How can low-income countries integrate into the innovation-led global economy?

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Extended abstract

Objective and contribution

Relatively poor countries or regions continue to face the unresolved challenge of innovation activities being concentrated in more developed areas. Existing research offers limited solutions, suggesting that the risk of widening regional disparities can be mitigated by adopting innovation strategies rooted in local competitive advantages or frugal innovation. This study challenges the conventional approach taken by many less developed countries, which aims to compete with more developed nations for attracting innovative activities.

Instead of a "competitive" approach, this study explores an "integrative" approach, grounded in the concept that innovation is a multifaceted phenomenon encompassing a diverse range of activities. It builds on the framework proposed by Capello and Lenzi (2013), who applied Schumpeter's distinction between innovation and commercialization, as well as the findings of Bar-El (2023), who identified a clear statistical differentiation between the factors influencing knowledge creation and those driving practical implementation.

This research aims to identify the mechanisms that sustain the innovation process in low-income regions compared to high-income regions, with a focus on both knowledge creation and knowledge implementation. To achieve this, a literature review is conducted to examine the indicators and measures of these two dimensions of innovation, as well as the factors influencing them in both affluent and disadvantaged regions. This review assesses the extent to which existing research offers a robust foundation for designing effective policies to promote innovation in low-income regions.

The contribution of this study is twofold. In the theoretical domain, it introduces a less conventional approach to comparative analysis of innovation strategies between low- and high-income regions. This perspective offers a valuable foundation for further research focused on innovation in economically disadvantaged regions.

In the practical domain, the study aims to inform more effective public policies that promote advanced and balanced economic growth in poorer regions. It challenges the common perception among policymakers that equates innovation solely with startups, patents, and new technologies, encouraging a more nuanced understanding of innovation dynamics.

Methods and data

This research utilizes data from the 2024 Global Innovation Index (GII), published by WIPO, encompassing 78 variables across 133 economies. The GII offers comprehensive insights into various aspects of innovation, which serve as proxies for the two key dimensions of interest: knowledge creation and knowledge implementation. The analysis utilizes the GII's standardized scores, which convert raw data for each variable into a 0-100 scale, facilitating comparative analysis across countries.

Regression analysis was conducted to test the hypotheses separately for high- and low-income countries. Patent applications were chosen as the primary proxy for knowledge creation and were modeled as a function of "initiator" factors, including education, R&D investment, business sector participation, academic collaboration, and linkages. High-tech manufacturing was selected as the main proxy for knowledge implementation and was modeled as a function of "enabling" factors, such as logistics, market size, skills, and the absorption of imported knowledge.

K-means clustering was then applied to classify the countries into distinct groups based on their innovation characteristics.

The primary challenge encountered was multicollinearity. In the regression analysis, the tolerance level of each variable was evaluated, and variables with a Variance Inflation Factor (VIF) exceeding 2.5 were excluded. This led to the exclusion of certain input variables that were expected to significantly influence the output variables, as they could not be tested simultaneously with others in the same model. To address this issue, multiple models were tested, selectively including and excluding variables to mitigate multicollinearity.

Data from the World Bank's 2024–2025 country classifications by income level were used to categorize countries into two groups: the "Low-Income" group, comprising countries classified as low-income, lower-middle-income, and upper-middle-income economies, and the "High-Income" group, consisting solely of high-income economies. This categorization was designed to ensure an adequate number of countries in each group, enabling separate regression analyses for each category.

This approach was particularly necessary due to the limited availability of data for some variables among low-income countries. By broadening the definition of the "Low-Income" group, a sufficient number of countries were retained for analysis, even after excluding cases with missing data.

Results and conclusions

The analysis of knowledge creation reveals five key findings:

a. The lower levels of knowledge creation in low-income economies are attributed not only to the scarcity of relevant ecosystem factors but also to the less efficient utilization of these resources.

b. R&D expenditures play a crucial role in knowledge creation, and their impact is stronger when the share of business funding is higher, in both high- and low-income economies.

c. Collaboration between industry and academia is effective for knowledge creation in high-income economies but remains ineffective in low-income economies. This is likely due to lower academic standards, a weaker culture of collaboration, and the absence of administrative frameworks similar to the Bayh-Dole Act.

d. In low-income economies, knowledge creation is notably driven by global corporate R&D investors and venture capital. This indicates that in response to the limited availability of essential ecosystem factors, less developed countries tend to concentrate their innovation efforts within the business sector.

e. The impact of education, measured by tertiary enrollment, is positive but not statistically significant. This may be due to the specialized nature of R&D activities, which do not require a large workforce.

The analysis of knowledge implementation can be briefly summarized as follows:

a. Knowledge implementation does not necessarily occur in the same country where knowledge creation takes place.

b. Knowledge implementation is strongly influenced by the availability of relevant skills, the capacity to import and adapt knowledge, and the presence of a large local market.

c. The system governing knowledge implementation in low-income countries is more structured and more efficient than the system driving knowledge creation.

d. Low-income economies can more effectively close the gap with high-income economies by prioritizing knowledge implementation.

Based on the availability of key influencing factors, three main clusters of low-income countries are identified (see Figure 1): those with significant knowledge implementation accompanied by some knowledge creation (cluster 3), those that are more engaged in knowledge creation (primarily driven by corporations) with less emphasis on implementation (cluster 2), and those with negligible activity in both types of innovation, which comprise the majority of low-income countries (cluster 1).

Figure 1. *Knowledge Creation and Implementation in 3 Clusters (Low-Income Countries)*
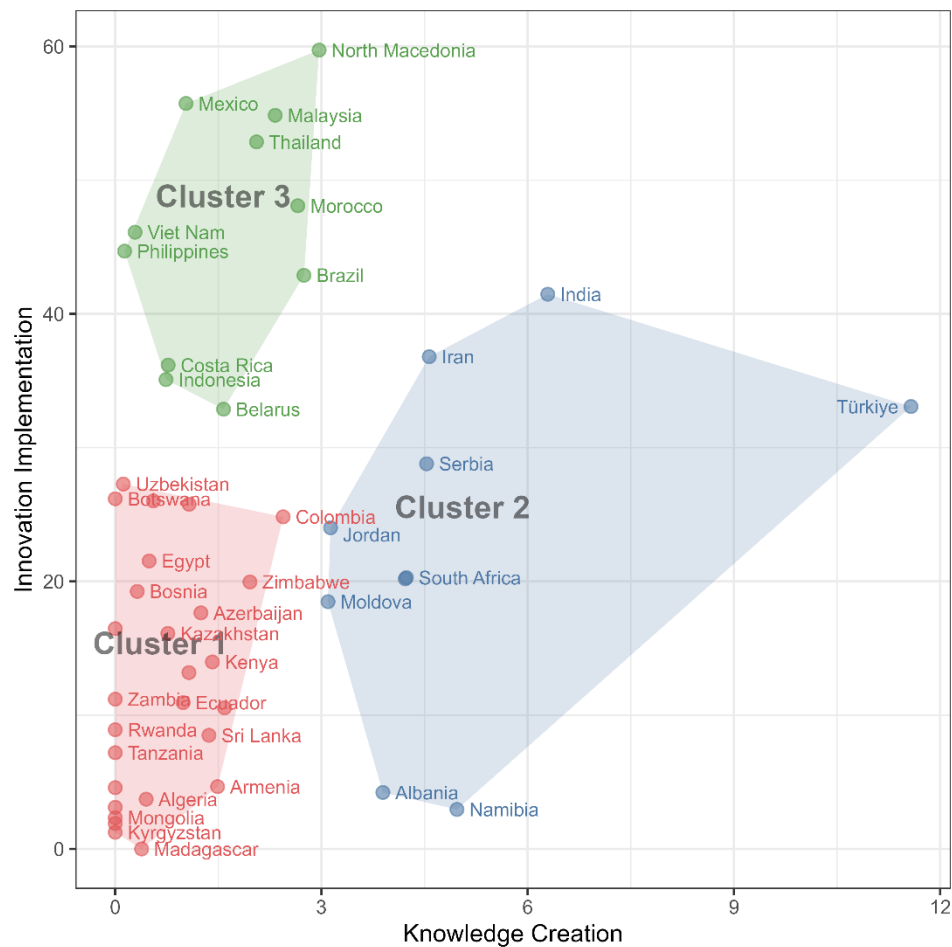
Although not all expected influences of ecosystem variables were statistically significant, the findings reasonably support the existence of two distinct innovation strategies: one focused on knowledge creation, predominantly associated with high-income countries, and the other centered on practical knowledge implementation, primarily observed in low- and middle-income countries.

Furthermore, compelling evidence supporting this dichotomy is the insignificant impact of knowledge creation on knowledge implementation within the same country, observed in both low- and high-income economies. This finding may explain the common pattern of "exits," where newly invented products or services are exported for production in other countries.

The dichotomy between innovation strategies does not imply a strict division between countries, where a nation exclusively specializes in either knowledge creation or knowledge implementation, even in light of the observed pattern of "exits." In other words, countries are not necessarily confined to focusing solely on generating new

knowledge (e.g., patents, research) or exclusively on applying that knowledge to achieve economic outcomes (e.g., manufacturing, exports).

The regression results indicate that each strategy relies on distinct ecosystem variables. Consequently, a country may exhibit varying levels of knowledge creation and implementation, depending on the strength of the ecosystem factors supporting each strategy, as demonstrated by the cluster analysis.

Several important policy implications emerge from this analysis and warrant careful consideration. As a general principle, innovation policies in low-income countries should prioritize strategies focused on knowledge implementation. This involves supporting the adoption of external technologies, enhancing logistics, and fostering skill development.

Depending on the specific economic and social structure of each country, this approach may include promoting technological advancements in traditional industries and agriculture, as well as supporting small and medium enterprises. While measures to encourage knowledge creation should not be excluded, they should be aligned with the strategic objectives of the national economy.