DOI: https://doi.org/10.24818/cike2024.21
UDC: [339.137.2:658.562]:339.564(478)

THE COMPETITIVENESS AND SOPHISTICATION INDEX OF DOMESTIC PRODUCTS ON GLOBAL MARKETS

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Abstract: This article analyzes the current state of Moldova's foreign trade, highlighting the importance of competitiveness and the sophistication of exported products within the global economy. Moldova, a country with limited economic resources, faces significant challenges in its integration into international markets. In this context, the article aims to investigate the impact of the complexity of exported products on Moldova's positioning, emphasizing both the positive aspects and the challenges encountered. To evaluate the competitiveness of Moldovan products, the article uses a range of economic indicators, including the sophistication index, which reflects the level of innovation and refinement of the exported goods. It is emphasized that a higher level of product sophistication not only increases added value but also enhances their attractiveness in international markets. The article also addresses the gaps that need to be filled to improve competitiveness. For example, it mentions the need for investments in logistical infrastructure, the development of clear international marketing strategies, and workforce training as essential factors for enhancing the country's export capacity. In conclusion, the article reiterates that by focusing on increasing product sophistication and improving competitiveness, Moldova can strengthen its position in global markets, attract foreign investment, and ensure sustainable economic development in the long term. A series of strategic recommendations for the future are proposed, with the primary goal of effectively integrating into the globalized economy.

Keywords: International Trade, Export Performance, Competitiveness, Sophistication Index.

JEL Classification: F6, F4, F1.

Introduction

The dynamics of international trade play a crucial role in shaping the economic growth trajectories of nations. For small economies like Moldova, with limited natural resources and a relatively small domestic market, competitiveness in global markets is essential for survival and economic growth. This article explores the concept of product sophistication and its impact on Moldova's global competitiveness. As globalization intensifies, countries that succeed in innovating and improving their product offerings gain a competitive edge. This study will examine the role product sophistication plays in enhancing Moldova's export performance and its implications for long-term economic development.

Moldova's foreign trade models reflect a struggle to establish a sustainable position in international markets. The country faces numerous challenges related to market access, product competitiveness, and the limited diversification of its export basket.

The purpose of this article is to analyze and assess the current state of Moldova's foreign trade, highlighting the importance of product competitiveness and sophistication in the global economy. We will also examine the specific barriers that hinder the improvement of Moldova's export performance and propose strategies to overcome these obstacles.

The objective of the research is to conduct a dynamic analysis of statistical data on Moldova's foreign trade, with a special focus on the main groups of exported goods, to illustrate the evolution of the sophistication index of these products and identify the key challenges and opportunities that can contribute to improving export performance. Based on this analysis, the research will formulate strategic proposals aimed at supporting the growth of Moldova's competitiveness in international markets.

Applied research methods

This article uses a series of economic indicators to assess Moldova's competitiveness in international trade, focusing on the analysis of the main groups of exported products. **The Product Complexity Index (PCI)**, also known as the sophistication index, will be used to measure the complexity and level of innovation embedded in the products exported by Moldova. The PCI evaluates the complexity of a product based on the knowledge and technologies required to produce it, thus suggesting how advanced the economy behind that product is (Hidalgo și Hausmann, 2009).

For this analysis, data comes from internationally recognized sources, such as **UN Comtrade** (UN Comtrade, 2023), a global database of international trade managed by the United Nations, and the **Observatory of Economic Complexity (OEC)** (Harvard University, 2022), which provides detailed indicators on product complexity and international trade. These indicators are essential for understanding the current structure of exports and identifying areas where Moldova can improve performance and diversify its exports (World Bank, 2022).

Results and discussions

The concept of economic complexity, particularly in relation to product sophistication, has gained significant attention in recent years, as highlighted by researchers Hausmann and Hidalgo, who demonstrated the importance of product diversification and sophistication in determining a country's long-term economic growth potential (Hidalgo și Hausmann, 2009).

The Economic Complexity Index **(ECI)** and The Product Complexity Index **(PCI)** have become crucial indicators in assessing the competitiveness of a country's export profile. According to these metrics, countries that export highly sophisticated products tend to experience higher growth rates and are more resilient to global economic shocks (World Bank, 2023).

In the case of Moldova, its export basket is dominated by agricultural products and low value-added goods. This lack of diversification and sophistication limits the country's ability to compete in higher value-added sectors, where economic gains are more substantial. Literature on small transitioning economies, such as those in Eastern Europe and the former Soviet space, indicates that product innovation, investments in technology, and skill development are essential for improving competitiveness in global markets (World Bank, 2022).

The current state of Moldova's export performance

The economy of the Republic of Moldova is strongly influenced by its international trade, with exports playing a crucial role in the country's economic growth. Currently, Moldova's export structure is dominated by agricultural products and basic manufactured goods, such as wine, fruits, electrical wiring, and textiles. This dependence on low-complexity and low value-added products creates vulnerabilities to global and regional economic changes, limiting the country's competitiveness in international markets.

A large portion of the production in Moldova's manufacturing sector is carried out under the lohn system, which reduces the value added created domestically, highlighting the need for modernization

and an increase in the technological level of the local industry. According to available data from international platforms such as **Trade Map** and **OEC**, Moldova's exports are concentrated in a few main groups: electrical equipment, cereals, oilseeds, and fruits (we consider fuels irrelevant in our analysis as they do not reflect the country's strategic direction for economic development).

These products are largely characterized by low technological sophistication, reflected in their low prices on external markets. Although global demand for these products remains steady, the lack of diversification and innovation in the production chain reduces Moldova's potential to increase its competitiveness and modernize its economy in the long term (Figure 1)

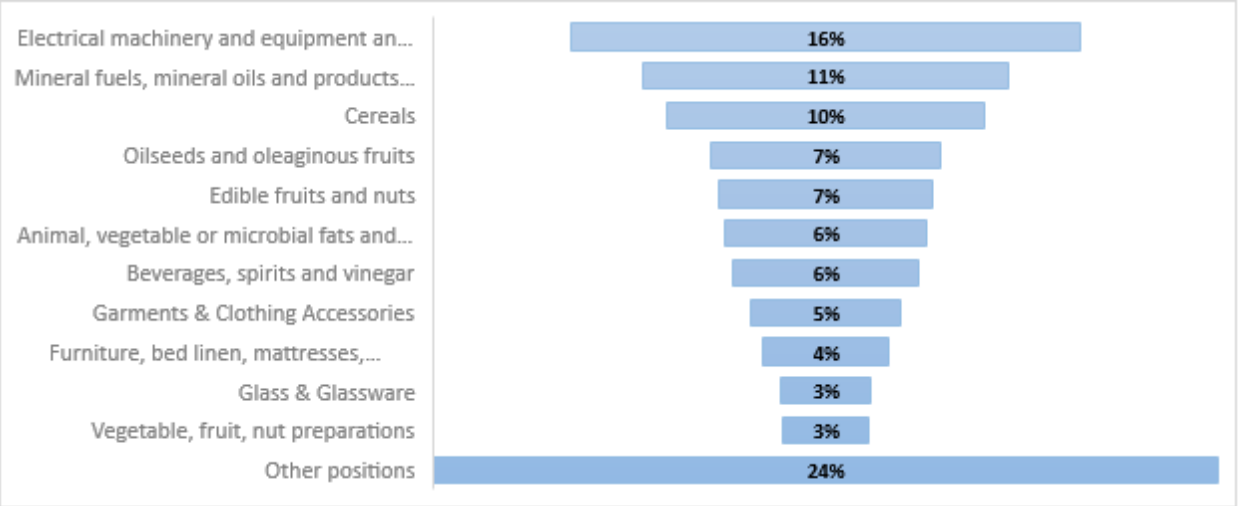

Figure 1. Structure of exports for the main product groups (%), year 2023

Source: Calculated by the author based on data from Trade Map, 2022.

From the perspective of the Product Complexity Index (PCI), Moldova is in a transitional phase, with significant opportunities to increase the added value of its exports. This index reflects the level of knowledge and technology involved in the production of exported goods, and Moldova, with an economy largely based on the export of raw materials, needs to prioritize investments in technology and innovation to advance.

An increase in product sophistication could enhance competitiveness in international markets, facilitating better economic diversification and reducing dependence on low-value-added goods (Hidalgo și Hausmann, 2009).

The analysis of exports for the year 2023 highlights a mixed dynamic, with some sectors experiencing modest growth, while others stagnated or declined. Notably, the machinery and electrical equipment sector, which accounts for a significant portion of Moldova's total export value, grew by only 3% annually between 2019 and 2023, according to the data (Biroul Național de Statistică al Republicii Moldova, 2023). This slow growth rate may be associated with several factors, including the lack of a skilled workforce (Center for International Relations, 2014) and insufficient investment in innovation and technology.

To counter this stagnation, Moldova must take significant steps by investing in the development of a well-prepared workforce and promoting technological innovation. Additionally, it is essential to find new markets and diversify its exports. Increasing the sophistication of exported goods could help strengthen Moldova's position in the international market, reducing vulnerability to external fluctuations and boosting overall competitiveness.

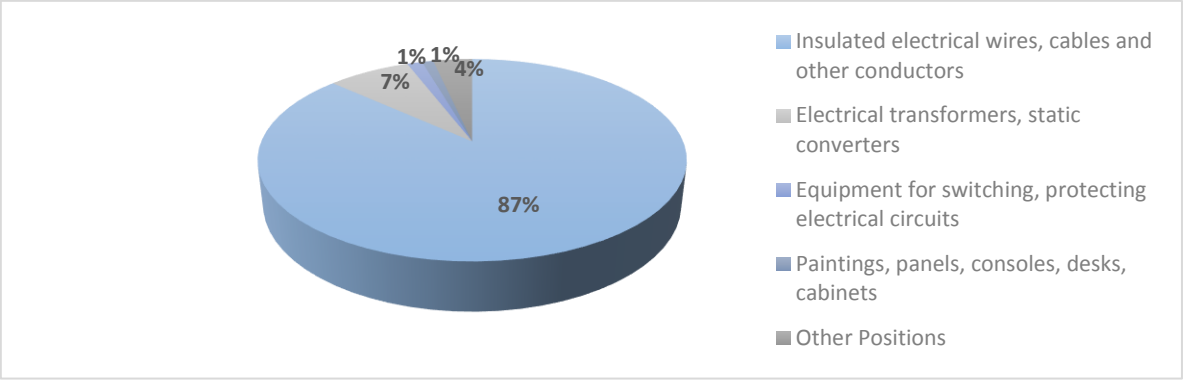

Figure 2. Structure of Electrical Machinery and Equipment, year 2023
Source: Calculated by the author based on data from Trade Map, 2022

In the category of **Machinery and Electrical Equipment**, **electrical wires and cables** have a significant share of total exports (86.7% of this category) (Figure 2), but their technological complexity, measured by the Product Complexity Index (PCI), is low. The negative PCI for the years 2021 (-0.1871) and 2020 (-0.4632) indicates that these products have low complexity and are considered less sophisticated compared to other goods. However, the slight improvement in PCI from -0.463 in 2020 to -0.187 in 2021 suggests a modest increase in diversification and the knowledge involved in producing these products, but they still remain below the level of sophistication required to enhance global competitiveness.

On the other hand, **electrical transformers** have a positive and increasing PCI from 0.755 in 2020 to 0.912 in 2021, which suggests potential for diversification and sophistication that could boost future export performance.

Electrical circuit equipment, with a small export value (1.4%), reflects a modest contribution to the economy, and the PCI remains constant around 0.7, suggesting a moderate potential for complexity. This is an area that would require additional investments in research and development.

In the category of **electrical panels and boards**, although the export value is low (1.0%), the relatively high PCI (0.749 in 2021) indicates a decent level of sophistication. This suggests that the products in this category are more technological and complex. The increase in PCI from 0.644 in 2020 to 0.749 in 2021 indicates an improvement in the technology used in producing these goods, which could contribute to a future increase in demand.

The analysis of products in this group, which includes **electrical equipment and related parts**, underscores a direct relationship between the complexity of the products and their export value. Products with a higher Product Complexity Index (PCI), such as electrical transformers, present a significantly higher added value, but their export volume remains relatively low. In contrast, less sophisticated products like electrical cables and wires register a large export volume but with lower technological sophistication. This dynamic emphasis the fact that, although complex products have a greater economic impact per unit of export, they require substantial investments in knowledge and technology (Hidalgo și Hausmann, 2009).

Regarding agricultural products, **cereals** represent an essential sector for the economy of the Republic of Moldova (Figure 3). The impressive 27% growth in cereal exports between 2019 and 2023 is largely due to favorable climatic conditions and investments in agricultural infrastructure, including the modernization of harvesting and irrigation technologies (Trade Map, 2022). This advance was

also supported by increased international demand for food products, driven by changes in global markets and regional instabilities, which have created opportunities for Moldova to capitalize on favorable trade relations.

In addition to these environmental and infrastructural factors, the Moldovan government has implemented measures to stimulate the competitiveness of agricultural products in global markets. Agricultural policies have aimed at increasing productivity and facilitating access to external markets, consolidating Moldova's position as an important supplier of cereals in Europe and other regions (World Bank, 2023).

In the Cereals category, analyzing data related to **wheat** reveals that, although its complexity remains low, with a negative PCI in 2021 (-0.1749) and 2020 (-0.3062), it continues to be the main exported product in the analyzed period, representing 56.5% of the total export value in the cereals group (Figure 3). This predominance suggests a stable international demand for basic cereals but, at the same time, highlights a significant dependence on regional market conditions, being also a product with low added value.

For **barley**, the slight decrease in PCI in 2021 (-0.1582) and its reduced share in export value (6.6% in group 10) indicate that, although this product has a higher level of complexity than wheat, the demand for it is lower, possibly due to a more restricted market or more intense competition. This suggests the need to explore new markets or improvements in the competitiveness of this product.

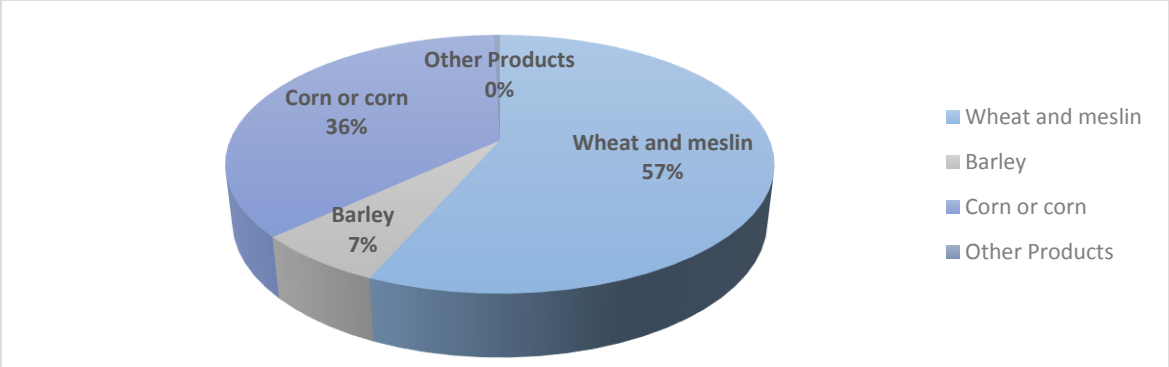

Figure 3. Structure by Cereals, the Year 2023

Source: Calculated by the author based on data from Trade Map, 2022

For **corn**, although its Product Complexity Index (PCI) is the lowest (-0.9369 in 2021), it continues to be the second most exported product in this category, with a share of 36.4% of the export value. The high demand for corn is likely supported by market conditions and its multiple uses in food and industry, despite its lower technological complexity.

Wheat and corn are the main products in the cereals category, with large sales volumes, but both have a negative Product Complexity Index (PCI). This indicates that, although these products contribute significantly to export value, they remain relatively unsophisticated technologically and could benefit from improvements to add value.

In this category, other products contribute marginally to the total export value, holding only a 0.4% share. This suggests that they are secondary products, without significant influence on Moldova's total cereal exports (Biroul Național de Statistică al Republicii Moldova, 2023).

Although cereal exports represent an expanding sector, there are significant challenges that could slow this growth in the future. Climate fluctuations and price volatility in international markets may

affect the stability of exports. In this regard, according to the World Bank report (World Bank, 2023), Moldova needs to improve agricultural technologies and invest in diversifying agricultural export products to better adapt to international market demands and ensure long-term sustainable development.

In addition to cereals, another important sector for Moldova's economy is **seeds and oilseeds** (Figure 4). This category saw an 8% growth between 2019 and 2023, according to OEC data (Harvard University, 2022), highlighting increasing demand in international markets. The expansion of production capacities and improved access to foreign markets have contributed to this positive trend. Oilseeds have thus become a crucial pillar in the export structure, reflecting a gradual transition in Moldovan agriculture toward products with more diversified global demand.

However, growth prospects in this sector could be affected by several factors. These include the volatility of international agricultural product prices, influenced by global factors such as climate change, geopolitical instability, and economic fluctuations. Additionally, Moldova faces increased competition from other oilseed-producing countries, such as Ukraine and Russia, which can offer products at more competitive prices (Food and Agriculture Organization, 2022).

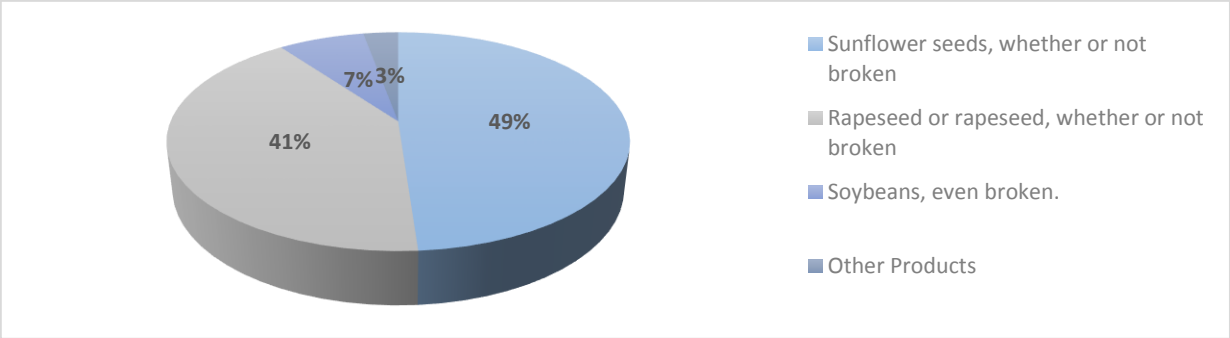

Figure 4. Structure by Seeds and Oilseeds, year 2023
Source: Calculated by the author based on data from Trade Map, 2022

In the category of **Seeds and Oilseeds**, data analysis shows that **Soybeans**, despite being characterized by a negative PCI and very low technological complexity (-1.7032 in 2021, down from -1.5254 in 2020), account for almost half of the export value (49%) for this category (Figure 4). This predominance indicates strong demand in international markets, especially due to their extensive use in food and biofuels. However, the low PCI signals the limited potential for added value growth in this sector.

Rapeseed, which constitutes 41% of exports in this group, shows the greatest improvement in complexity, with a PCI rising from 0.0117 in 2020 to 0.2241 in 2021. This evolution indicates progress in production and processing technologies, which could stimulate demand in more sophisticated sectors, such as oil production and other industrial derivatives.

Sunflower seeds, although showing a slight increase in complexity (-0.0641 in 2021 compared to -0.3536 in 2020), contribute only 7% to the export value for oilseeds. This low share may be influenced by strong competition or global market preferences, despite the product's popularity in other regions. Products categorized as "other products" contribute very little to the export value, with a share of only 3%, reflecting their marginal importance.

To maintain competitiveness and better leverage the potential of this sector, it is essential for Moldova to invest in modernizing oilseed processing technologies. This could enhance the added value of exported products and help the country better adapt to international market demands. Additionally,

diversifying the range of products derived from oilseeds, such as vegetable oils or other processed products, could significantly contribute to the sustainable growth of Moldova's exports in this sector (Food and Agriculture Organization, 2022).

The next group of products analyzed with a significant impact on Moldova's exports are **edible fruits and nuts** (Figure 5). These products represent an important component of agriculture and the national economy, contributing significantly to the total export value. Between 2019 and 2023, fruit and nut exports recorded a growth of approximately 6%, highlighting steady but insufficient progress to ensure robust development in a highly competitive global context (National Bureau of Statistics of the Republic of Moldova, 2023).

Moldova's fruit exports are mainly based on low-value-added products, such as fresh and dried fruits. These products are exposed to international market volatility, being sensitive to seasonal changes and fluctuating prices. Furthermore, Moldova faces fierce competition from other exporting countries, which can deliver similar products at lower costs or higher standards. At the same time, the lack of technological innovation and product diversification limits the potential for rapid and sustained growth in this sector (Food and Agriculture Organization, 2022).

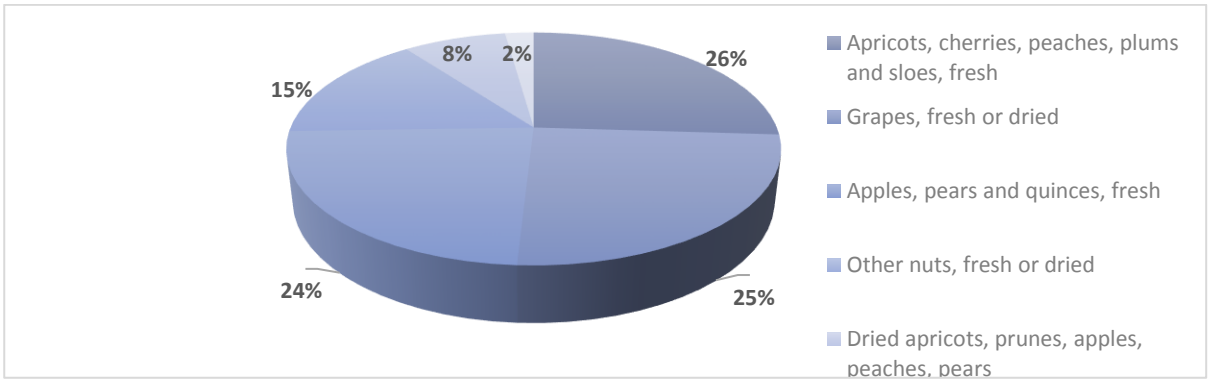

Figure 5. Structure of Edible Fruits and Nuts, Year 2023

Source: Calculated by the author based on data from Trade Map, 2022

Analyzing in detail the categories of exported products from this group **Fruits and Nuts**, the following aspects are noted:

Grapes, with a relatively low PCI (Product Complexity Index), though less low than other products in this group. PCI in 2020 (-1.1693) and 2021 (-1.2149) indicates a consistently low level of complexity, with no significant changes in production technology. However, their stability and consistent demand in international markets have maintained an important position in Moldovan exports (25% of the export value for this group), confirming their market stability due to multiple uses, both fresh and dried.

Apples and pears, despite having a negative PCI of -0.5549 in 2021, show a somewhat higher complexity than other products in this group, suggesting greater potential for development and increased added value through the modernization of processing technologies. Contributing 24% to exports in this group, they hold a significant position.

Dried fruits and mixtures, although less relevant in terms of exports (8%), have shown a slight improvement in technological complexity - 0.9918 in 2021 compared to -1.1252 in 2020 and may offer opportunities for diversification in the future.

Apricots, cherries, peaches, and plums have a negative and relatively constant PCI between 2020 (-1.0952) and 2021 (-1.1725), reflecting low technological complexity. Nevertheless, they remain dominant in exports, representing 26% of the value for this category.
Nuts, despite showing low technological complexity (PCI 2021: -1.6698), hold a significant share of the export value, accounting for 15% in this product group.
It is evident that staple products like apricots, apples, and grapes dominate the market due to high demand. However, to increase competitiveness, Moldova must focus on technological modernization, introduce more efficient production and processing methods, and diversify the range of exported products to increase added value. This approach could stimulate the development and diversification of exports, especially for products with potential for higher added value, such as dried fruits and mixtures. Diversification and added value growth through modern technologies and investments will be essential for enhancing long-term competitiveness.
PCI trends show a slight improvement for all products, indicating modest progress in diversification and technological enhancement. Still, a greater focus on innovation and technology is necessary to increase competitiveness in international markets. By investing in technology and increasing the added value of these products, Moldova could improve export performance and product complexity. Regarding other export sectors, categories such as animal, vegetable, or microbial fats and oils recorded a significant annual growth of 47% in the same period (2019–2023), demonstrating considerable potential for growth and diversification. Glass and glassware also had a significant growth rate of 26%, while traditional sectors such as electrical machinery, beverages, furniture, and footwear stagnated, indicating the need for innovative measures to revitalize these areas (Trade Map, 2022).
An essential finding of this analysis is the relatively weak presence of Moldovan products in higher added value market segments. Thus, Moldova should focus its efforts on improving production activities with added value, exploring new markets, and adopting advanced technologies to surpass the competition and ensure sustainable export growth. In the long term, the focus should be on product diversification and the development of industries with high complexity, following the example of other countries in the region that have successfully improved their export portfolios by transitioning to higher added value products that are less vulnerable to market volatility (e.g., Romania and Bulgaria moving to automotive components, electronics, and machinery).
In this context, a potential growth area is the technology sector, where Moldova has shown some potential, especially in IT outsourcing and software development. By promoting innovation and improving the quality of the workforce, Moldova could gradually shift its export profile toward more complex and higher-added-value products. Additionally, addressing infrastructural bottlenecks is crucial for facilitating trade. As demonstrated by other small economies, improving transport links and simplifying customs procedures can significantly reduce export costs and increase the country's attractiveness to foreign investors. Simultaneously, a stronger focus on international marketing could help Moldovan products gain traction in new markets, thereby diversifying the country's export destinations and reducing dependence on a few trade partners (in 2022: Romania - 27.4%, Ukraine - 14.8%, Italy - 7.13%, Turkey - 6.27%) (Harvard University, 2022).

Conclusions and recommendations

The Republic of Moldova faces a fundamental challenge in modernizing its economy and enhancing its competitiveness by diversifying its export portfolio and increasing the sophistication of its products.

Currently, its dependence on low value-added agricultural exports, such as grains and fruits, limits its resilience to global economic challenges and contributes only modestly to long-term development. The Product Complexity Index (PCI) highlights the need for a shift towards more advanced and sophisticated products to ensure greater economic stability and sustainable growth in the future.

However, significant growth opportunities exist. The development of sectors like oilseeds and processed plant products, which show substantial potential, could increase the value-added of Moldova's exports. Furthermore, investments in modern technologies, infrastructure, and education can transform Moldova's economy, enabling it to better leverage its resources and compete more effectively in international markets with more complex and innovative products.

To achieve these goals, Moldova must prioritize the development of complex, knowledge-intensive products, which can elevate the country's global competitiveness. Encouraging innovation and technological advancement through public-private partnerships, fiscal incentives, and improved access to technology are crucial. Moreover, investments in infrastructure, logistics, and supply chains, especially for high value-added products, are essential to reducing export costs and enhancing the country's competitiveness in global markets.

In conclusion, expanding trade partnerships and exploring new markets will help reduce Moldova's vulnerability to regional economic fluctuations and create new opportunities for growth. By implementing these strategies, Moldova can improve its economic performance, increase the value-added of its exports, and ensure long-term sustainable growth.

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