Complexity (OEC), the World Bank's World Development Indicators (WDI) (World Bank, 2024a), and the Global Innovation Index (GII). The analysis covers the period from 2017 to 2024, allowing for an assessment of recent export trends and structural changes in Uzbekistan's economy. This period was selected on the basis of data availability, as it corresponds to the years for which consistent indicator values could be obtained across the UNCTAD, WITS, OEC, WDI, and GII databases for the variables reported in Table 1.

To evaluate the degree of export diversification, export concentration and diversification indicators are utilized. Export concentration measures the extent to which a country's exports are dependent on a limited number of products, while diversification indices assess how closely a country's export structure resembles the global export pattern. Lower concentration levels

generally indicate a more diversified export basket and greater resilience to external economic shocks (Cadot et al., 2011).

The study further employs the Revealed Comparative Advantage (RCA) index developed by Balassa (1965) to identify sectors in which Uzbekistan demonstrates international competitiveness. The RCA index is calculated as follows:

$$RCA_{ij} = \frac{X_{ij}/X_i}{X_{wj}/X_w}$$

where X_{ij} represents exports of product j by Uzbekistan, X_i denotes total exports of Uzbekistan, X_{wj} represents world exports of product j , and X_w denotes total world exports. An RCA value greater than one indicates that the country possesses a revealed comparative advantage in the respective product category, while values below one suggest a comparative disadvantage (Balassa, 1965).

In addition to RCA analysis, Product Space methodology is applied to identify potential diversification opportunities. Developed by Hidalgo and Hausmann (2009), the Product Space framework assumes that products requiring similar capabilities are more likely to be produced together. Therefore, countries can diversify more successfully into products that are technologically and institutionally related to their existing export basket. This methodology enables the identification of realistic opportunities for export upgrading and structural transformation based on current productive capabilities.

To support the interpretation of diversification prospects, the study also considers indicators related to innovation performance and productive capacities, including human capital development, innovation capability, infrastructure quality, and technological readiness. These factors are widely recognized as important determinants of export sophistication and long-term competitiveness (UNCTAD, 2024b; WIPO, 2024). The innovation-related indicators are defined and classified in accordance with internationally accepted guidelines for measuring innovation activity (OECD and Eurostat, 2018).

The reliability of the research is ensured through the use of internationally recognized databases and widely accepted analytical methods. The validity of the findings is strengthened by combining multiple analytical approaches, including descriptive statistics, RCA analysis, and Product Space assessment, allowing for a comprehensive evaluation of export diversification opportunities in Uzbekistan.

Based on this methodological framework, the following section presents the empirical analysis of Uzbekistan's export structure, comparative advantages, and innovation-driven diversification opportunities.

Analysis and Discussion of Results

Current State of Export Diversification in Uzbekistan

Over the past decade, Uzbekistan has experienced significant growth in export activity as a result of economic liberalization, trade facilitation reforms, and industrial modernization policies. Merchandise exports increased substantially between 2017 and 2023, rising from USD 12.9 billion to USD 26.2 billion (Table 1), reflecting the country's deeper integration into international markets. Nevertheless, the structure of exports remains relatively concentrated in a limited number of product groups, including textiles, agricultural products, metals, and mineral-based goods.

The data reveal a gradual improvement in Uzbekistan's export structure and innovation capacity. Merchandise exports increased significantly between 2017 and 2024, while the export concentration index showed a declining trend, indicating a reduced dependence on a limited range of export products. In parallel, the country's performance in international innovation and economic complexity rankings improved, reflecting progress in knowledge-based and value-

added economic activities. Nevertheless, the share of high-technology exports remains relatively low, suggesting that the transition toward a more sophisticated and diversified export basket is still in progress.

Table 1.

Key Export Diversification and Innovation Indicators of Uzbekistan

Indicator	2017	2020	2024
Merchandise Exports (USD billion)	12.9	17.4	26.2
Export Concentration Index	0.256	0.241	0.227
High-Technology Exports (% of total exports)	1.2	1.6	1.5
Global Innovation Index Rank	122	93	83
Economic Complexity Rank	95	86	79

Source: Compiled by the author based on UNCTAD, WITS, OEC, and WIPO databases.

These findings support the view that export growth and export diversification do not necessarily occur simultaneously. As noted by Hausmann et al. (2007), many developing economies initially experience rapid export expansion before achieving substantial structural transformation. Therefore, sustained policy efforts aimed at technological upgrading, innovation development, and product diversification remain essential for enhancing Uzbekistan’s long-term export competitiveness.

Technological Structure of Exports

The technological composition of exports provides additional insights into the nature of Uzbekistan’s export specialization.

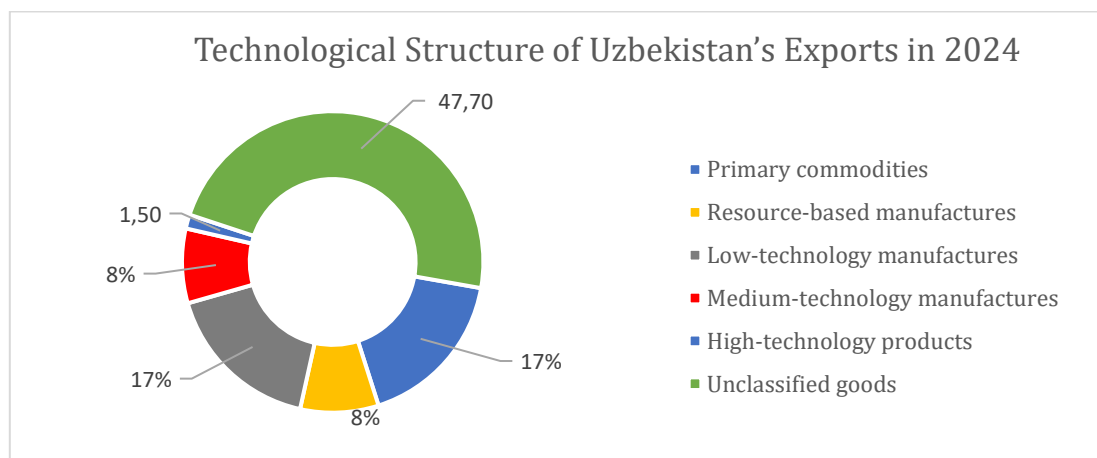


Figure 1. Technological Composition of Uzbekistan’s Exports in 2024

Source: Author’s calculations based on UNCTAD and OEC data.

The technological composition of Uzbekistan’s exports in 2024 reflects the country’s ongoing transition toward a more diversified export structure. As shown in Figure 1, primary commodities accounted for 17.3 percent of total exports, while resource-based and low-technology manufactures represented 8.4 percent and 17.1 percent, respectively. Medium-technology products contributed 8.0 percent, whereas high-technology exports remained limited at only 1.5 percent of total exports.

The relatively small share of high-technology exports indicates that Uzbekistan continues to rely predominantly on products with low and medium technological content. Nevertheless, the growing presence of manufactured goods in the export basket suggests gradual progress in industrial development and value-added production. These findings highlight the importance of policies aimed at strengthening innovation capacity, technological upgrading, and integration into higher-value segments of global value chains.

Revealed Comparative Advantage Analysis

To identify sectors in which Uzbekistan possesses international competitiveness, the Revealed Comparative Advantage (RCA) index was calculated for major export categories.

Table 2.

Revealed Comparative Advantage of Uzbekistan by Product Groups

Product Group	RCA Value
Precious Stones and Metals, incl. Gold (HS 71)	8.45
Textiles and Apparel	5.13
Vegetables and Agricultural Products	2.42
Metals	1.33
Chemicals	0.30
Machinery and Equipment	0.15

Source: Author's calculations based on WITS and OEC trade statistics.

The RCA results reveal that Uzbekistan maintains strong comparative advantages in traditional sectors, particularly precious stones and metals (including gold), textiles, and agricultural goods. These sectors have RCA values substantially above one, indicating that their share in national exports exceeds the corresponding share in world exports.

The exceptionally high RCA value recorded for the precious stones and metals category (8.45) is largely driven by gold, which has consistently represented one of Uzbekistan's largest single export commodities over the period under review. This concentration carries a dual implication for the diversification agenda. On the one hand, gold exports generate substantial foreign exchange earnings and contribute to the relatively favorable RCA position of this category. On the other hand, heavy reliance on a single primary commodity is itself a source of export concentration and exposes the economy to fluctuations in world commodity prices. Consequently, the diversification strategies discussed in Sections 4.4 and 4.5 should be understood as efforts to broaden the export base around, rather than instead of, the existing resource-based sectors.

In contrast, machinery, equipment, and chemical products exhibit RCA values below one, suggesting relatively weak international competitiveness. This finding reflects the limited technological sophistication of the current export structure.

The results support previous studies emphasizing that Uzbekistan's export strengths remain concentrated in resource-intensive and labor-intensive industries. While these sectors provide an important foundation for export earnings, long-term competitiveness requires diversification into more technologically advanced activities (Rodrik, 2008).

Product Space Analysis and Diversification Opportunities

While RCA analysis identifies existing strengths, Product Space methodology helps determine potential directions for future diversification.

According to Hidalgo and Hausmann (2009), countries are more likely to succeed in producing new products that are technologically related to goods already present in their export basket. Therefore, diversification opportunities should be assessed not only according to market demand but also according to existing productive capabilities.

It should be noted that the full Hidalgo–Hausmann methodology typically requires the construction of product-level density and proximity indicators from disaggregated bilateral trade matrices and their representation as a product network. Therefore, the Product Space framework is applied here in a qualitative form. Sectors are evaluated according to (i) their current export competitiveness, informed by the RCA results presented in Table 2, and (ii) their conceptual proximity to Uzbekistan's existing productive capabilities, technological complexity, and global demand trends derived from the OEC and GII databases. Future research

may extend this analysis through the application of a full quantitative Product Space approach using detailed HS-code-level trade data.

A related methodological clarification concerns the inclusion of information technology services among the priority sectors in Table 3. The RCA index and the formal Product Space network are both constructed from merchandise trade data classified under the Harmonized System (HS), whereas information technology services belong to the services account of the balance of payments and are therefore not part of the conventional merchandise product space. Information technology services are included in Table 3 as a qualitative, services-based extension of the diversification analysis, reflecting Uzbekistan's growing digital infrastructure and human-capital base rather than a position within the merchandise Product Space network. Its diversification potential should accordingly be interpreted as complementary to, rather than directly comparable with, the merchandise-based sectors in Table 3.

The Product Space assessment indicates that Uzbekistan possesses favorable conditions for diversification into several medium-technology manufacturing sectors closely connected to current export activities.

Table 3.

Priority Sectors for Future Export Diversification

Sector	Current Competitiveness	Diversification Potential
Agro-processing	High	High
Textile Upgrading and Technical Textiles	High	High
Chemical Industry	Medium	High
Pharmaceuticals	Medium	High
Information Technology Services	Medium	Very High
Renewable Energy Equipment	Low	High

Source: Author's assessment based on Product Space analysis.

The analysis suggests that agro-processing and textile upgrading represent the most realistic short-term diversification opportunities because they build upon existing comparative advantages. These sectors require capabilities that are already partially available within the economy.

At the same time, pharmaceuticals, information technology services, and renewable energy equipment offer promising medium- and long-term opportunities. Although these sectors currently exhibit limited export competitiveness, they possess higher technological complexity and greater value-added potential.

The sectoral priorities and ratings reported in Table 3 are directly informed by the RCA results presented in Table 2, even though the two tables employ different sectoral classifications. Agro-processing and textile upgrading are rated as having "High" current competitiveness because they represent value-added extensions of the vegetables and agricultural products (RCA = 2.42) and textiles and apparel (RCA = 5.13) categories, in which Uzbekistan already demonstrates a strong revealed comparative advantage. The chemical industry and pharmaceuticals correspond to the chemicals category in Table 2 (RCA = 0.30); their "Medium" current-competitiveness rating reflects this below-unity RCA value, while their "High" diversification potential reflects the technological proximity of basic chemical production to pharmaceutical manufacturing. Renewable energy equipment is linked to the machinery and equipment category (RCA = 0.15); its "Low" current-competitiveness rating mirrors this weak RCA position, while its "High" diversification potential reflects rising global demand for renewable energy components. Information technology services, as discussed above, does not correspond to any category in Table 2 and is instead assessed on the basis of human-capital and digital-infrastructure indicators.

Innovation and Productive Capacities as Drivers of Export Diversification

The empirical evidence indicates that successful diversification depends not only on trade policies but also on broader innovation and productive capacity development. Countries that achieve sustained export upgrading generally invest heavily in human capital, technological capabilities, research and development, and institutional quality (Aghion and Howitt, 1992).

Uzbekistan has demonstrated notable progress in innovation performance during recent years, with its Global Innovation Index rank improving from 122nd in 2017 to 83rd in 2024 (Table 1). Despite this improvement, a rank in the low 80s still places Uzbekistan in the lower-middle tier of the index, and the share of high-technology exports remained at only 1.5 percent of total exports in 2024 (Table 1). This suggests that, although the trend is positive, the absolute level of innovation capacity and export sophistication remains modest relative to the scale of structural transformation envisaged in Sections 4.3 and 4.4.

From a policy perspective, strengthening productive capacities should focus on four priority areas:

- Expansion of research and development activities targeted at the chemical, pharmaceutical, and agro-processing sectors identified in Table 3, with the explicit aim of increasing the share of high-technology exports beyond the 1.5 percent recorded for 2024 (Table 1) over the medium term;

- Improvement of higher education and workforce skills in fields directly relevant to the sectors rated “High” or “Very High” in diversification potential in Table 3, particularly digital and information technology skills for the IT services sector and pharmaceutical and chemical engineering skills for the chemical and pharmaceutical industries;

- Development of digital infrastructure to support the growth of information technology services exports, and of transport, logistics, and cold-chain infrastructure to support the agro-processing and textile upgrading sectors, which Table 3 identifies as already possessing “High” current competitiveness;

- Targeted support for export-oriented firms operating in the sectors where Uzbekistan already holds a revealed comparative advantage (Table 2) – particularly textiles and agricultural products – to facilitate their upgrading into the higher-value-added agro-processing and textile-upgrading activities identified as priority sectors in Table 3.

These measures would facilitate the transition from resource-based exports toward more sophisticated products, thereby improving economic complexity and export resilience.

Overall, the findings suggest that Uzbekistan possesses significant opportunities for export diversification. Existing comparative advantages provide a strong foundation for industrial upgrading, while Product Space analysis identifies realistic pathways toward more complex and higher-value-added exports. Nevertheless, realizing these opportunities requires sustained investments in innovation, productive capacities, and institutional development.

Conclusion.

This study examined the current state of export diversification in Uzbekistan and assessed the role of innovation and productive capacities in supporting export transformation. Using export diversification indicators, Revealed Comparative Advantage (RCA), and Product Space methodologies, the research identified both the strengths and limitations of the country’s existing export structure.

The findings indicate that although Uzbekistan has achieved substantial growth in export volumes during recent years, exports remain concentrated in a limited number of traditional sectors, particularly textiles, agricultural products, metals, and resource-based goods. The RCA analysis confirms that these sectors continue to represent the country’s strongest comparative advantages in international markets. However, the relatively low share of medium- and high-technology products suggests that the level of export sophistication remains limited.

The Product Space analysis reveals that Uzbekistan possesses significant opportunities for diversification into more complex and higher-value-added products. In particular, agro-processing, advanced textile manufacturing, chemicals, pharmaceuticals, information technology services, and renewable energy-related industries emerge as promising directions for future export development. These sectors are closely connected to the country's existing productive capabilities and therefore represent realistic pathways for structural transformation.

The study further demonstrates that innovation, human capital development, technological capabilities, and institutional quality are critical factors influencing export diversification. Sustainable export transformation requires not only trade promotion policies but also long-term investments in research and development, education, infrastructure, and innovation ecosystems.

Overall, the results suggest that Uzbekistan has favorable conditions for accelerating export diversification and increasing export sophistication. The successful implementation of innovation-oriented industrial policies can strengthen international competitiveness, reduce dependence on traditional exports, and contribute to sustainable economic growth. Therefore, integrating innovation policy with export development strategies should remain a key priority for achieving long-term structural transformation and enhancing the country's position in the global economy.

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