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Technical and statistical report

Productive Capacities Index, 3rd Generation

Enhanced Statistical and Methodological Approach with Results

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- **International Monetary Fund (IMF)** *International Financial Statistics*
- **International Road Federation (IRF)** *World Road Statistics 2024 Millennium Dataset*
- **International Telecommunication Union (ITU)** *World Telecommunication/ICT Development Report and Database*
- **International Union of Railways (UIC)** *International Railway Statistics*
- **Materialflows.net**
- **National statistical offices** *Census reports and other statistical publications*
- **Organization for Economic Co-operation and Development (OECD)**
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- **UNESCO Institute for Statistics (UIS)**
- **United Nations Development Programme (UNDP)**
- **United Nations Population Division** *World Population Prospects: 2024 Revision*
- **United Nations Statistical Division (UNSD)** *Population and Vital Statistics Report; National Accounts – Analysis of Main Aggregates (AMA); SDG Global Database*
- **United States of America, Census Bureau** *International Database*
- **World Bank** *World Development Indicators, Sustainable Energy for All (SE4ALL), Worldwide Governance Indicators*
- **World Health Organization (WHO)** *Global Health Expenditure Database*
- **World Intellectual Property Organization (WIPO)**

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Executive Summary

The Productive Capacities Index (PCI) allows for statistical analyses of existing gaps and limitations within and across countries and regions in developing productive capacities. It is framed on internationally recognized methodologies used in developing composite indices.

This manual presents the methodological approach of the third generation of the Productive Capacities Index (PCI), which covers 195 economies for the period 2000-2024, and is intended to accompany the metadata available on the UNCTADstat Data Centre. The PCI was developed in response to mandates from member States at the Fourteenth Session of the United Nations Conference on Trade and Development (UNCTAD XIV), as contained in the Nairobi Maafikiano, para. 76(k) and the United Nations Economic and Social Council (ECOSOC) resolution (E/RES/2017/29). It is designed to guide policymaking and implementation in support of building productive capacities and fostering structural economic transformation in developing countries.

The importance of strengthening productive capacities has been increasingly recognized in global development frameworks and high-level conferences in recent years. Ministerial declarations, along with the Vienna Programme of Action for Landlocked Developing Countries for the Decade 2014-2024 (VPoA) , the Doha Programme of Action for the Least Developed Countries for the Decade 2022-2031 (DPoA), the Nairobi Maafikiano and Nairobi Azimio adopted at UNCTAD XIV, the Bridgetown Covenant adopted at UNCTAD XV, the Geneva Consensus adopted at UNCTAD XVI, the Antigua and Barbuda Action Agenda for Small Islands Developing States (ABAS) as well as the Awaza programme of Action for Landlocked Developing Countries, have consistently emphasized that fostering productive capacities is crucial for achieving sustainable development.

The PCI was launched for the first time in 2021 (UNCTAD, 2021). The first edition (PCI 21) covered 193 economies from 2000 to 2018. The 2023 update (PCI 23) refined the methodology, improving missing-data treatment and modernising the computation pipeline. The approach was reviewed by the Statistical and Technical Advisory Group (STAG) in February 2023, which endorsed the Index's transparency, multidimensionality and statistical soundness.

The 2025 update (PCI 25) builds directly on the recommendations and endorsement of the third STAG meeting, held in Lisbon, Portugal in June 2025. The update extends country and time coverage and introduces several methodological and technical innovations:

- A restructured data pipeline, with increased automation in data retrieval, earlier transformations and improved handling of missing values;
- Enhanced imputation procedures combining time-series features and cross-indicator relationships;
- A new seed-averaged estimation step to improve robustness and allow for confidence intervals; and
- The inclusion of a maritime transport indicator (*seaborne trade*) made possible by new country-level data from UNCTADstat (available since April 2025).

Together, these enhancements strengthen the reliability, transparency and interpretability of the PCI, consolidating it as a key analytical and policy tool for diagnosing capacity gaps, benchmarking progress and guiding strategies for structural transformation and sustainable development.

Users are encouraged to access the UNCTADstat Data Centre for the latest data, documentation and working files, which represent the authoritative reference for PCI values and analysis.

I. Introduction

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The Productive Capacities Index (PCI) has become a key tool in guiding data-driven and evidence-based policymaking. The index allows for statistical analyses, benchmarks, and assessment of existing gaps within and across countries and regions based on eight key categories of productive capacities, namely: natural capital, human capital, energy, ICT, transport, structural change, institutions, and private sector leading to the formulation of National Productive Capacities Gap Assessments (NPCGAs).

The evolution of the PCI is anchored on a well-designed data processing framework that ensures its consistency, stability and methodological rigor. This report details the methodological and technical changes made to the 3rd generation PCI released on UNCTADstat on 31 October 2025. PCI users are advised to consult the UNCTADstat Data Centre to download updated data and editable working files to ensure the most recent values are captured in their analysis. Statistics presented through the UNCTADstat Data Centre reflect the most up-to-date revision and should be considered the reference value for analysis.

The PCI is based on 43 indicators across 8 categories, which refer to variables directly collected or calculated as a combination of other collected variables (see Appendix 7.1.).

It is important to highlight at the outset that one of the main challenges for the computation of the PCI is the paucity of data and the comprehensive nature of productive capacities itself. When data is available, it is not necessarily consistent for all the years and countries covered by the PCI, potentially leading to high levels of missing values in the data series used as inputs. Beyond the mere time update, the primary goal of the update was therefore, to improve, wherever possible, the original methodology in dealing with missing data, and extrapolating data points. This update cycle also provided an opportunity to restructure the data pipeline, improving the sequencing of key steps, enhancing transparency and documentation and modernizing the computational tools to ensure greater accuracy and robustness of the PCI.

This report should be considered in conjunction with the STAG report (UNCTAD, 2025a, see summary in Box 1 below). The present document focuses on the technical work of the PCI 2025 update, while the STAG report provides an overview of methodological discussions and expert feedback. Previous methodological updates are documented in earlier UNCTAD publications and STAG summary reports. (e.g. UNCTAD, 2023a; UNCTAD, 2023b; UNCTAD, 2020).

1.1. Terminology

In the present report, the following terminology was adopted:

- *"PCI 25"* refers to the updated version of the PCI released on UNCTADstat on 31 October 2025 with data covering 2000-2024.
- *"PCI 23"* refers to the prior version of the PCI released on UNCTADstat on 20 June 2023 with data covering 2000-2022.
- "*Indicator*" denotes a measurable economic indicator, for which data for all countries and all years are available or imputed.
- "*Category*" refers to one of the eight productive capacities that make up the PCI. They may have one or two components.
- "*Component*" refers to the variables extracted from a principal components analysis for a given category.

- *"Raw data"* refers to the untreated, uncleaned data that is collected for all indicators from various sources in various formats. The include variables combined to calculate the indicators that make up the input data.
- *"Input data"* is the data input which consists of values for 195 countries on the 43 indicators inputted to the PCA over 25 years, ranging from 2000 to 2024.
- *"Data pipeline"* denotes the various data processing steps necessary to go from raw data to PCI scores.
- *"Principal components analysis (PCA)"* is a dimension reduction technique that transforms a set of input variables into a smaller set of indicators.

Box 1
Summary of the Third Meeting of the Statistical and Technical Advisory Group (STAG) on the Productive Capacities Index (PCI)

23 June 2025, Banco de Portugal, Lisbon

The third meeting of the Statistical and Technical Advisory Group (STAG) on the Productive Capacities Index (PCI), organized by UNCTAD and hosted by Banco de Portugal, brought together statisticians, technical experts and academics to review ongoing methodological developments and provide guidance on future directions of the PCI. Chaired by OECD Chief Statistician, the meeting focused on advancing the PCI as a robust, policy-relevant tool to support structural transformation and sustainable development.

STAG members expressed strong appreciation for the growing institutional relevance and statistical quality of the PCI, noting its increasing use by international organizations and its value for evidence-based policymaking. The PCI was recognized as a practical diagnostic and capacity-building tool, particularly for least developed countries (LDCs), landlocked developing countries (LLDCs) and small island developing States (SIDS). Members commended UNCTAD's efforts to improve data coverage, methodological rigor and engagement with national statistical systems.

A central focus of the meeting was the review of the next update of the index (third generation). The UNCTAD secretariat reported improvements in data quality, consistency and automation, although challenges remain due to limited statistical capacity and increasing data access restrictions. STAG members supported ongoing efforts to enhance data collection processes, while emphasizing the need for greater transparency, stronger collaboration with data providers and continued investment in national statistical systems.

The Group also endorsed key methodological refinements to the PCI statistical pipeline, including a new longitudinal random forest imputation method that improves the handling of missing data and strengthens the stability of results. While supporting these improvements, members recommended further testing of imputation thresholds and continued validation of results through engagement with countries.

Discussions on extending PCI categories highlighted progress in addressing data gaps, particularly in transport. Members expressed support for including a maritime transport indicator (seaborne goods discharged), while calling for further refinement of indicators in the human capital and institutions categories due to conceptual and data limitations.

On robustness testing, the STAG reviewed alternative aggregation methods and reaffirmed support for the current approach combining principal component analysis (PCA) within categories and geometric averages across categories. While recognizing the appeal of simpler methods, members emphasized the importance of maintaining statistical rigor and coherence.

The meeting also explored the development of satellite indices. A preliminary "Green PCI" was presented, covering environmental sustainability, financial vulnerability and gender dimensions. While considered a promising extension, members highlighted the need for further conceptual clarification and indicator refinement. In parallel, the conceptual framework for a SIDS-specific PCI was welcomed as a relevant and timely initiative, though participants stressed the importance of maintaining methodological consistency with the core PCI and avoiding conceptual dilution.

Finally, the meeting emphasized the importance of strengthening synergies and increasing the visibility and use of the PCI. Collaboration with UNDP and other partners was identified as a key avenue for expanding country-level application and policy impact. Greater engagement with national statistical offices and global statistical forums was also encouraged.

In conclusion, the STAG reaffirmed its support for the continued development of the PCI, highlighting its growing maturity and policy relevance. Key priorities going forward include addressing data challenges, refining methodology, advancing satellite indices and enhancing the PCI's role in capacity-building and international development processes.

II. Structural Composition of the PCI

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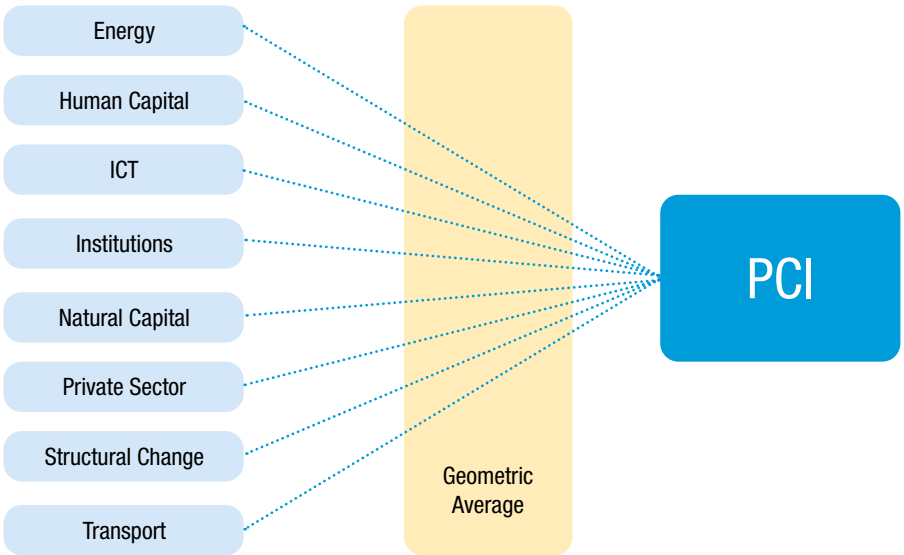
Drawing on UNCTAD's conceptual framework for measuring productive capacities (UNCTAD 2025b), the PCI is disaggregated into eight category scores, each corresponding to one of the categories of productive capacities identified in the framework: natural capital, human capital, energy, institutions, private sector, structural change, transport, and information and communication technologies (Figure 2.1). In addition, a composite score synthesises these dimensions into a single indicator. This structure enables an assessment of productive capacities both at an aggregate level and within specific domains, thereby providing analytical flexibility according to the perspective and requirements of the user.

The PCI is constructed from **43 input indicators**, all drawn from internationally harmonised data sources and mapped across the eight categories of productive capacities. A concise description of each category is provided below[1], while the detailed composition in terms of input indicators is presented in Appendix 7.1.

Figure 2.1.
Overall structure of PCI 25



[1] As reflected in the last STAG report (UNCTAD, 2025a), UNCTAD has been exploring further integration of three dimensions—environment, gender, and finance—under a broader "Green PCI" framework aimed at better capturing the sustainability, inclusivity, and resilience of productive capacities. These dimensions would complement the existing PCI by addressing structural constraints that are only partially reflected in current categories: environmental pressures and mitigation efforts, gender inequalities rooted in the care economy and their effects on human capital, and macro-financial vulnerabilities that limit investment and long-term development.

Strong human capital enables higher productivity, fosters technological progress, and supports economic upgrading by providing the knowledge and skills needed for structural transformation.

2.1. Human Capital

Human capital is at the core of productive capacities, as it encompasses the education, skills, and health of a population, as well as the integration of research and development into society. It reflects both the ability of individuals to participate productively in the economy and the collective capacity of societies to innovate and adapt. Strong human capital enables higher productivity, fosters technological progress, and supports economic upgrading by providing the knowledge and skills needed for structural transformation. In this sense, it is not only a factor of production but also a dynamic driver of long-term development and competitiveness.

2.2. Natural Capital

Natural capital refers to the stock of natural resources available to a country, including extractive and agricultural assets, as well as the rents generated from their use after accounting for extraction costs. It plays a critical role in shaping development paths, particularly in resource-rich economies. While natural capital alone does not guarantee sustained growth, it strongly influences opportunities for structural transformation and productive diversification. High dependence on commodities, however, can expose economies to volatility in global markets and limit broader industrial and technological upgrading if resources are not managed strategically. The availability and management of natural resources affect investment decisions, sectoral productivity, and the scope for long-term economic upgrading.

2.3. Energy

Energy is a fundamental enabler of productive capacities, as all economic and social activities depend on reliable and affordable energy supply. Adequate energy infrastructure supports industrial output, technological upgrading, and structural transformation, while shortages or instability can constrain production, investment, and innovation. Energy bottlenecks represent major barriers to development and macroeconomic stability. Beyond its direct role in powering production, energy access determines the extent to which firms and households can adopt modern technologies and connect to broader value chains.

2.4. Transport

Transport infrastructure underpins productive capacities by enabling the efficient movement of people, goods, and information within and across borders. Reliable transport systems reduce transaction costs, expand market access, and support the integration of regions and sectors, thereby fostering structural transformation and national cohesion. Modern transport networks also facilitate the diffusion of knowledge, technology, and innovation by connecting firms and consumers across larger markets. The PCI captures transport capacity through indicators covering road, rail, air, and maritime transport, reflecting both infrastructure density and actual usage.

To strengthen the measurement of maritime transport within the PCI, PCI 25 introduces the indicator *seaborne goods discharged* into the Transport category. This decision follows recommendations from the STAG, which reviewed alternative maritime indicators and assessed the alignment of different configurations of the Transport category with the PCI framework (UNCTAD, 2025a). Previous versions of the PCI did not include a direct indicator of maritime transport due to the lack of data meeting the required standards. While UNCTAD has long published seaborne trade volumes at the country-group level, country-level data only became available in April 2025.

2.5. Information and Communication Technology (ICT)

Information and Communication Technologies (ICTs) form a vital part of modern infrastructure, enabling the movement of ideas, data, and innovation across economies. ICTs underpin structural transformation by facilitating information exchange, technological diffusion, and the creation of new sectors and business models. They enhance productivity, reduce information asymmetries, and support financial inclusion and connectivity across firms and regions. The PCI captures ICT capacity through indicators reflecting both access and usage.

2.6. Institutions

Institutions form the foundation of the environment in which economic decisions are made and are, therefore, central to long-term development and productive transformation. They establish the legal, regulatory, and governance frameworks that enable markets to function, protect property rights, and ensure policy effectiveness. Strong and credible institutions reduce uncertainty, encourage investment, and foster entrepreneurship by lowering transaction costs and maintaining trust in public systems. In the context of productive capacities, effective institutions are those that support strategic planning, industrial policy, and innovation, while maintaining stability and accountability.

2.7. Private sector

Private sector development is a cornerstone of productive capacities, driving capital formation, innovation, and employment creation. A dynamic and diversified private sector stimulates entrepreneurship, fosters linkages across industries, and supports structural transformation through investment and innovation. Its inclusion in the PCI reflects its role in mobilizing resources, translating ideas into production, and sustaining growth.

2.8. Structural change

Structural change reflects the reallocation of resources from lower- to higher-productivity activities, a process that both drives and results from the development of productive capacities. It captures the transformation in a country's economic structure—from agriculture to industry and services, or from basic to more technology-intensive production. This ongoing evolution creates a virtuous cycle in which productivity gains foster competitiveness, investment, and further upgrading. Although structural change is often viewed primarily as an outcome of productive capacity development, it is in fact a powerful force that continually drives and sustains it over time[2].

A dynamic and diversified private sector stimulates entrepreneurship, fosters linkages across industries, and supports structural transformation through investment and innovation.

[2] The term "sectoral dynamics" can be used to describe this category, as it better reflects its dual role as both a driver and an outcome of productive capacity development, avoiding confusion with "structural transformation," which is more commonly understood as an outcome in the economic literature.

III. Input Indicators: Updates and Main Challenges

III. Input Indicators: Updates and Main Challenges

For PCI 25, all input indicator series were recompiled and updated, covering both recent and historical observations. This comprehensive process is essential, as data providers frequently revise past values, sometimes significantly, which can affect the consistency of the PCI and its component series over time. Additional challenges include the complete discontinuation of some time series when data is no longer produced, new restrictions on access due to financial barriers and declining quality reflected in rising levels of missing values. By reprocessing the full set of indicators, the update cycle ensures that the index reflects the latest information available, while preserving comparability with earlier releases.

The results presented in this publication represent the collected data up to a cutoff date of 15 May 2025. A comparison of the PCI 23 and PCI 25 input datasets shows that 34 of the 42 common indicators[3] (81 per cent) recorded a reduction in the percentage of missing values. Moreover, 40 out of 42 series achieved Pearson correlation coefficients above 0.95 between old and updated versions, underscoring the overall consistency of the data.

These findings demonstrate that, while new information has been integrated and some data points have been subject to revisions, the overall structure and data quality remain stable. Full results of these consistency checks are available upon request.

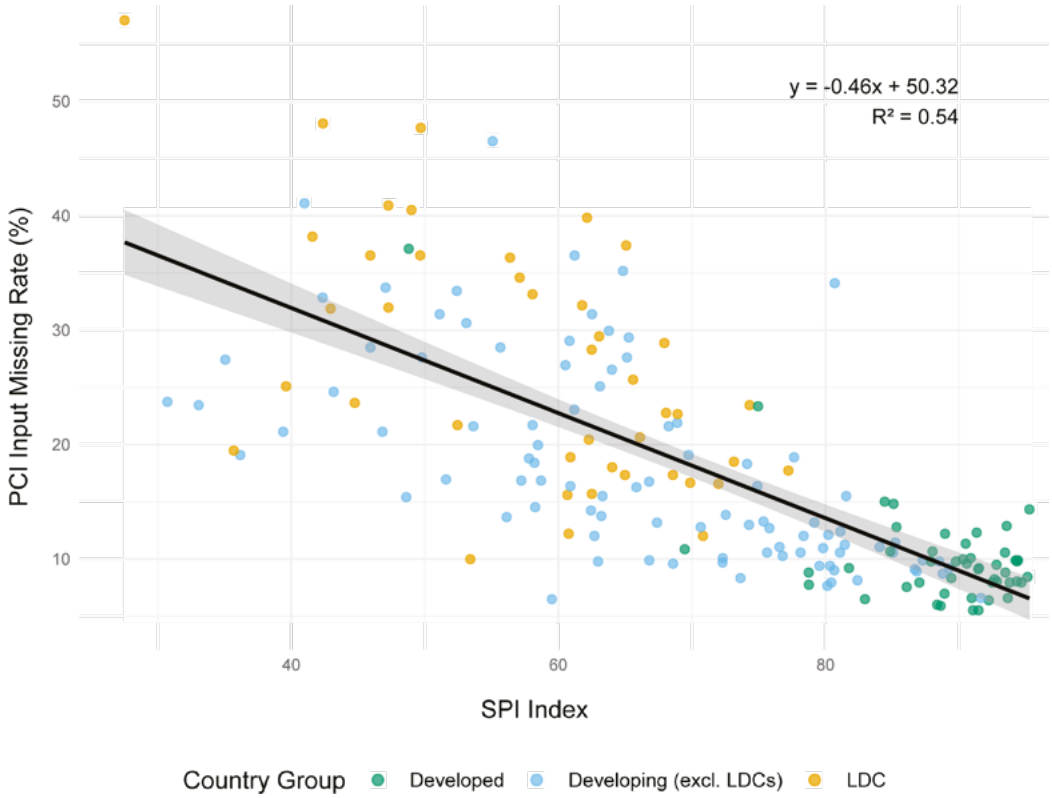
Nonetheless, persistent challenges continue to affect data collection. In many developing countries, limited statistical capacity constrains the regular production of key data series, leading to gaps that are particularly acute in the most recent periods. Using the World Bank's Statistical Performance Indicators (SPI; Stacy et al., 2024), Figure 3.1 shows how the coverage of the PCI's input indicators is highly correlated with the statistical capacity of countries. On average, a 1-point increase in the overall SPI index is associated with a 0.46 percentage-point decrease in the missing rate. These results underscore the ongoing need to strengthen national statistical systems, improve international coordination and standardize reporting mechanisms to secure a more reliable foundation for future PCI updates.

Data providers frequently revise past values, sometimes significantly, which can affect the consistency of the PCI and its component series over time.

In many developing countries, limited statistical capacity constrains the regular production of key data series.

[3] PCI 25 includes 43 input indicators, one of which – seaborne goods discharged (thousand metric tons per capita) – was newly introduced and was not part of the PCI 23 dataset. As a result, 42 indicators are directly comparable across the two versions. The comparisons are across all available years, i.e. 2000-2022.

Figure 3.1.
Link between missing rates of PCI input indicators (2000-2023) and World Bank's SPI index (2023)



Complete coverage is one of the quality dimensions prioritized for the PCI.

UNCTAD has increasingly automated data retrieval through API-based methods.

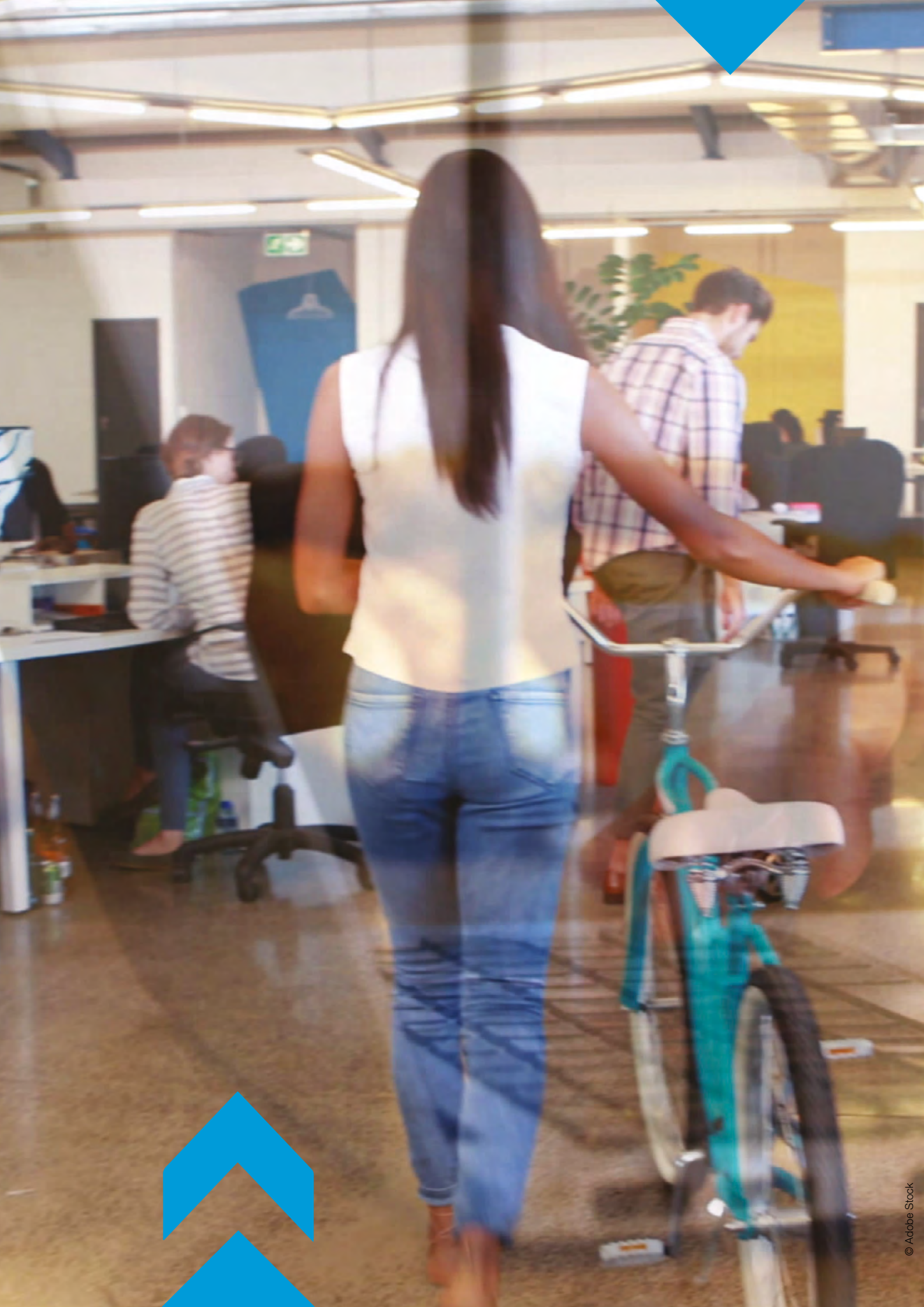
Access barriers such as paywalls and restrictive licensing agreements have become more prevalent.

Complete coverage is one of the quality dimensions prioritized for the PCI. PCI values are judged to be meaningful, informative and worth publishing even when based on imputed data. However, it is also important that the user does not interpret the dissemination of complete country level data as availability of country reported data in domains where data for LDCs may be otherwise hard to find. To communicate the cases where imputations play a major role, UNCTAD explicitly flags in those category scores where a majority of the underlying indicators are imputed in UNCTADstat Data Centre.

To improve efficiency and reduce manual errors, UNCTAD has increasingly automated data retrieval through API-based methods wherever possible, as detailed in Section 4.1. However, many indicators still do not have machine-readable access and must be collected manually – either through online downloads or, in the case of restricted datasets, direct email correspondence with providers. This reliance on manual processes leaves the pipeline more vulnerable to delays, errors and inconsistencies.

Compounding the challenge, access barriers such as paywalls and restrictive licensing agreements have become more prevalent. These barriers have been especially acute in the Transport and Energy categories, where limited access hampers reproducibility and complicates the integration of data into the PCI pipeline. Ensuring open and fair access to essential statistical data is therefore vital to supporting the robustness of the PCI and strengthening countries' ability to design evidence-based capacity building strategies.

IV. Data Pipeline Enhancement in PCI 25



IV. Data Pipeline Enhancement in PCI 25

One of the main focuses of the previous release (PCI 23) was to redesign the original statistical pipeline to enhance statistical performance when treating missing data. PCI 25 further develops the pipeline to improve robustness, transparency and methodological stability (Figure 4.1). Since the PCI is increasingly used, not only for research but also for diagnostic purposes at the country level, ensuring accuracy and resilience of individual country scores is critical. Small methodological shifts, while muted in cross-country regressions or global analyses, can materially affect country profiles of productive strengths and gaps.

PCI 25 further develops the pipeline to improve robustness, transparency and methodological stability.

Figure 4.1.
The six main steps of the PCI 25 pipeline

The main procedures of the PCI 25 pipeline are as follows:

1. Read and process data
2. Data transformation
3. Treatment of missing data
   - 3.1. Data interpolation
   - 3.2. Data extrapolation
   - 3.3. Series imputation
4. Outlier treatment
5. Principal components analysis and computing PCI
6. Repeated-run stability check and score finalization

A key structural novelty of the PCI 25 data pipeline is that most data transformations, including distributional transformations, per-capita scaling and computation of derived indicators, are now performed in Step 2 – prior to the interpolation, extrapolation and imputation steps. Only outlier treatment is left for after treatment of missing data. The new approach differs from that used in PCI 23, where all data transformations were applied after imputation and before computing derived indicators. While this sequencing ensured consistency in constructing composite indicators, it offered less scope to stabilize and normalize input distributions ahead of estimation and imputation. In contrast, PCI 25 applies data transformations earlier to strengthen statistical properties, resulting in more effective handling of extreme values and improved imputation accuracy, especially when using methods that are sensitive to distribution.

A second major enhancement to the pipeline structure is the introduction of Step 6: Seed-averaged estimation. By averaging results across multiple

The PCI pipeline entails transformation of indicators to render their distributions closer to normal.

random seeds, this step mitigates stochastic variation in the imputation processes and principal component analysis, enhancing the robustness and reproducibility of PCI estimates.

The remainder of this section examines each step of the PCI 25 pipeline in detail, outlining the rationale, methods and improvements introduced (where applicable) at every stage.

4.1. Step 1: Read and Process Data

The first step of the PCI data pipeline involves compiling the 43 input indicators, in addition to five auxiliary variables, including gross domestic product and population, into a unified dataset. At this stage, raw data for 195 economies across 25 years (2000-2024) are retrieved, validated and organized in preparation for further processing. The full list of input indicators can be found in Appendix 7.1.

To improve efficiency, UNCTAD has increasingly automated data retrieval through API-based methods wherever possible. Automation reduces dependence on manual downloads, minimizes the risk of transcription errors, and allows for faster and more consistent updates. As detailed in Appendix 7.1, 31 of the 43 input indicators were either directly retrieved from the World Bank World Development Indicators (WDI) API using the WDI package in R (Arel-Bundock, 2025) or derived entirely from such series. The remaining indicators were obtained through manual downloads from official databases or received directly through correspondence with data agencies, as not all providers currently support open and automated access. The results presented in this publication represent the collected data up to a cutoff date of 15 May 2025.

4.2. Step 2: Data transformation

Several of the input indicators can be seen as combination or scaled versions of raw variables. These calculations are often done already by the international data sources for the read data and can be considered part of step 1. Three input indicators: *Electric power transmission and distribution losses, Industrial ratio and Material intensity*, were calculated as a first part of the data transformation step to arrive at the 43 input indicators. The formulas for these and the sources for the initial indicators can be found in Appendix 7.1. In a similar manner, scaling of these indicators to per capita figures were relevant.

Importantly, step 2 of the PCI pipeline entails transformation of indicators to render their distributions closer to normal. In PCI 25, both the calculation of the final indicators and the distributional transformations have been shifted earlier in the pipeline, before interpolation, extrapolation, and imputation. This change marks an important methodological refinement relative to PCI 23, where these transformations were only applied after missing values had been filled[4].

The Principal Components Analysis, used in step 5, is designed to extract linear combinations of indicators and performs best when the data are normally distributed. The distributional transformations are used to ensure that within each year, indicator values are approximately normally distributed to prevent extreme cases from exerting disproportionate influence on component computations. However, these transformations also enhance the reliability of imputation and extrapolation methods, which often perform best when applied to data with regular distributions. By moving distributional transformations earlier in the pipeline, PCI 25 improves performance of a larger part of the statistical pipeline by

[4] In PCI 23, this sequencing was adopted to retain as much information as possible through the treatment of missing data and avoid discarding partial information when, for example, only the numerator or the denominator of calculated indicator was available. In PCI 25, the arguments for early calculation and transformation were deemed to outweigh concerns about potential data loss. However, cases in which only the numerator or the denominator of a calculated indicator is available are still used as predictors in the imputation step in their original form.

improving the statistical properties of the input data, stabilizing distributions, reducing skewness and limiting the impact of outliers.

From a policy perspective, the PCI is meant to capture productive capacities in an integrated and holistic manner, rather than through the behavior of any single indicator. Distributional transformation supports this objective by ensuring that no variable exerts disproportionate influence due to its scale or distribution, so that each indicator contributes more evenly to the overall assessment. This preserves comparability across categories and helps the PCI reflect balanced progress in productive capacities, consistent with its role in guiding broad, economy-wide development strategies.

In light of these considerations, some indicators were transformed using logarithmic, logit or Box-Cox transformations. Appendix 7.1 lists the transformations applied to each indicator. Most of the indicators requiring transformation are either right-skewed or are compositional data, i.e., they represent a share of some quantity. In the former case, a logarithmic transformation is often appropriate (and determined to be sufficient for the construction of the PCI); in the latter case, a logit transformation was considered, which is one of the standard options for compositional data (Aitchison, 1983).

In two cases[5], neither of these transformation methods were judged to be sufficient and were thus treated with a Box-Cox transformation (Box and Cox, 1964).

Step 2 also involves adjusting the direction of indicators to have a consistent interpretation of being indicators of higher productive capacity. Four initial indicators: *Electric power transmission and distribution losses, Fertility rate, Lending rates, and Export concentration index* are indicators where the lower values (rather than higher) are desirable from the perspective of productive capacities. For the PCA loadings and their interpretation to be consistent, the direction of these indicators was inverted by taking the maximum of the indicator and subtracting the initial indicator's value. Thus, hereafter, for example, a positive correlation between the *Human Capital* score and the indicator *Fertility* rate should be seen as a positive correlation between human capital and a low fertility rate.

4.3. Step 3: Treatment of Missing Data

Addressing missing data continues to be one of the central challenges of compiling the PCI, particularly for low- and middle-income developing countries. Overall, 22.9% of the observations in the input dataset are missing in PCI 25.

Table 4.3.1 presents the share of missing values by PCI category and by development group. Gaps are largest in LDCs, especially in the Transport, Private Sector and Energy components.

[5] *Air transport, freight (million ton-km per capita)* and *Km of rail lines (per capita).*

Table 4.3.1.
Percentage of missing observations per PCI category and development status.

PCI Category	Development status: Least Developed Countries	Development status: Other developing economies	Development status: Developed economies
Transport	61.4%	41.9%	22.6%
Private Sector	55.7%	41.9%	34.8%
Energy	37.5%	23.0%	12.1%
Human Capital	35.7%	29.9%	13.2%
ICT	21.9%	18.1%	14.9%
Structural Change	11.4%	8.8%	6.8%
Natural Capital	10.2%	9.6%	8.9%
Institutions	9.4%	9.7%	8.9%
Auxiliary [6]	5.6%	4.8%	4.0%

Note: The regional grouping refers to the UNCTAD classification, as specified in the UNCTAD classification, 2025 revision (UNCTAD, 2025c).

As the PCI is of particular interest for the Least Developed Countries (LDCs), special attention is warranted on the coverage of the data for these countries. This helps identify where the biggest gains can be made and where efforts should be concentrated in order to improve the assessment of productive capacities in LDCs. Examples of indicators where better coverage would benefit the index are "*Research and development expenditure as share of GDP*" and "*Researchers in research and development per million people*" in the Human Capital category; "*Total km of rail lines*" in the Transport category; and "*Logistics performance index*", "*Patent applications (per capita)*" and "*Trademark applications (per capita)*" in the Private Sector category.

Imputation serves two essential purposes within the PCI framework. First, it ensures that principal component analysis can be performed, as PCA requires a complete dataset with no missing values. Second, it increases the interpretability of results at the intermediate stage, ensuring that key aspects of productive capacities are represented and can be assessed even when observed data are incomplete. While this approach helps fill data gaps and offers a more comprehensive view of country performance, imputed values remain estimates and cannot substitute for real data. From a policy perspective, this underscores that the PCI should not be interpreted through the behavior of a single indicator or component in isolation, but rather from an integrated, holistic standpoint. Development gains emerge when improvements occur across all components and indicators, rather than through progress in only a few areas. The PCI is therefore intended to guide domestic policymaking towards comprehensive, economy-wide strategies, moving beyond short-term or project-based interventions.

[6] Auxiliary refers to the variables used to scale and/or transform the input indicators, such as population or GDP.

In line with previous iterations of the PCI, the strategies used to fill data gaps depend on whether the series have sufficient observations or not. In the case where there is sufficient information from the series itself, missing values are estimated by interpolation (Step 3.1) and extrapolation (Step 3.2); otherwise, multivariate techniques are used to draw information from other observations and variables (Step 3.3).

4.3.1. Step 3.1: Data interpolation

In this interpolation step, for each country, series with sufficient observations (more than eight observations) and with gaps within the observations (with a maximum gap size of five) are linearly interpolated. Data points which do not satisfy these conditions are imputed in Step 3.3, together with series with no observations at all.

4.3.2. Step 3.2: Data extrapolation

Data extrapolation (or forecasting) refers to the prediction of the future values of a series *after* the last observed data point, and until the last year for which predicted values are desired (hereafter *end year*). If the end year is the current year, this extrapolation would generally be referred to as "nowcasting". While the methodology and its software implementation allow for nowcasting (and indeed forecasting into the long-term future), it should be stressed that forecasting PCI values ahead of any available data merely reflects one possible development based on recent trends and is likely to change once the actual data is observed. Forecasting PCI values further than a few years ahead of available data is not recommended.

As in PCI 23, indicator series are extrapolated using double-exponential smoothing, with the parameters estimated and the extrapolation performed using the function ets of the R package forecast (Hyndman and Khandakar, 2008; Hyndman et al., 2022). Since most series exhibit some trend, using double-exponential smoothing is likely to improve the extrapolations obtained over simply repeating the last observed value. Double-exponential smoothing is known to perform well in a wide range of forecasting tasks including for time series with relatively few observations.

In PCI 23, a GDP-based linear extrapolation procedure was introduced to account for the exceptional impact of the COVID-19 pandemic on selected indicators such as healthcare expenditure and air freight transport. While effective for that update cycle, this approach was explicitly treated as an exception. In PCI 25, the GDP-based extrapolation step is discontinued. Series with observations extending to 2022 or later follow the regular pipeline, prioritising interpolation, then extrapolation, and using imputation only as a last resort. For four indicators that were significantly affected by the pandemic but lack data beyond 2021[7]– air transport, freight (million ton-km per capita); air passengers (per capita); air transport, registered carrier departures worldwide (per capita); and health-adjusted life expectancy (years) – missing values are estimated in Step 3.3, using multivariate methods that leverage more recent information from related variables and country patterns.

The strategies used to fill data gaps depend on whether the series have sufficient observations or not.

[7] Due to the fact that double exponential smoothing places high weight on the latest observations in the time series, using the extrapolation method under these conditions would place unjustified weight on the pandemic years and assume a long-term trend starting in 2020 and 2021 and continuing into 2024.

4.3.3. Step 3.3: Data imputation

Step 3.3 addresses missing data in series that contain insufficient information for interpolation and extrapolation, imputing missing values using multivariate methods. That is, for such big gaps of missing values, instead of guessing the values of the series based on trend of previously observed values (in the cases where they exist), the missing values of the series, say, indicator *j* for country *i*, are imputed using a combination of information sources: (i) the values of other indicators for the same country *I*; (ii) the statistical relationship between indicator *j* and other indicators in countries with sufficient data on *j*; and (iii) the time-series of indicator *j* itself, where available.

The PCI 25 upgrade introduced significant refinements to the imputation strategy, aimed at improving both the computational performance and the statistical robustness of missing data handling. These changes respond to growing dataset size, expanding thematic coverage, and feedback from users and technical reviewers.

Several imputation methods were considered in this update.

Several imputation methods were considered in this update. All methods are iterative and aim to improve imputation accuracy by updating imputed values until a convergence criterion is met where the improvement from one iteration to the next is minimal. The methods considered vary in how these updates to the imputed values are generated.

- **Parallelized missForest:** The baseline imputation engine from PCI 23 was re-engineered to run in parallel using the doParallel and foreach frameworks, reducing runtime by up to 20 times without affecting reproducibility. The missForest function updates imputed values using a random forest algorithm.
- **missRanger** (Mayer, 2024): A high-performance, memory-efficient random forest implementation based on the ranger C++ library. It is conceptually identical to parallelized missForest and produces nearly identical results, but executes significantly faster, especially with wide data matrices.
- **MICE (Multiple Imputation by Chained Equations):** Introduced by Van Buuren and Groothuis-Oudshoorn (2011) as an interpretable, flexible alternative particularly well suited for social and health-related indicators. It supports a variety of statistical models, including multi-level linear models and is appropriate for domains where understanding the imputation logic is important.
- **Longitudinal Random Forest Imputation (longitudinalRFI):** Recognizing that most PCI indicators evolve over time and that missForest assumes independent observations, we enrich the feature space with temporal patterns (e.g., lags, rolling slopes, and stability measures) to better capture temporal dependence within a cross-sectional imputation framework. This helps smooth transitions, reduce edge-year volatility, and improve prediction in sparse regions. A further optimization of the longitudinal approach that separates *to-be-imputed variables from predictor features*, eliminating unnecessary computation. This design greatly reduces overhead and has become the default mode for large-scale longitudinal imputations in PCI 25.

Comparative Results

To evaluate the practical performance of different imputation methods, we conducted a simulation-based comparison using masked real data. A random subset (10%) of observed and transformed values was artificially masked across all indicators, and each imputation method was tested on its ability to recover these missing values. The simulation repeated step 3 of the pipeline 50 times in two scenarios with only the imputation method differing.

This is not a perfect test of the robustness of the imputations since values that were available at collection may be values that are also more predictable than values from countries where indicators are less stable and auxiliary variables are less available. However, it is a useful tool to compare algorithms and indicative of the performance of the imputations.

Two standard metrics were used to measure imputation accuracy:

- **Normalized Root Mean Squared Error (NRMSE)**
- **Normalized Root Median Squared Error (NRMedSE)**

Both metrics normalize the squared differences between imputed and true values by the variance of the true (non-masked) values. For a given indicator column:

$$\mathrm{NRMSE} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\frac{(x_i^{\mathrm{true}} - x_i^{\mathrm{imp}})^2}{\mathrm{Var}(x^{\mathrm{true}})}}$$

$$\mathrm{NRMedSE} = \sqrt{\frac{\mathrm{Median}_i\left((x_i^{\mathrm{true}} - x_i^{\mathrm{imp}})^2\right)}{\mathrm{Var}(x^{\mathrm{true}})}}$$

To compute the **total NRMSE and NRMedSE for each imputation run**, we applied these formulas independently to each indicator with at least 5 masked values, then took the **average of all valid indicator-level errors**. This yielded a single summary score per method per run, which was then used for cross-method comparison.

For PCI25, the choice of method stood between two of the imputation methods mentioned above: missRanger which is equivalent to the method in PCI23 but computationally more efficient than missForest, or longitudinalRFI which aims to overcome the limitations of the simpler methods based on random forest that cannot take longitudinal relationships into account. In the PCI25 implementation MICE could not compete with the methods based on random forests. The two methods performed practically identically on both NRMSE (missranger: $M = 0.116$, $SD = 0.007$; longitudinalRFI: $M = 0.116$, $SD = 0.007$) and "NRMedSE" (missranger: $M = 0.030$, $SD = 0.001$; longitudinalRFI: $M = 0.030$, $SD = 0.001$). LongitudinalRFI was then chosen based on the theoretical considerations mentioned above.

UNCTAD seeks to iteratively refine methods and improve the accuracy of the imputations (which includes reconsideration of MICE if any changes to the data pipeline proves to give the method a stronger advantage).

4.4. Step 4: Outlier treatment

While data transformation in Step 2 reduces the likelihood of extreme values, there may be some outliers present in the data, either from source or due to imputation. To prevent some outliers from having too much weight in the computation of the PCI, for indicators considered affected by outliers, the top and bottom two and a half percent of the data are winsorized prior to performing the PCA (in the case of *Gross fixed capital formation per capita* only the top and bottom one per cent were winsorized). This process moves extreme values from their original point to the value of the specified percentile, which adds robustness to abnormal values and helps avoid excessive bias in the estimates.

4.5. Step 5: Principal Component Analysis (PCA) and Computing the PCI

4.5.1. Raw category scores from principal component scores

PCA is used in the PCI as a weighting scheme to reduce input indicators into category scores while retaining as much relevant information as possible.

Scores are calculated independently for each of the eight categories. For each category a principal component analysis (PCA) was performed. PCA is used in the PCI as a weighting scheme to reduce input indicators into category scores while retaining as much relevant information as possible. Conceptually, productive capacities can be viewed as latent constructs – underlying dimensions of productive capacity such as transport or human capital that are not directly observable but manifest in correlated indicators. PCA is well suited to this interpretation, as it identifies the strongest common signal across related variables and assigns weights automatically, thereby limiting redundancy and ensuring that highly correlated indicators do not dominate the results. Compared with a simple average, PCA captures more of the statistical structure of the data and reduces noise, while still allowing comparability across countries and categories. Although simpler methods can improve transparency, especially for country-level applications, PCA provides a stronger empirical foundation for the global index by balancing conceptual clarity with statistical rigor.

The PCA was performed with the principal function from the psych package in R. This function standardizes the input indicators as part of the computation.

In PCI 23, the number of components extracted was determined by retaining only those with eigenvalues greater than 1.0 and variance explained above 10 percent. In PCI 25, a fixed number of components is maintained, consistent with PCI 23, to ensure comparability across update cycles and preserve the stability of country scores for policy use. Despite this, it is important to note that the choice of components is not considered permanent. It will be periodically reviewed and adjusted where long-term structural changes in the underlying data or trends alter the way productive capacities are reflected.

For four PCI components (Human Capital, ICT, Institutions and Transport) a single component was extracted. For the other four (Energy, Natural Capital, Private Sector and Structural Change) the extraction rule results in two extracted components. When more than one component is extracted, a varimax rotation is applied to improve interpretability. Multiple extracted components imply that these PCI categories have more than one dimension and since varimax is used as the rotation method, the extracted component scores are uncorrelated. For example, the loadings[8] of the PCA in the Private Sector category imply that the indicators *Patent applications (per capita)* and *Trademark applications (per capita)* are closely related to a second component that is distinct from a component that is more strongly related to the remaining three indicators. Appendix 7.2 shows the loadings of all the 43 input indicators.

[8] A loading in PCA is the coefficient (weight) of an original variable in a principal component, indicating the strength and direction of that variable's contribution to the component.

A raw category score is calculated by first calculating component scores for each extracted component[9]. When only one component is extracted, the score on this component is also the raw category score. When two components are extracted the category score is the average of the two component scores weighted by the variance explained of the two components in the PCA.

4.5.2. Scaling and calculating overall PCI score

The raw category scores, mentioned above, are scaled so that the lowest value of any country in any year gets the score 1. The highest observed score in the time series for the category is given the score 100. The user is reminded that the PCI is thus a relative index and should not be interpreted in absolute terms such as a percentage. Since the maximum and minimum recorded value may change between editions these relative index values may not be directly comparable from version to version (e.g. PCI23 to PCI25).

With all categories given a score between 1 and 100, these scaled scores are used to calculate the overall PCI score as the geometric mean of the category scores. The use of the geometric mean for aggregation reflects the conceptual parity of the eight categories, each of which captures a distinct and complementary aspect of productive capacities. This approach avoids overweighting certain categories or indicators, ensuring that weaknesses in one dimension cannot be fully offset by strengths in another. By contrast, approaches such as applying PCA at the aggregate level would emphasize statistical correlations at the expense of conceptual balance and risk obscuring the multidimensional nature of productive capacities. Tables 7.3.1 and 7.3.2, found in Appendix 7.3, illustrate the nature and structure of the PCI scores.

4.6. Step 6: Repeated-Run Stability Check and Score Finalization

The stochastic nature of the imputation step means that the results will not be identical from one run through the pipeline to another. Identical results will only be produced if the random seed is set in order to fix the sequence of random numbers that will produce the results. Repeating the run through the pipeline and allowing the random seed to vary constitutes a test on the stability of the computational part of the statistical pipeline.

The stability of the final scores is influenced by how many indicators are imputed of those that make up the score and how efficient the imputation method is for those indicators. In PCI 25, to obtain the most reliable estimates the analysis was repeated 200 times, each time with a different random seed. For category scores, the mean of these 200 repeated runs through the statistical pipeline are the published results. The overall PCI score is the geometric mean of the category scores obtained through repeated runs.

This exercise should not be confused with resampling for the purpose of obtaining a confidence interval of the estimate. Instead, the repeated values constitute a range of values obtained using the same input data and the same algorithms and only the stochastic outcome of the imputation varying. It is however an indication of the extent to which a particular value is vulnerable to alternative data.

Repeating the analysis is an efficient way to analyze all observed combinations of missing values and their consequences. It also allows for the publication of the most plausible value for cases where the values vary. Moreover, it enables the identification of cases that warrant caution in interpretation. In the vast majority of cases, the results vary within a very narrow range, that is, results

[9] The psych function uses the regression method to calculate the component scores. The regression method accounts for multicollinearity within indicators to reduce redundancy when calculating the weights. In practice, these weights are very close to the eigenvectors of indicators for the components.

remain practically unchanged even if the analysis is repeated (see Table 4.6.1).

UNCTAD already notes scores where the majority or all underlying indicators are interpolated, forecasted or imputed. It is deemed relevant to inform the user to what extent the PCI scores are based on data observed in the country. In PCI 25, these notes are complemented by a note on the run-to-run variation. The thresholds for the notes are based on the range of the middle 95% of results of the 200 repeated runs.

Table 4.6.1 shows the notes associated with the PCI data on UNCTADstat Data Centre.

Table 4.6.1.
Stability of PCI component scores across imputation runs and levels of missingness

Imputation rate	Range of 95% of re-peated runs	Note	% of data points
< 50%	*<= 2*	*(No note)*	82.32
< 50%	*> 2*	*Run-to-run variation exceeds ±1 index point*	0.17
>= 50%	*<= 2*	*Half or more of the in-dicators imputed. Val-ue stable across runs (variation within ± 1 index point).*	8.81
>= 50%	*> 2*	*Half or more of the in-dicators imputed. Run-to-run variation ex-ceeds ±1 index points.*	3.63
>= 50%	*> 6*	*Half or more of the in-dicators imputed. Run-to-run variation ex-ceeds +/- 3 index points.*	0.01
100%	*<= 2*	*All indicators imputed. Value stable across runs (variation within ±1 index point).*	4.23
100%	*> 2*	*All indicators imputed. Run-to-run variation exceeds ±1 index points.*	0.78
100%	*> 6*	*All indicators imputed. Run-to-run variation exceeds ±3 index points.*	0.06

V. Consistency of Results with Previous Update

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To evaluate the effect of the methodological updates introduced in PCI 25, country-level scores were compared against those from PCI 23 across all categories, using three standard metrics: Mean Absolute Error (MAE), Spearman rank correlation, and Pearson correlation. MAE captures the average magnitude of absolute differences between the two versions, providing a direct measure of how much score levels change. Spearman rank correlation evaluates the stability of country rankings, indicating whether relative positions are preserved regardless of scale changes. Pearson correlation measures the strength of the linear relationship between the two sets of scores, capturing overall consistency in both direction and proportionality. Together, these metrics provide a comprehensive assessment of robustness by jointly capturing changes in levels, rankings, and linear structure.

Table 5.1 correlation coefficients show a very high degree of robustness of the PCI structure across versions. Overall, the mean absolute error (MAE) is small across categories, indicating that the absolute differences between PCI 23 and PCI 25 scores are limited in magnitude. At the same time, both Spearman and Pearson correlation coefficients are very close to 1, implying near-perfect preservation of country rankings and a very strong linear relationship between the two versions.
Taken together, these results indicate that the transition from PCI 23 to PCI 25 preserves both the relative ordering of countries and the overall structure of the index, with only minor changes in score levels, that appear to be driven primarily by revisions in the underlying input indicators by data providers, especially in the Transport, Private Sector and Energy categories.

Correlation coefficients show a very high degree of robustness of the PCI structure across versions.

Table 5.1.
Correlation coefficients between PCI 25 and PCI 23 scores by Category

Category	Mean MAE	Mean Spearman	Mean Pearson
Institutions	0.0035	1.0000	1.0000
Structural change	0.1033	0.9997	0.9998
Human capital	0.1230	0.9997	0.9998
ICT	0.9635	0.9990	0.9989
Natural capital	2.1137	0.9982	0.9988
Energy	2.4503	0.9625	0.9772
Private sector	1.3717	0.9821	0.9737
Transport	12.3257	0.9265	0.8912
Overall PCI	**1.9497**	**0.9862**	**0.9911**

VI. Conclusion and Way Forward

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PCI 25 enhances the index methodologically, while preserving continuity with PCI 23. Moving data transformation earlier in the pipeline, refining imputation (adopting longitudinal, parallelized algorithms), retiring the COVID-specific extrapolation step and averaging results across random seeds, together, improve statistical stability and robustness, reduce missingness, and make intermediate results easier to interpret. The Transport update – integrating *seaborne goods discharged* from UNCTADstat – addresses a long-noted maritime gap and better reflects countries' capacity to receive and process seaborne trade, including for landlocked economies via transit ports.

Data availability and work remain constraints. UNCTAD's expanded automation and documentation strengthen reproducibility, but uneven reporting, manual retrieval, and access barriers - especially for Transport and Energy data – still affect coverage and robustness. Promoting open and fair access to essential statistics is therefore integral to the PCI's robustness and to countries' ability to use it for evidence-based policymaking.

Looking forward, further work will advance on developing satellite indices tailored to specific policy priorities. The "Green PCI" remains under refinement, with ongoing efforts to enhance the ability of the PCI framework to model sustainable development and its impacts on productive capacities. Also under development is a satellite PCI for Small Island Developing States (SIDS), which is produced as part of the UNCTAD project on "Stronger and greener productive capacities for just transitions in Caribbean Small Island Developing States". Both initiatives, as described in more detail in another report by UNCTAD (2025a), reflect the adaptability of the PCI framework to emerging development challenges and the needs of specific country groups.

Further work will advance on developing satellite indices tailored to specific policy priorities.

Appendices

7.1. Metadata for Input Variables

Indicator	Source / Formula	Data processing steps
Energy		
• Access to electricity (% of population)	IEA, IRENA, UNSD, World Bank, WHO. 2023. Tracking SDG 7: *The Energy Progress Report.**	
• GDP per total energy supply (thousand 2015 USD PPP per toe)	IEA World Energy Statistics and Balances. *World Indicators.*	
• Renewable energy consumption (% of total final energy consumption)	IEA, IRENA, UNSD, World Bank, WHO. 2023. *Tracking SDG 7: The Energy Progress Report.**	3
• Total primary energy supply (per capita)	IEA. *World Indicators.*	2
• Total energy consumption (per capita)	IEA. *World Energy Balances.*	1, 2, 6
• Electric power transmission and distribution losses (% of output)	IEA. *World Energy Balances.*	2, 6
a: Losses of electricity output (ktoe)	IEA. *World Energy Balances.*	
b: Electricity output (ktoe)	IEA. *World Energy Balances.*	
Human capital		
• Health expenditure, total (% of GDP)	World Health Organization. *Global Health Expenditure database.*	2
• Research and development expenditure (% of GDP)	UN Population Division. *World Population Prospects: 2024.* National statistical offices. Eurostat. UNSD. *Population and Vital Statistics Report* U.S. Census Bureau: *International Database* Secretariat of the Pacific Community*.	
• Health adjusted life expectancy (years)	The Institute for Health Metrics and Evaluation.	
• Researchers in R&D (per million people)	UNESCO Institute for Statistics.	
• Expected years of schooling	UNDP. Human Development Reports.	

Indicator	Source / Formula	Data processing steps
Information and Communication Technology		
• Fixed broadband subscriptions (per 100 people)	ITU *World Telecommunication/ICT Indicators Database**.	3
• Fixed telephone subscriptions (per 100 people)	ITU *World Telecommunication/ICT Indicators Database**.	3
• Individuals using the Internet (% of population)	ITU *World Telecommunication/ICT Indicators Database**.	3
• Mobile cellular subscriptions (per 100 people)	ITU *World Telecommunication/ICT Indicators Database**.	
• Secure Internet servers (per 1 million people)	Netcraft (netcraft.com) and World Bank population estimates.*	2
Institutions		
• Control of corruption	World Bank, Worldwide Governance Indicators.	
• Government effectiveness	World Bank, Worldwide Governance Indicators.	
• Political stability and absence of violence/terrorism	World Bank, Worldwide Governance Indicators.	
• Regulatory quality	World Bank, Worldwide Governance Indicators.	
• Rule of law	World Bank, Worldwide Governance Indicators.	
• Voice and accountability	World Bank, Worldwide Governance Indicators.	
Natural capital		
• Agricultural land (% of land area)	Food and Agriculture Organization*.	
• Extraction flows (% of GDP)	United Nations Environment Programme, International Resource Panel. *Global Material Flows Database*.	2
• Forest area (% of land area)	Food and Agriculture Organization*.	2
• Material intensity	c / d	
c: Total domestic extraction of raw materials (t)	United Nations Environment Programme, International Resource Panel. *Global Material Flows Database*.	
d: Industry (including construction), value added (constant 2015 US$)	World Bank and OECD national accounts data*.	
• Total natural resources rents (% of GDP)	World Bank staff estimates based on sources and methods described in the World Bank's *The Changing Wealth of Nations.**	2

Indicator	Source / Formula	Data processing steps
Private sector		
• Domestic credit to private sector (% of GDP)	IMF, *International Financial Statistics* and data files, and World Bank and OECD GDP estimates.*	2
• Patent applications (per capita)	WIPO statistics database.	1, 2, 6
• Trademark applications (per capita)	WIPO statistics database.	1, 2, 6
• Lending interest rate (%)	IMF, *International Financial Statistics* and data files.*	2, 5, 6
• Logistics performance index: Overall	World Bank: *Logistics Performance Index**.	
Structural change		
• Export concentration index	UNCTADstat.	2, 5
• Economic complexity index	UNCTAD secretariat calculations based on UN COMTRADE.	
• Industrial ratio (Industry and Services VA over total GDP)	*(d + e) / (d + e + f) * 100.*	
d: Industry (including construction), value added (constant 2015 US$)	World Bank and OECD national accounts data*.	
e: Services, value added (constant 2015 US$)	World Bank and OECD national accounts data*.	
f: Agriculture, forestry, and fishing, value added (constant 2015 US$)	World Bank and OECD national accounts data*.	
• Gross fixed capital formation (% of GDP)	UNSD. National Accounts Main Aggregates Database.	6
Transport		
• Air transport, freight (million ton-km per capita)	International Civil Aviation Organization (ICAO), *Civil Aviation Statistics of the World* and ICAO staff estimates.*	1, 4, 6
• Km of roads (100km^2 land)	International Road Federation (IRF), available at www.irfofficial.org and www.worldroadstatistics.org	2, 6
• Air passengers (per capita)	ICAO, Civil Aviation *Statistics of the World* and ICAO estimates*	1, 2, 6
• Km of rail lines (per capita)	International Union of Railways (UIC), *International Railway Statistics*	1, 4, 6
• Air transport, registered carrier depar-tures worldwide (per capita)	ICAO, *Civil Aviation Statistics of the World* and ICAO estimates*	1, 2, 6
• Seaborne goods discharged (thousand metric tons per capita)	UNCTADstat	1, 2, 6

Notes: *Sourced via World Bank Open Data. Data preprocessing steps: 1. Raw data divided by population, 2 Log transformation, 3 Logit transformation, 4 Box-Cox transformation, 5 Inverting indicating lower scores as more desirable, 6 Winsorization.

7.2. PCA Loadings

The loadings of the indicators grouped by PCI component are presented below. PC stands here for a single principal component. Rotation is not relevant for single components. RC stands for a principal component rotated with varimax rotation. Absolute loadings over .4 are underlined and bolded. For each PCI component, the number of loadings reflects the number of components retained in the formulation of the PCI score.

Values presented here are the medians of 200 repeated runs. None of the loadings obtained in the 200 runs deviates by more than ±0.02 from these medians. The "variance explained" reported in the footnotes refers to that for the first iteration.

Table 7.2.1.
Loadings for the Energy category.

Indicator	RC 1	RC 2
Access to electricity (% of population)	**.81**	.34
Electric power transmission and distribution losses (% of output)*	**.73**	.13
Renewable energy consumption (% of total final energy consumption)	**-.78**	-.23
GDP per total energy supply (thousand 2015 USD PPP per toe)	-.07	**.97**
Total primary energy supply (per capita)	**.96**	-.09
Total energy consumption (per capita)	**.96**	-.09

Notes: Variance explained: RC1 61%, RC2 19%. *Values for Electric power losses inverted so that higher values indicate more efficient transmission and distribution.

Table 7.2.2.
Loadings for the Human Capital category.

	PC
Expected years of schooling	**.90**
Research and development expenditure (% of GDP)	**.78**
Health adjusted life expectancy (years)	**.85**
Health expenditure, total (% of GDP)	**.57**
Fertility rate, total (births per woman)*	**.81**
Researchers in R&D (per million people)	**.86**

Notes: Variance explained: 64%. *Values for Fertility rate inverted so that higher values indicate lower fertility.

Table 7.2.3.
Loadings for ICT category.

	PC
Fixed broadband subscriptions (per 100 people)	**.93**
Mobile cellular subscriptions (per 100 people)	**.82**
Fixed telephone subscriptions (per 100 people)	**.75**
Individuals using the Internet (% of population)	**.94**
Secure Internet servers (per 1 million people)	**.94**

Note: Variance explained: 78%.

Table 7.2.4.
Loadings for the Institutions category.

	PC
Control of corruption	**.95**
Government effectiveness	**.95**
Political stability and absence of violence/terrorism	**.83**
Regulatory quality	**.94**
Rule of law	**.98**
Voice and accountability	**.86**

Note: Variance explained: 85%.

Table 7.2.5.
Loadings for the Natural Capital category.

	RC 1	RC 2
Agricultural land (% of land area)	.16	**.67**
Forest area (% of land area)	.05	**-.82**
Extraction flows (% of GDP)	**.93**	.12
Material intensity	**.78**	.00
Total natural resources rents (% of GDP)	**.80**	.09

Note: Variance explained: RC1 43%, RC2 23%.

Table 7.2.6.
Loadings for the Private Sector component.

	RC 1	RC 2
Domestic credit to private sector (% of GDP)	**.80**	.36
Lending interest rate (%)*	**.89**	.12
Logistics performance index: Overall	**.86**	.31
Trademark applications (per capita)	.33	**.74**
Patent applications (per capita)	.15	**.86**

Notes: Variance explained: RC1 46%, RC2 31%. *Values for Lending rates inverted so that higher values indicate lower and more favorable lending rates.

Table 7.2.7.
Loadings for the Structural Change component.

	RC 1	RC 2
Export concentration index*	**.85**	-.08
Economic complexity index	**.88**	-.03
Gross fixed capital formation (% of GDP)	-.02	**.96**
Industrial ratio (Industry and Services VA over total GDP)	**.63**	.36

Notes: Variance explained: RC1 47%, RC2 26%. *Values for Export concentration index inverted so that higher values represent more export diversification.

Table 7.2.8.
Loadings for the Transport component.

	PC
Air transport, registered carrier departures worldwide (per capita)	**.92**
Air transport, freight (million ton-km per capita)	.80
Air passengers (per capita)	**.92**
Km of roads (100km2 land)	**.75**
Km of rail lines (per capita)	**.61**
Seaborne goods discharged (thousand metric tons per capita)	**.90**

Note: Variance explained: 68%.

7.3. The Productive Capacities Index

The rankings of the countries according to the composite Productive Capacities Index computed in the present study is presented below.

PCI users are advised to consult the UNCTADstat Data Centre to download updated data and editable working files to ensure the most recent values are captured in their analysis. Statistics presented through the UNCTADstat Data Centre reflect the most up-to-date revision and should be considered the values of reference.

Table 7.3.1. *Productive Capacities Index, 2024* shows the final results of PCI 25, with 2024 values released on UNCTADstat on 31 October 2025.

Table 7.3.2. shows the results of the overall index in PCI 25 release on 31 October 2025. Data are presented for the years 2021, 2022, 2023 and 2024. Countries/economies were ranked according to the year 2024.

Table 7.3.1.
Productive Capacities Index, 2024
(PCI 25 released on UNCTADStat on 31 October 2025)

Rank	Economy	Energy	Human Capital	ICT	Institutions	Natural capital	Private Sector	Structural Change	Transport	PCI
1	**Denmark**	72.6	86.9	80.1	96.1	27.3	75.0	79.8	80.8	**70.9**
2	**United States**	75.9	79.1	76.4	79.1	25.2	94.4	97.6	73.1	**70.6**
3	**Australia**	73.3	76.8	75.6	90.3	41.7	85.0	67.6	61.6	**69.9**
4	**Netherlands**	75.7	79.4	78.2	90.4	23.1	78.4	82.3	88.2	**69.8**
5	**United Kingdom**	70.6	76.1	79.5	83.3	27.9	79.1	83.6	68.7	**67.9**
6	**Canada**	72.1	74.2	74.5	88.5	28.1	85.2	75.3	68.4	**67.6**
7	**New Zealand**	67.6	73.9	72.2	94.7	27.9	93.9	64.2	75.7	**67.6**
8	**Germany**	73.9	81.3	81.9	85.9	18.9	79.0	90.8	74.2	**67.4**
9	**United Arab Emirates**	81.2	61.1	84.5	71.4	33.8	76.1	64.1	81.2	**66.9**
10	**Belgium**	75.0	88.5	73.8	80.9	19.6	74.4	81.7	83.7	**66.8**
11	**South Korea**	78.1	100.0	82.3	78.7	12.3	95.8	79.4	74.2	**65.8**
12	**Sweden**	67.1	90.4	72.5	91.3	17.5	76.0	80.6	80.5	**65.7**
13	**Luxembourg**	77.2	62.2	82.0	94.4	15.8	92.4	65.5	95.3	**65.5**
14	**Norway**	71.4	77.5	70.2	94.1	25.5	72.3	60.3	77.5	**64.9**
15	**France**	68.8	74.0	80.0	79.5	18.7	77.3	92.5	70.1	**64.6**
16	**Qatar**	81.7	42.2	70.5	70.4	46.3	69.9	65.2	82.9	**64.5**
17	**Austria**	71.6	82.4	76.1	85.1	16.6	72.3	84.7	76.0	**64.4**
18	**Ireland**	89.3	68.9	76.5	89.2	21.1	60.3	64.8	84.4	**64.3**
19	**Finland**	69.8	86.6	69.6	94.1	17.5	74.1	71.9	76.8	**64.1**
20	**Iceland**	70.0	81.2	78.8	89.0	22.6	67.1	52.5	87.2	**63.9**
21	**Switzerland**	77.0	84.3	81.8	94.4	10.8	83.8	77.2	76.0	**63.5**

Rank	Economy	Energy	Human Capital	ICT	Institutions	Natural capital	Private Sector	Structural Change	Transport	PCI
22	Israel	75.1	79.8	73.9	68.2	26.1	74.0	69.7	62.2	**63.2**
23	Hong Kong SAR China	87.9	68.1	99.3	80.4	12.3	96.0	58.9	76.3	**63.1**
24	Bahrain	81.9	49.0	71.3	58.9	37.6	68.6	60.8	93.4	**63.0**
25	China	67.7	63.2	67.2	49.6	37.3	91.5	97.2	49.2	**62.5**
26	Singapore	96.8	80.1	81.2	93.7	6.2	96.7	67.3	94.6	**62.3**
27	Portugal	65.6	74.3	78.7	76.4	23.4	71.8	74.6	59.8	**62.0**
28	Estonia	60.1	66.7	78.6	84.6	28.7	65.2	76.5	55.4	**61.7**
29	Czechia	71.0	70.3	71.0	78.9	26.7	58.8	77.8	61.4	**61.7**
30	Japan	73.2	81.6	81.7	86.8	8.2	97.4	83.6	71.4	**61.4**
31	Curaçao	69.2	67.8	64.7	77.8	21.1	74.5	68.7	78.1	**61.3**
32	Spain	66.4	69.3	78.4	72.4	19.3	71.0	80.4	65.9	**60.9**
33	Andorra	67.3	56.7	85.7	86.5	24.4	71.5	54.0	70.9	**60.9**
34	Malta	76.7	60.1	78.0	69.3	24.6	64.9	55.8	78.4	**60.3**
35	Poland	70.7	65.1	69.3	68.2	31.3	57.9	77.7	55.9	**60.2**
36	Saudi Arabia	75.9	48.0	75.1	57.2	56.7	58.4	56.4	51.3	**59.2**
37	Chile	65.1	56.2	68.5	72.0	40.8	67.1	57.9	51.7	**59.0**
38	Hungary	66.9	63.5	72.8	63.7	30.9	47.3	72.9	65.8	**58.6**
39	Latvia	65.4	56.6	66.7	75.2	29.0	54.8	72.0	62.6	**58.3**
40	Italy	69.6	64.9	74.9	69.8	16.7	62.3	91.1	58.5	**58.2**
41	Lithuania	60.3	63.1	70.2	79.8	28.1	57.7	70.8	51.0	**57.8**
42	Brunei	74.3	41.2	72.9	75.0	26.5	60.2	57.9	77.8	**57.5**
43	Slovenia	69.6	74.2	75.8	76.4	19.9	57.8	61.2	54.4	**57.2**
44	Kuwait	75.2	46.0	60.7	58.0	44.7	64.6	49.0	65.0	**57.0**
45	Turkey	68.2	61.2	63.5	43.1	34.5	62.4	85.0	53.4	**57.0**
46	Oman	73.8	37.8	58.1	58.3	49.4	61.9	57.5	66.9	**57.0**
47	San Marino	73.6	59.6	75.0	84.0	10.3	89.9	53.4	81.0	**57.0**
48	Malaysia	66.0	43.9	70.9	66.3	33.3	65.6	58.8	59.4	**56.5**
49	Thailand	60.9	54.6	66.8	53.1	34.1	65.0	72.1	52.7	**56.2**
50	Cyprus	71.4	57.1	80.9	70.4	22.6	58.5	54.6	57.0	**55.9**
51	Greece	65.4	75.5	74.7	64.0	18.6	59.5	57.0	61.3	**55.6**
52	Barbados	67.5	53.6	70.2	73.9	19.9	58.8	53.9	76.5	**55.6**
53	Uruguay	58.8	55.4	73.1	78.5	42.4	49.7	50.4	44.0	**55.3**
54	Aruba	68.5	52.4	70.7	78.8	14.1	67.7	54.7	81.7	**55.1**
55	Croatia	61.4	59.8	70.1	67.2	24.6	50.3	72.3	55.2	**55.1**
56	Mauritius	68.0	48.7	72.7	72.8	22.7	52.7	61.5	65.1	**55.0**

Rank	Economy	Energy	Human Capital	ICT	Institutions	Natural capital	Private Sector	Structural Change	Transport	PCI
57	Serbia	57.8	56.1	72.5	53.7	36.8	52.8	67.7	47.3	**54.6**
58	Bulgaria	64.9	54.2	68.5	58.5	36.2	55.6	67.9	40.7	**54.5**
59	Macao SAR China	71.8	59.8	69.4	74.4	10.8	73.3	53.4	80.5	**54.3**
60	Slovakia	68.7	58.7	69.9	67.6	23.7	56.3	62.3	43.9	**53.7**
61	Romania	64.1	46.5	68.9	61.4	33.1	46.3	73.6	48.5	**53.7**
62	Panama	71.7	45.0	65.0	54.1	31.1	56.0	62.5	52.0	**53.2**
63	Antigua & Barbuda	68.3	48.5	65.9	66.3	15.7	59.1	63.7	74.8	**53.2**
64	Trinidad & Tobago	76.7	45.0	64.6	55.9	29.6	49.7	47.4	69.4	**52.8**
65	Tuvalu	66.3	46.7	50.7	68.0	23.1	66.6	49.9	72.5	**52.7**
66	Montenegro	55.7	49.7	76.6	59.2	31.4	55.9	51.6	49.1	**52.3**
67	Costa Rica	60.9	51.5	66.1	69.5	25.2	55.8	50.8	52.6	**52.1**
68	Seychelles	70.3	50.9	78.5	71.2	13.8	52.3	45.9	81.1	**52.0**
69	Dominica	62.4	47.3	58.4	70.1	16.8	56.7	67.0	68.8	**51.9**
70	South Africa	55.2	42.7	56.8	53.3	48.8	52.9	65.3	42.3	**51.7**
71	Vietnam	58.2	47.6	59.8	48.0	38.5	57.2	67.6	42.2	**51.6**
72	Cape Verde	57.1	43.4	51.9	68.3	36.8	50.5	49.2	61.3	**51.5**
73	Grenada	61.6	49.9	59.5	67.4	14.0	54.3	72.5	72.1	**51.5**
74	Georgia	61.1	52.2	66.9	64.3	33.5	48.4	52.2	41.1	**51.3**
75	Guam	67.7	48.7	57.4	76.8	12.1	63.5	51.4	82.6	**51.2**
76	Maldives	66.8	49.1	57.5	52.0	24.7	47.4	58.5	69.7	**51.1**
77	Kazakhstan	68.1	37.5	65.3	49.2	57.3	42.7	52.8	42.9	**51.0**
78	Palau	69.9	49.1	62.1	71.7	9.1	59.6	65.0	82.7	**50.9**
79	St. Vincent & Gren dines	65.6	48.6	58.9	69.0	14.2	53.4	58.8	74.4	**50.6**
80	North Macedonia	55.5	48.9	64.6	56.4	30.7	55.7	55.2	40.8	**49.9**
81	Mongolia	59.2	41.9	64.5	53.2	69.4	40.3	48.3	31.9	**49.6**
82	Moldova	56.4	46.2	68.8	52.1	43.6	47.5	51.4	36.4	**49.5**
83	Brazil	51.9	54.8	61.4	49.0	37.4	47.3	60.8	39.1	**49.5**
84	Russia	69.8	51.8	73.8	30.7	33.2	46.8	59.5	47.0	**49.4**
85	Armenia	61.4	48.9	60.4	52.1	49.5	46.5	50.9	30.9	**49.2**
86	Mexico	58.3	43.4	59.1	44.3	35.1	48.7	71.5	42.1	**49.2**
87	Fiji	53.3	39.1	47.2	63.5	28.8	58.0	49.9	61.4	**48.8**
88	Belarus	65.9	48.4	75.5	30.1	35.2	43.0	62.8	46.3	**48.7**
89	Bahamas	71.4	46.6	67.2	68.8	8.8	59.8	50.3	75.9	**48.5**
90	Argentina	59.1	58.0	68.1	50.7	37.8	35.6	56.0	32.8	**48.2**
91	St. Lucia	61.9	44.0	51.7	68.1	14.1	54.7	54.6	71.2	**48.1**

Rank	Economy	Energy	Human Capital	ICT	Institutions	Natural capital	Private Sector	Structural Change	Transport	PCI
92	Marshall Islands	60.0	48.4	45.0	66.1	21.4	53.7	37.4	77.1	**48.1**
93	Bermuda	75.8	53.8	76.3	78.6	4.1	75.6	42.4	88.9	**48.1**
94	Bhutan	41.3	41.7	45.8	68.7	41.9	44.2	66.6	40.3	**47.7**
95	El Salvador	50.8	43.0	60.9	48.6	33.4	50.6	57.8	41.1	**47.5**
96	Colombia	58.7	47.8	63.0	51.1	32.9	41.9	52.1	39.8	**47.5**
97	Ukraine	55.3	46.7	61.2	41.4	59.6	37.3	50.8	34.4	**47.4**
98	Tonga	57.1	47.5	40.5	61.4	26.5	49.7	49.3	56.9	**47.3**
99	Tunisia	51.0	50.6	58.7	47.3	43.5	44.5	55.4	32.2	**47.2**
100	Belize	48.5	39.3	53.5	52.9	29.5	50.2	49.6	62.1	**47.2**
101	Morocco	50.7	46.5	57.4	49.4	40.1	47.4	57.8	32.8	**47.1**
102	Bosnia & Herzegovina	58.3	46.7	66.8	44.9	35.5	55.3	62.0	24.0	**47.0**
103	Jamaica	49.4	46.3	57.4	60.1	29.8	45.3	50.3	43.6	**46.9**
104	Indonesia	57.8	39.5	49.2	55.4	34.8	47.6	67.4	32.8	**46.8**
105	Dominican Republic	62.3	40.8	52.6	56.3	31.6	41.1	65.8	33.7	**46.5**
106	Suriname	56.8	39.0	66.0	49.6	35.3	34.4	61.2	40.3	**46.5**
107	India	47.2	39.7	41.4	54.2	41.8	50.8	74.3	32.4	**46.4**
108	Peru	54.4	44.7	53.1	48.1	36.3	46.7	54.6	36.2	**46.2**
109	Cayman Islands	76.8	53.5	79.5	77.3	2.7	72.3	47.5	88.9	**46.2**
110	Philippines	51.2	42.0	55.0	50.3	36.4	50.4	55.0	32.5	**45.8**
111	Samoa	48.7	37.1	35.7	70.1	23.5	53.4	61.6	52.6	**45.5**
112	Azerbaijan	64.7	42.4	61.3	40.7	45.9	36.7	39.9	38.8	**45.3**
113	Ecuador	53.3	49.5	53.0	43.2	31.9	47.8	50.2	37.8	**45.2**
114	Albania	52.8	47.7	56.6	56.0	35.9	48.8	51.8	24.0	**45.2**
115	Iran	66.3	48.8	68.4	24.9	42.4	41.8	60.7	28.9	**45.1**
116	Botswana	47.8	35.5	52.7	68.5	34.1	48.3	50.3	33.2	**45.0**
117	Palestinian Territories	52.6	42.0	49.4	35.1	41.0	50.7	58.0	33.9	**44.6**
118	Paraguay	49.9	42.3	54.6	47.7	38.7	49.7	49.7	27.2	**44.1**
119	Guyana	74.3	36.9	56.1	49.7	28.7	41.6	35.9	42.0	**43.9**
120	Jordan	53.1	43.6	46.9	55.5	28.8	50.4	51.8	30.1	**43.8**
121	Lebanon	59.5	40.3	50.9	27.9	33.2	48.9	60.2	40.5	**43.8**
122	Namibia	38.3	36.1	43.1	61.4	46.8	45.0	56.3	29.2	**43.4**
123	Uzbekistan	63.5	38.0	63.8	40.5	48.1	33.3	52.0	24.3	**43.4**
124	Bolivia	54.6	44.8	49.7	38.3	44.4	46.8	43.6	29.8	**43.4**
125	Algeria	63.0	41.3	53.5	38.7	45.6	38.5	55.5	22.0	**43.0**
126	Turkmenistan	70.0	38.7	42.8	24.1	53.9	32.3	63.1	35.0	**42.5**

Rank	Economy	Energy	Human Capital	ICT	Institutions	Natural capital	Private Sector	Structural Change	Transport	PCI
127	Kiribati	39.7	37.9	33.9	65.6	43.3	41.0	35.6	48.7	**42.3**
128	Sri Lanka	58.9	39.9	52.0	48.2	23.5	42.7	54.7	31.7	**42.3**
129	Egypt	54.7	42.6	50.2	40.5	46.5	36.1	52.7	23.7	**42.2**
130	Cuba	61.0	52.4	45.6	42.9	33.2	38.5	43.2	28.6	**42.1**
131	Timor-Leste	47.5	44.3	31.7	47.8	43.9	40.7	35.8	45.0	**41.7**
132	Vanuatu	38.8	32.0	35.8	58.7	32.4	44.0	49.9	49.2	**41.7**
133	Nepal	37.5	42.0	44.6	44.3	42.4	44.2	45.7	24.5	**40.0**
134	Bangladesh	54.6	35.5	39.9	36.9	38.5	42.1	56.1	23.5	**39.6**
135	Cambodia	45.9	35.2	42.1	39.0	36.1	46.9	60.9	22.2	**39.6**
136	Kyrgyzstan	44.0	36.6	51.1	35.9	53.7	31.6	58.0	19.8	**39.4**
137	Eswatini	42.0	39.2	43.4	38.7	44.7	38.9	45.7	26.1	**39.3**
138	Lesotho	29.1	35.8	28.6	44.6	72.0	36.1	56.1	27.9	**39.0**
139	Libya	55.5	39.2	61.1	16.0	49.2	37.0	40.4	33.3	**38.9**
140	Guatemala	48.3	37.0	46.2	39.4	35.6	40.8	52.3	20.6	**38.7**
141	Senegal	36.3	27.5	40.9	53.5	43.0	45.2	60.1	19.2	**38.6**
142	São Tomé and Príncipe	37.3	36.8	33.6	49.4	34.6	32.9	48.3	37.9	**38.4**
143	Nicaragua	38.3	40.8	45.0	30.9	45.0	42.2	46.0	24.7	**38.4**
144	Solomon Islands	37.5	31.5	28.8	50.6	37.8	49.2	35.3	39.2	**38.1**
145	Djibouti	37.7	23.5	32.8	35.1	49.0	36.1	63.8	37.2	**37.9**
146	Laos	52.7	29.1	43.6	39.5	37.7	28.9	52.5	27.4	**37.8**
147	Honduras	37.6	36.7	40.6	38.8	32.0	43.5	53.3	24.0	**37.4**
148	Côte d'Ivoire	37.1	27.7	42.5	47.1	50.7	45.7	46.6	16.6	**37.2**
149	Kenya	31.7	33.1	38.7	44.7	41.6	39.6	47.8	24.0	**36.9**
150	Rwanda	25.8	35.7	29.1	58.2	49.1	36.1	46.5	23.6	**36.3**
151	Tajikistan	43.0	36.5	40.6	30.0	44.9	26.3	60.4	18.5	**35.5**
152	Gabon	43.6	29.9	43.6	37.4	30.8	34.0	42.4	24.1	**35.0**
153	Comoros	36.5	36.3	31.3	31.7	46.6	39.9	23.7	38.5	**35.0**
154	Ghana	46.0	30.1	38.0	55.0	47.1	34.4	31.1	15.1	**34.9**
155	Zambia	30.9	27.7	31.1	47.5	48.4	34.9	52.5	14.2	**33.5**
156	Mauritania	30.8	24.1	31.7	38.4	64.4	31.8	40.6	19.8	**33.2**
157	Gambia	29.6	23.8	33.4	47.7	45.1	25.3	50.0	23.1	**33.2**
158	Togo	19.3	32.2	30.2	41.2	48.1	44.3	43.3	20.7	**33.2**
159	Pakistan	44.5	24.1	31.6	33.6	42.5	36.9	41.3	19.5	**33.1**
160	Iraq	47.4	34.3	48.5	21.5	44.1	31.9	31.9	18.0	**32.9**
161	Benin	25.7	23.0	30.3	48.8	41.7	42.1	50.7	13.4	**31.8**

Rank	Economy	Energy	Human Capital	ICT	Institutions	Natural capital	Private Sector	Structural Change	Transport	PCI
162	Myanmar	39.8	35.5	33.5	18.0	38.0	35.6	56.5	15.2	**31.6**
163	South Sudan	29.7	27.4	24.4	45.0	44.1	33.9	48.2	15.2	**31.5**
164	Venezuela	41.4	40.0	44.2	16.4	42.6	30.9	32.4	19.0	**31.5**
165	Papua New Guinea	29.2	27.5	25.4	43.2	34.5	37.6	30.4	26.4	**31.3**
166	Equatorial Guinea	52.5	27.8	28.4	26.4	28.4	27.7	38.8	27.4	**31.3**
167	Tanzania	26.7	22.0	32.9	46.4	41.4	33.1	42.3	15.9	**30.9**
168	Nigeria	32.3	24.8	31.0	32.5	46.0	32.4	48.0	13.6	**30.7**
169	Congo - Brazzaville	21.8	26.0	29.4	31.8	41.9	33.5	48.8	19.6	**30.3**
170	Syria	37.4	28.2	41.9	10.4	56.8	31.5	36.4	18.5	**29.4**
171	Uganda	22.6	27.7	24.4	40.9	50.1	30.0	45.4	12.9	**29.4**
172	Liberia	18.0	32.8	19.0	38.6	46.7	32.4	27.3	30.0	**29.2**
173	Cameroon	29.0	26.2	32.7	31.4	36.6	31.9	41.6	12.9	**28.9**
174	Angola	36.3	23.5	27.6	37.6	39.3	25.5	29.1	13.4	**27.7**
175	Ethiopia	22.7	23.9	21.7	33.6	44.9	34.4	34.0	16.6	**27.7**
176	Mozambique	19.4	27.7	20.4	36.1	49.2	28.5	50.8	11.9	**27.6**
177	Guinea	27.0	24.6	26.3	32.7	67.9	29.0	29.6	10.1	**27.6**
178	Zimbabwe	24.7	25.4	33.4	28.6	42.9	20.8	39.0	14.4	**27.2**
179	Afghanistan	42.5	34.7	21.4	16.0	43.5	24.2	30.8	16.7	**26.9**
180	Guinea-Bissau	17.6	29.1	32.3	31.7	43.2	39.4	14.5	19.6	**26.7**
181	Burkina Faso	19.4	25.3	28.5	37.0	53.7	42.6	33.1	5.4	**26.0**
182	Haiti	26.2	27.9	27.4	21.1	36.7	22.6	35.7	15.7	**25.8**
183	Mali	26.2	16.3	31.3	28.2	59.9	44.1	22.4	8.5	**25.7**
184	Burundi	11.5	27.1	18.2	26.7	67.4	38.0	24.7	19.4	**25.6**
185	Madagascar	25.3	22.1	23.7	37.3	51.7	24.9	40.2	7.1	**25.5**
186	Malawi	20.7	28.3	22.5	45.6	56.4	22.1	31.4	7.7	**25.5**
187	Eritrea	23.6	22.4	20.2	16.4	56.2	37.1	26.4	15.4	**24.9**
188	Sierra Leone	18.6	27.4	25.5	39.6	73.4	18.1	17.7	11.6	**24.7**
189	Sudan	30.3	24.1	19.0	16.3	55.2	22.6	26.2	13.8	**23.8**
190	Congo - Kinshasa	15.4	20.8	23.1	19.7	43.7	28.1	44.0	8.7	**22.6**
191	Yemen	41.6	24.4	17.4	11.3	44.4	19.8	35.5	9.9	**22.3**
192	Chad	15.8	17.5	19.1	23.9	63.8	32.1	25.0	6.6	**21.3**
193	Central African Republic	11.6	19.0	17.9	18.8	47.6	29.7	35.7	11.0	**21.2**
194	Niger	7.9	19.4	20.3	37.2	59.6	37.9	28.1	3.3	**19.8**
195	Somalia	15.8	13.4	24.3	10.6	59.0	24.9	33.5	7.0	**19.3**

Source: UNCTADstat

Table 7.3.2.
Productive Capacities Index (Overall), 2021, 2022, 2023 and 2024
(PCI 25 released on UNCTADStat on 31 October 2025)

Rank	Economy	2021	2022	2023	2024
1	Denmark	71.0	71.0	70.9	70.9
2	United States	71.1	70.5	70.5	70.6
3	Australia	69.8	69.7	69.9	69.9
4	Netherlands	70.6	69.8	70.0	69.8
5	United Kingdom	68.4	68.4	68.0	67.9
6	Canada	67.9	67.6	67.4	67.6
7	New Zealand	67.7	67.6	67.4	67.6
8	Germany	67.7	67.7	67.4	67.4
9	United Arab Emirates	65.5	66.0	66.4	66.9
10	Belgium	66.7	66.9	66.7	66.8
11	South Korea	64.8	65.3	65.7	65.8
12	Sweden	66.3	66.0	65.7	65.7
13	Luxembourg	65.5	65.1	65.7	65.5
14	Norway	66.8	64.8	65.1	64.9
15	France	64.9	64.9	64.6	64.6
16	Qatar	64.7	64.2	64.4	64.5
17	Austria	64.9	64.6	64.4	64.4
18	Ireland	64.2	63.9	64.5	64.3
19	Finland	64.2	64.6	64.1	64.1
20	Iceland	64.9	64.8	64.0	63.9
21	Switzerland	63.5	63.5	63.5	63.5
22	Israel	63.5	64.3	63.0	63.2
23	Hong Kong SAR China	62.2	63.0	62.9	63.1
24	Bahrain	62.0	63.1	62.9	63.0
25	China	60.8	61.6	62.1	62.5
26	Singapore	61.1	62.2	62.0	62.3
27	Portugal	62.0	61.8	62.0	62.0
28	Estonia	59.1	61.8	61.6	61.7
29	Czechia	61.1	61.5	61.7	61.7
30	Japan	60.5	61.4	61.3	61.4
31	Curaçao	58.0	59.2	58.1	61.3
32	Spain	61.6	61.3	60.9	60.9

Rank	Economy	2021	2022	2023	2024
33	Andorra	60.5	59.9	60.5	60.9
34	Malta	60.6	61.3	60.0	60.3
35	Poland	59.1	59.7	59.8	60.2
36	Saudi Arabia	56.9	58.3	59.4	59.2
37	Chile	58.8	58.9	59.0	59.0
38	Hungary	61.0	58.8	57.7	58.6
39	Latvia	58.2	58.5	58.0	58.3
40	Italy	57.3	58.7	58.4	58.2
41	Lithuania	56.0	57.3	57.6	57.8
42	Brunei	56.7	56.7	57.5	57.5
43	Slovenia	55.9	57.2	57.2	57.2
44	Kuwait	55.5	56.7	57.8	57.0
45	Turkey	57.3	56.5	56.5	57.0
46	Oman	56.3	56.7	57.4	57.0
47	San Marino	58.5	58.1	56.3	57.0
48	Malaysia	55.6	56.5	56.2	56.5
49	Thailand	55.0	56.2	56.2	56.2
50	Cyprus	54.9	55.7	56.1	55.9
51	Greece	55.5	56.0	55.9	55.6
52	Barbados	55.6	55.6	55.5	55.6
53	Uruguay	55.0	55.5	55.1	55.3
54	Aruba	55.6	55.6	55.6	55.1
55	Croatia	54.4	55.1	55.1	55.1
56	Mauritius	53.9	54.3	54.5	55.0
57	Serbia	54.6	54.6	54.7	54.6
58	Bulgaria	51.5	54.1	54.5	54.5
59	Macao SAR China	54.8	55.2	53.9	54.3
60	Slovakia	53.0	54.1	53.7	53.7
61	Romania	53.8	54.0	53.6	53.7
62	Panama	53.1	52.9	52.9	53.2
63	Antigua & Barbuda	52.8	53.0	53.8	53.2
64	Trinidad & Tobago	52.2	51.6	52.8	52.8
65	Tuvalu	52.3	52.7	52.7	52.7
66	Montenegro	48.8	51.7	52.8	52.3

Rank	Economy	2021	2022	2023	2024
67	Costa Rica	51.4	51.6	51.8	52.1
68	Seychelles	51.8	51.9	52.1	52.0
69	Dominica	51.0	52.0	52.4	51.9
70	South Africa	51.4	52.2	51.7	51.7
71	Vietnam	50.3	51.2	51.2	51.6
72	Cape Verde	49.0	50.6	50.6	51.5
73	Grenada	49.5	49.7	51.4	51.5
74	Georgia	48.9	50.3	51.0	51.3
75	Guam	51.3	51.0	51.1	51.2
76	Maldives	49.9	51.4	51.0	51.1
77	Kazakhstan	49.9	49.3	51.1	51.0
78	Palau	51.3	51.6	51.1	50.9
79	St. Vincent & Gren dines	49.9	50.3	50.1	50.6
80	North Macedonia	48.6	50.1	50.1	49.9
81	Mongolia	46.6	48.7	49.3	49.6
82	Moldova	49.8	48.6	48.8	49.5
83	Brazil	49.1	49.6	49.4	49.5
84	Russia	52.2	49.3	49.4	49.4
85	Armenia	48.5	49.0	49.2	49.2
86	Mexico	49.4	49.2	48.9	49.2
87	Fiji	46.5	47.6	48.3	48.8
88	Belarus	48.9	48.2	48.8	48.7
89	Bahamas	48.0	48.4	48.7	48.5
90	Argentina	46.7	47.1	48.2	48.2
91	St. Lucia	48.4	48.7	48.7	48.1
92	Marshall Islands	45.3	46.5	47.5	48.1
93	Bermuda	48.0	48.6	48.5	48.1
94	Bhutan	45.4	47.3	47.7	47.7
95	El Salvador	45.8	46.1	47.2	47.5
96	Colombia	48.5	47.7	47.1	47.5
97	Ukraine	48.3	46.4	47.0	47.4
98	Tonga	48.3	47.0	47.4	47.3
99	Tunisia	46.7	47.2	46.8	47.2
100	Belize	47.2	46.2	47.7	47.2

Rank	Economy	2021	2022	2023	2024
101	Morocco	45.7	46.7	47.1	47.1
102	Bosnia & Herzegovina	44.9	46.3	47.0	47.0
103	Jamaica	45.3	46.7	46.6	46.9
104	Indonesia	44.8	45.8	46.5	46.8
105	Dominican Republic	44.6	45.7	46.2	46.5
106	Suriname	45.4	46.3	46.8	46.5
107	India	44.1	45.7	46.0	46.4
108	Peru	46.2	46.3	46.3	46.2
109	Cayman Islands	46.3	46.3	46.4	46.2
110	Philippines	42.4	44.7	45.5	45.8
111	Samoa	43.1	44.9	45.3	45.5
112	Azerbaijan	46.2	44.7	45.5	45.3
113	Ecuador	44.3	45.5	45.0	45.2
114	Albania	44.1	43.9	45.5	45.2
115	Iran	45.8	44.7	45.1	45.1
116	Botswana	43.9	44.9	44.9	45.0
117	Palestinian Territories	44.5	45.0	44.3	44.6
118	Paraguay	42.7	44.2	44.1	44.1
119	Guyana	39.9	42.0	43.3	43.9
120	Jordan	43.3	43.7	43.8	43.8
121	Lebanon	44.2	44.2	43.9	43.8
122	Namibia	41.0	43.3	43.6	43.4
123	Uzbekistan	42.2	42.8	43.2	43.4
124	Bolivia	43.1	43.3	43.3	43.4
125	Algeria	40.6	41.9	42.7	43.0
126	Turkmenistan	41.1	42.3	42.6	42.5
127	Kiribati	39.9	41.2	40.8	42.3
128	Sri Lanka	42.8	42.4	42.2	42.3
129	Egypt	41.5	42.4	42.2	42.2
130	Cuba	40.4	41.5	42.0	42.1
131	Timor-Leste	40.2	40.5	42.1	41.7
132	Vanuatu	42.8	42.7	40.6	41.7
133	Nepal	38.7	39.8	40.4	40.0
134	Bangladesh	39.3	40.1	40.0	39.6

Rank	Economy	2021	2022	2023	2024
135	Cambodia	35.2	38.1	38.8	39.6
136	Kyrgyzstan	37.1	39.2	39.2	39.4
137	Eswatini	37.4	38.5	39.2	39.3
138	Lesotho	37.3	38.8	39.1	39.0
139	Libya	38.4	37.9	38.8	38.9
140	Guatemala	36.8	38.3	38.7	38.7
141	Senegal	36.4	37.2	38.3	38.6
142	São Tomé and Príncipe	39.8	40.9	38.8	38.4
143	Nicaragua	38.0	38.1	38.4	38.4
144	Solomon Islands	36.2	37.9	38.0	38.1
145	Djibouti	39.3	38.4	38.8	37.9
146	Laos	36.7	37.5	37.6	37.8
147	Honduras	36.4	37.3	37.5	37.4
148	Côte d'Ivoire	33.8	36.0	37.0	37.2
149	Kenya	36.5	36.8	36.9	36.9
150	Rwanda	34.9	35.3	36.7	36.3
151	Tajikistan	32.1	33.8	35.3	35.5
152	Gabon	34.3	34.8	34.9	35.0
153	Comoros	34.1	34.3	34.6	35.0
154	Ghana	34.9	34.9	34.2	34.9
155	Zambia	32.1	32.5	33.3	33.5
156	Mauritania	33.2	33.6	33.4	33.2
157	Gambia	32.5	32.6	33.0	33.2
158	Togo	32.4	33.5	33.0	33.2
159	Pakistan	32.3	33.0	32.8	33.1
160	Iraq	31.9	32.9	32.8	32.9
161	Benin	29.2	30.7	31.6	31.8
162	Myanmar	31.0	31.4	31.8	31.6
163	South Sudan	19.1	19.0	18.8	31.5
164	Venezuela	29.1	31.2	31.2	31.5
165	Papua New Guinea	31.1	31.0	31.3	31.3
166	Equatorial Guinea	30.2	31.2	31.4	31.3
167	Tanzania	29.3	30.0	30.6	30.9
168	Nigeria	29.6	30.2	30.7	30.7

Rank	Economy	2021	2022	2023	2024
169	Congo - Brazzaville	29.1	30.0	30.3	30.3
170	Syria	29.6	28.9	29.0	29.4
171	Uganda	26.9	28.5	29.1	29.4
172	Liberia	28.3	28.4	28.6	29.2
173	Cameroon	27.5	28.4	28.9	28.9
174	Angola	26.2	27.2	27.9	27.7
175	Ethiopia	29.0	28.0	28.1	27.7
176	Mozambique	26.7	28.5	27.3	27.6
177	Guinea	27.0	27.4	27.3	27.6
178	Zimbabwe	25.1	26.8	27.4	27.2
179	Afghanistan	24.8	25.7	25.8	26.9
180	Guinea-Bissau	25.2	26.2	26.3	26.7
181	Burkina Faso	23.1	25.3	25.8	26.0
182	Haiti	25.1	25.6	25.4	25.8
183	Mali	25.2	25.6	25.5	25.7
184	Burundi	25.1	25.8	25.9	25.6
185	Madagascar	22.9	25.3	25.3	25.5
186	Malawi	24.8	25.4	25.6	25.5
187	Eritrea	24.6	24.4	24.5	24.9
188	Sierra Leone	24.0	24.4	24.5	24.7
189	Sudan	25.7	25.3	23.5	23.8
190	Congo - Kinshasa	19.8	20.5	22.7	22.6
191	Yemen	20.9	21.8	22.8	22.3
192	Chad	20.3	19.9	20.7	21.3
193	Central African Republic	20.2	20.7	20.9	21.2
194	Niger	19.6	20.0	19.7	19.8
195	Somalia	17.0	17.8	18.6	19.3

Source: UNCTADstat

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