



UNCTAD PRODUCTIVE CAPACITIES INDEX

Methodological Approach and Results





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The PCI, as part of the overall project, was prepared by a team led by Mussie Delelegn, Chief, Landlocked Developing Countries Section, and consisting of Moritz Meier-Ewert, Economic Affairs Officer, Johanna Silvander, Programme Management Officer, Alberto Munisso, Associate Expert, and Sonia Bouali, Individual Contractor, Landlocked Developing Countries Section. Stefanie Garry, Office of the Director, provided additional support. Patrick Osakwe, Head, Trade and Poverty Branch, provided substantive inputs and feedback. Valuable consultancy services in refining the methodological design and statistical framework were provided by Yohannes Kinfu, Associate Professor, Faculty of Health, University of Canberra. Michael Bratt provided consultancy services and Cédric Houdré was responsible for the initial statistical and methodological foundation. Country case studies were developed by Montle Nicole Phutego (Botswana), Vanxay Sayavong (Lao People’s Democratic Republic) and Leonard Mugisha Mungarulire (Rwanda). Comments and suggestions from UNCTAD colleagues, including Lisa Borgatti, Junior Davis and Rolf Traeger and the Least Developed Countries Report team, are gratefully acknowledged.

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FOREWORD

Measuring and benchmarking productive capacities globally reveals significant gaps, not only between developed and developing economies, but also among developing countries themselves. The new Productive Capacities Index (PCI) of UNCTAD demonstrates that differences in socioeconomic development across countries and regions are a consequence of gaps in their productive capacities. Structurally weak and vulnerable economies, including the least developed countries (LDCs) and landlocked developing countries (LLDCs) perform particularly poorly on PCI.

These persistent development challenges have been further compounded by novel external shocks and instability, including the coronavirus disease (COVID-19) pandemic, climate change effects, a collapse in global commodity prices and waning trust in multilateralism.

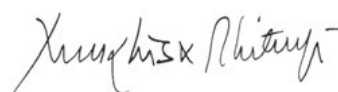
Building the economic resiliency of developing countries remains a daunting challenge. It depends fundamentally on creating, maintaining and using productive capacities to advance development. This will require a shift from the current fragmented and project-based interventions towards coherent, economy-wide and programme-based approaches to removing binding constraints on development. Actions and interventions at the domestic level need to be supported and complemented by additional robust international support.

PCI makes an important contribution to these efforts. The index draws on decades of extensive research and policy analysis work, as well as lessons learned from our technical support to the most vulnerable countries in developing key aspects of their trade and productive structures. The index is the first comprehensive attempt to measure productive capacities in all economies and construct a multidimensional index that can provide country-specific insights and diagnostics of productive capacity development. PCI also offers country and region-specific scores to help in understanding

the sources of systemic vulnerabilities and identifying the enablers of economic growth, including progress towards national and global development targets.

This publication has been designed as a user-friendly and step-by-step guide to PCI. It walks the user through the methodological foundations of the index, aligned with the mandates given by the international community in the Programme of Action for the Least Developed Countries for the Decade 2011–2020 (Istanbul Programme of Action), the Vienna Programme of Action for Landlocked Developing Countries for the Decade 2014–2024 and the Nairobi Azimio and Nairobi Maafikiano, among others. It also provides a detailed overview of the index, its requisite categories and, importantly, the insights drawn from its results.

As part of its development, UNCTAD put the index through an extensive peer review process, including academic, statistical and technical reviews by experts. Member States tested and validated the index through a series of national workshops, policy-oriented discussions and technical exchanges with national staff. It is our belief that PCI can serve as an indispensable tool, to guide policy interventions and realign incentive structures to revive socioeconomic progress in a post-pandemic policy environment. Governments in all developing countries and their development partners are encouraged to closely examine and use the index for their specific needs. We believe it is both a powerful analytical and advocacy tool for putting productive capacity at the centre of international efforts to leave no one behind.



Mukhisa Kituyi
Secretary-General of UNCTAD

INTRODUCTION

This summary of PCI is intended to provide policymakers, practitioners and experts, as well as researchers and academics, with a simplified version or snapshot of some interpretations of the values and trends with regard to the index. The objective is to assist in the appreciation and application of PCI by a diverse audience. The summary also aims to guide policymakers in their day-to-day work, including in the formulation and implementation of country-specific development policies and strategies.

Fostering productive capacities and structural transformation has been intensely debated at major international conferences, such as the Fourth United Nations Conference on LDCs held in Istanbul, Turkey, in 2011, the Second United Nations Conference on Landlocked Developing Countries held in Vienna in 2014 and the fourteenth session of the United Nations Conference on Trade and Development (UNCTAD XIV) held in Nairobi in 2016. Ministerial declarations, as well as the Istanbul Programme of Action, the Vienna Programme of Action and the Nairobi Azimio and Nairobi Maafikiano, have all underlined that developing productive capacities is key for sustainable development in LDCs and LLDCs.

Following the mandate given by the United Nations Economic and Social Council (E/RES/2017/29) and in accordance with paragraph 76 (k) of the Nairobi Maafikiano, UNCTAD has finalized the development of PCI. This also responds to the request of the Economic and Social Council to share the outcome of its work on productive capacities as “an input to the impact assessments of the Department of Economic and Social Affairs of the Secretariat and the monitoring reports of the Committee on countries graduating or graduated from the least developed country category”. As such, analysis of productive capacities, leveraging PCI and its composite indicators, will now be included as part of the assessment by the Committee for Development Policy of LDCs that meet the criteria for graduation. PCI will be incorporated into the new generation of General Assembly-mandated vulnerability profiles for graduating LDCs and into considerations of the possible impacts of graduation.

Background and methodology

This is the first comprehensive attempt to measure productive capacities in all economies and construct a multidimensional and country-specific PCI. The index helps to compare national or regional performances and progress made over a given time period. In particular, it assists in

the identification of economy-wide gaps, limitations and areas for policy intervention.

While there is consensus on the need to foster productive capacities for sustained economic growth and sustainable development, there is no universally accepted definition of the concept itself. PCI builds on the conceptual and analytical foundations of UNCTAD to measure the levels of productive capacities across the three pillars: “the productive resources, entrepreneurial capabilities and production linkages which together determine the capacity of a country to produce goods and services and enable it to grow and develop” (UNCTAD, 2006).

The PCI results presented cover 193 economies in the period 2000–2018. The set of productive capacities and their specific combinations are mapped across 46 indicators, selected from international sources to ensure comparability across all 193 economies. Internationally collected and/or validated data ensure the use of standard concepts, classifications and target populations, to promote coherence, as does the use of a common methodology across surveys and aggregation methods.

Combined, the indicators provide a quantitative measure of the productive resources, entrepreneurial capabilities and production linkages of a given economy. For operational, statistical

and measurement purposes, the three pillars of productive capacities are further broken down into the following eight categories: information and communication technologies (ICTs), structural change, natural capital, human capital, energy, transport, the private sector and institutions.

Overall, the index summarises the state of productive capacities in economies worldwide by computing scores that range between 0 and 100 (boundaries not included). Intergroup and intragroup comparisons are based on the latest actual data available up to 2016, whereas figures indicating the evolution of the PCI scores cover the period 2017–2018, thanks to estimates obtained through solid time series models.

As with any composite index and all statistical indicators, there are limitations to PCI. Above all, the PCI scores are ultimately a reflection of the accuracy and availability of the data used. The available data are severely limited for certain indicators and for some countries. The results are also dependent on the methodology used and the assumptions made. PCI is not meant to be a perfect and the only definitive assessment of productive capacities in economies worldwide and should not be taken as such. Rather, its value lies in its aptness, methodological rigour and robustness, as a pointer that enables national decision makers to gain a sense of the current state of productive capacities.

Objectives

The overall objective in developing PCI was to support the formulation and implementation of holistic, coherent and evidence-based policymaking in developing countries. The index is designed with the aim of improving the quality of trade and development policies by placing the fostering of productive capacities and structural transformation at the centre. In particular, it assists in the identification of economy-wide gaps and limitations that hinder efforts to foster productive capacities and structural transformation. Such structural limitations increase socioeconomic vulnerabilities to external shocks and undermine the ability of countries to rapidly respond to emergencies such as the COVID-19 pandemic.

Therefore, the index is a valuable tool in identifying key binding constraints on economic development and in realigning policy actions and interventions, as well as incentives, to address such constraints. PCI also serves as a consistent and comprehensive tool in tracking progress towards national and global development targets and goals, including the Sustainable Development Goals.

Findings and main results

The results are expected, insofar as developed countries frequently achieve higher scores and developing

countries comparatively lower scores. Within the developing country group, the weakest performers are LDCs and LLDCs. The results suggest that it is primarily the productive capacities related to structural change, human capital, energy, institutions and ICTs that underlie the differences in scores across groups. Addressing these gaps and underlying challenges can help in resilience-building in weaker economies, to address persistent development challenges such as widespread poverty and to quickly and effectively respond to emergencies such as the COVID-19 pandemic.

It is important to note that, with regard to PCI values and ranking, small island developing States appear to perform better than other developing countries. However, this performance must be interpreted with caution and understood in the context of their unique geographical and structural characteristics. Due to their demographic features (small population) and smaller size and/or surface area, small island developing States perform better statistically when measured using indicators that utilize population or geographical ratios as units of measurement. An additional substantive reason for the better-than-expected PCI performance of small island developing States compared with other developing countries is the relative shift of their economic activities towards the services sector, in particular financial

intermediation and tourism and other intangible services.

While there is growing recognition of the critical importance of productive capacities in the development process, there is no simple, uniform and universal blueprint that enables developing countries to address their persistent and emerging development challenges. This means that each country needs to design homegrown and indigenous development policies and strategies based on country-specific socioeconomic circumstances, resource bases, institutional capabilities and overall local conditions. There is a need for country-specific policies and strategies and the fostering of productive capacities is a critical prerequisite for achieving structural transformation, inclusive economic growth and sustainable development. It is also essential for building socioeconomic resilience, to withstand the negative consequences of external shocks, whether economic, political or otherwise.

One important use of PCI and the country-specific scores lies in the understanding of the sources of systemic vulnerabilities and the identification of the enablers of economic growth, including progress towards sustainable development in countries. For example, most developing countries, in particular LDCs, LLDCs and other weaker and vulnerable economies, have a low level

of performance on the human capital, energy, structural change and ICT categories of PCI.

Vulnerabilities to external shocks, which are inherent in weaker economies and their persistent development challenges, require a new generation of trade and development policies and strategies that places the fostering of productive capacities and structural transformation at its centre. A prerequisite in such a process is to determine the current levels of productive capacities in individual economies or countries.

The way forward

Building productive capacities is a key strategy to accelerate structural transformation, promote inclusive economic growth and achieve sustainable development. Only by advancing productive resources, entrepreneurial capabilities and production linkages can economies enhance the ability to grow and develop and reduce their vulnerability to external shocks, whether economic, political or health related. The COVID-19 pandemic reveals not only systemic interconnectedness and interdependence among countries, but also socioeconomic fragility and inequality within and between countries.

Measuring and benchmarking productive capacity indicators by using a multidimensional PCI is,

therefore, indispensable, because it provides national policymakers, development partners and other stakeholders, including private sector actors, with the knowledge of how much productive capacities have been developed. It also draws attention to the strengths and weaknesses of past policies, processes and actions, which – in combination with the state of a country's productive capacities – can suggest a road map for future policy actions and interventions, as well as effective responses to emerging crises. Furthermore, in addition to monitoring or measuring country-level performance, PCI can help in forecasting a country's future economic trajectory, for example, the level of productive capacity needed for a given economy, based on current performance, to generate a higher level of gross domestic product (GDP) growth in the future, assuming that a certain level of growth in PCI scores is maintained.

PCI also provides further insights into cross-country comparisons and analyses, which can facilitate the sharing of experiences, and best and worst practices in fostering productive capacities and structural transformation. This is particularly important for policymakers and development experts in understanding that variations in socioeconomic performances across countries and regions are largely driven by the differences in productive capacity levels between the leading and

worst-performing economies. This can clearly be discerned from the high PCI performance level of developing countries in East Asia, which can provide an important lesson for other developing countries, including LDCs and LLDCs, in fostering productive capacities and structural transformation as a foundation for sustainable and inclusive growth and development.

For these important reasons, composite indices are valuable tools in monitoring progress towards the targets of the 2030 Agenda for Sustainable Development and implementation of domestic policies and strategies. PCI serves as an important policy tool in building socioeconomic resilience to unexpected shocks and enabling policymakers, development partners and other stakeholders to forecast expected scenarios of future performance or policy outcomes. Therefore, PCI is consistent with and complementary to the Sustainable Development Goals and indicators. It is vital in providing a coherent statistical tool to measure the outcomes of policy interventions at the national and international levels.

Policymakers are encouraged to use PCI to identify and evaluate the strengths and weaknesses of the productive capacities in their economies and to formulate policies and strategies for the effective building of productive capacities. In operationalizing strategies to address

the structural vulnerabilities revealed by PCI, development partners and other national stakeholders, such as private sector and civil society actors, can also contribute to national efforts to address the gaps and limitations in a country’s productive structure.

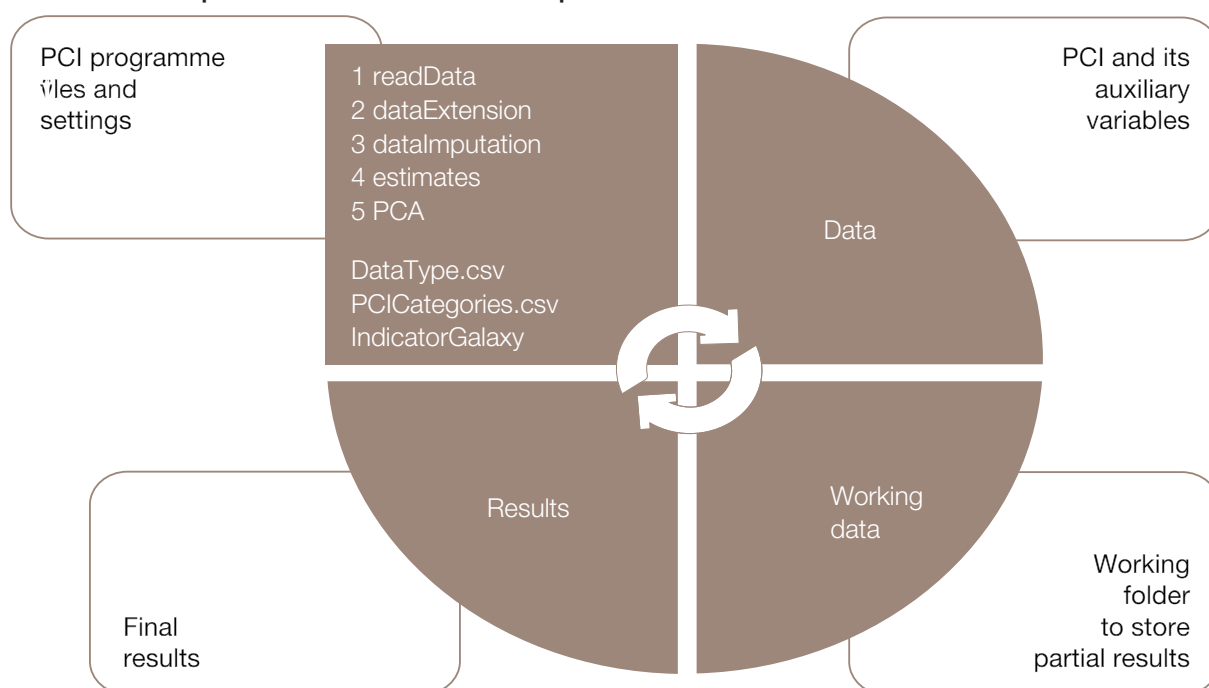
In addition to developing a composite PCI, UNCTAD has also developed a holistic and practical manual on building and utilizing productive capacities in Africa and LDCs. Building on the work of UNCTAD, including PCI, and drawing on cross-country evidence, the operational manual provides a comprehensive framework for building productive capacities and developing socioeconomic resilience to shocks, particularly in countries in

Africa and other structurally weak and vulnerable economies.

METHODOLOGY

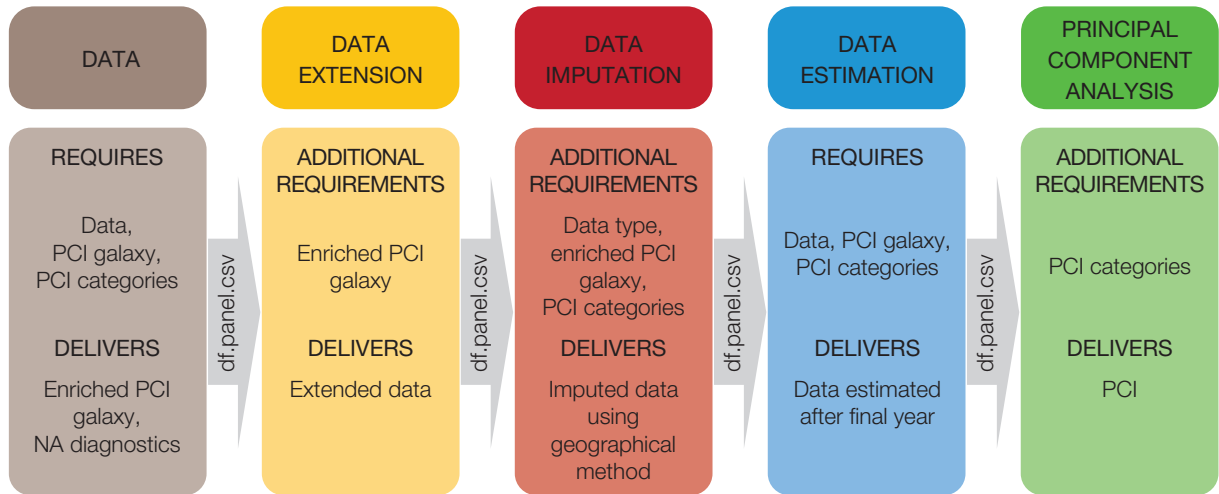
This section provides a step-by-step guide on how to compute PCI. It can also be used in future to maintain and update PCI scores, as new input data and approaches become available. The programme to compute PCI is developed using R, statistical software that is widely used for data management, synthesis and statistical inference. This software was selected as it is free to download and flexible, as per user needs. PCI is coded to be run sequentially and delivers results as shown in figures 1 and 2 (see appendix I for further technical specifications).

Figure 1
Productive Capacities Index: Results sequence



Source: UNCTAD.

Figure 2
Productive Capacities Index: Results sequence and data



Source: UNCTAD.
R package requirements: dplyr, tidyr, foreign, reshape, psych, lavaan, forecast, data.table.

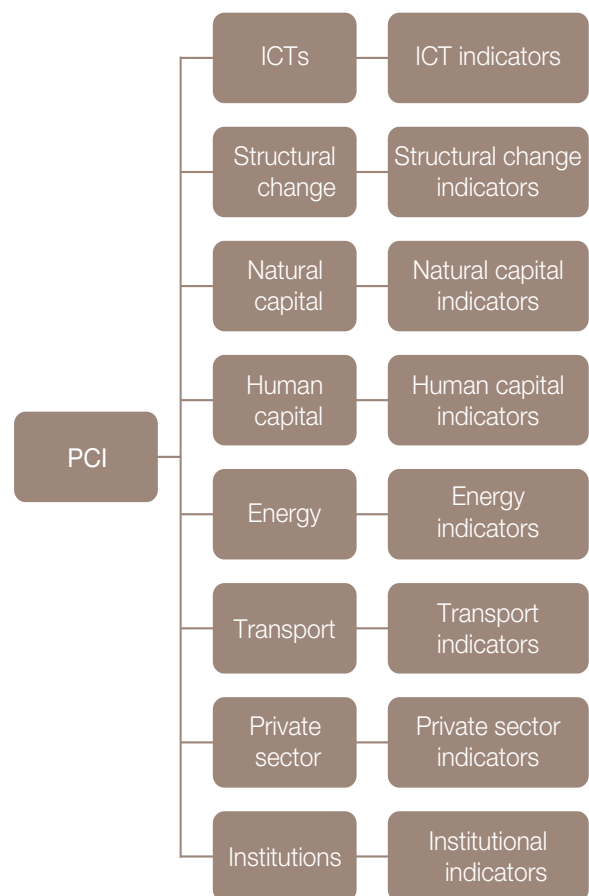
DATA

The construction of PCI is based on an original set of 46 indicators extracted from various sources (see appendix II). In all, the analysis includes 193 economies. The sensitivity analysis of the procedures used for the data imputation and alignment is described in appendix III.

Steps for constructing the index

PCI is calculated as a geometric average of eight domains or categories, namely, ICTs, structural change, natural capital, human capital, energy, transport, the private sector and institutions (see figure 3). The categories are selected on the basis of their relevance to conceptual and analytical frameworks for building productive capacities.

Figure 3
Productive Capacities Index: Distribution of domains and indicators



Source: UNCTAD.

Algebraically, PCI can be written as follows:

$$PCI = \sqrt[N]{\prod_{i=1}^N X_i^{PCA}}$$

Where N is the total number of categories and X_i^{PCA} is the weighted category score extracted using the principal component analysis (PCA) of category i .

PCI scores range between 0 and 100 and are computed following the six steps detailed in this section.

1. Imputation of missing data

Given the breadth and depth of the analysis, it is not possible to obtain data for each economy, for each calendar year or for each indicator. Therefore, the imputation of data for missing values is an unavoidable exercise. To impute missing values in the PCI analysis, a twofold approach is pursued. First, data is extended for missing years and second, data is extended in instances where no data are available. In the first step, the missing data is inferred by way of simple interpolation. That is, if there is data for a country for 2007 and 2010, but no data available for 2008 and 2009, then the existing data are used to fill in the missing data. In the second step, for every economy that has an unobserved value for a given variable, the five closest neighbouring economies with observed values are identified. Then, these values are weighted by the logarithm of GDP per

capita to impute the missing values for the economy in question. In formal terms, this may be expressed as follows:

$$x_i^{NA} = \log(GDP\ capita_i) * \left(\frac{1}{5} \sum_{j=1}^5 \frac{x_j}{\log(GDP\ capita_j)} \right)$$

Where x_j represents neighbouring countries' available values and x_i^{NA} represents the country's missing value.

2. Forecasting

This optional step involves an automatic forecasting system that generates new observations for each indicator. New observations are generated by: (a) an autoregressive moving average, where AR(p) and MA(q) are selected using the Bayesian information criterion; and (b) a local linear forecast using smoothing splines (Hyndman, King, Pitrun and Billah, 2005).

For PCI, the two forecast methods are highly correlated, and the correlation coefficient of the estimated values is:

$$\rho(PCI_{splines}, PCI_{ARMA}) = 0.99$$

With regard to forecasting error, the two methods show a high correlation with the real PCI, but Arma achieves a slightly lower mean squared error than the local linear forecast based on smoothing splines, as follows:

$$\begin{cases} MSE(splines) = E [\sum(x_{i,splines} - \hat{x})^2] = 0.004 \\ MSE(ARMA) = E [\sum(x_{i,ARMA} - \hat{x})^2] = 0.002 \end{cases}$$

3. Multivariate analysis

In this step, PCA is applied to reduce the dimensions of the data by extracting a group of factors that best represent the original data. The resulting factor weights are then used in the weighting of the individual indicators to construct the PCI categories. In this context, PCA is used to cluster individual indicators and capture the information common to individual indicators, in a latent factor. In the PCI framework, weights are applied to the indicators only to capture their common information. Furthermore, such weights only measure the explanatory capability of each indicator in terms of the overall variance in the data. They do not imply any form of ranking of their theoretical importance.

The first step in the application of PCA is to check the correlation structure of the data, thereby explaining the variance of the observed data through a few linear combinations of the original data. In this context, correlated principal components indicate that they are measuring the same domain, while a lack of correlation indicates that the indicators refer to different latent structures.

Then, a certain number of latent factors are identified to represent the data. In this context, each of the selected factors fulfils both of the following binding constraints:

- (a) The factor's eigenvalue is greater than one;
- (b) The factor explains at least 10 per cent of the total variance.

Finally, the PCI category scores are built on the F_i scores of the rotated factors, weighted by their respective shares of the total explained volatility. The scores are standardized using the following formula (see appendix IV for an example of the computation for the PCI structural change category):

$$X_i^{PCA} = \frac{F_{i,o} - F_{i,min}}{F_{i,max} - F_{i,min}}$$

4. Computation of the index

To obtain the overall PCI score, the individual scores for each of the eight categories need to be aggregated by using the geometric mean instead of the arithmetic mean. This is because the geometric mean reduces the level of substitutability between dimensions and is less sensitive to outliers, thereby reducing the effect of skewed PCI categories. This choice is justified by the theoretical framework underlying productive capacities, in which a balanced mix of inputs is necessary to foster economic development.

$$PCI = \sqrt[N]{\prod_{i=1}^N X_i^{PCA}}$$

Where X_i^{PCA} are PCI category scores extracted using PCA.

Finally, Cronbach's alpha is used to estimate the significance and internal consistency of each category at the normalized indicator level (see appendix V). Cross-category correlations are shown in appendix VI.

RESULTS

Table 1
Productive Capacities Index data for 2016

Rank	Economy	Energy	Human capital	ICTs	Institutions	Natural capital	Private sector	Structural change	Transport	PCI
181	Afghanistan	25.60	36.09	4.96	19.55	57.97	42.31	15.35	14.64	21.71
102	Albania	25.31	52.56	11.31	54.35	50.43	81.88	16.99	15.58	31.18
125	Algeria	29.05	51.44	9.93	35.45	53.62	77.84	16.23	14.69	29.16
25	Andorra	29.26	54.43	16.56	63.05	52.72	87.14	40.08	28.16	41.40
177	Angola	22.62	33.86	5.03	31.91	51.88	65.67	12.49	10.61	22.03
81	Argentina	29.86	55.37	15.56	54.06	55.34	73.63	21.45	11.65	33.03
95	Armenia	28.20	47.70	12.60	48.70	57.06	78.62	19.76	14.62	31.89
21	Australia	36.12	70.16	22.74	90.50	58.15	88.91	21.81	15.72	41.76
15	Austria	33.52	79.11	24.68	87.14	44.54	85.25	29.26	20.28	43.51
116	Azerbaijan	29.92	46.66	14.55	39.22	58.94	71.98	15.21	13.47	30.20
49	Bahamas	24.23	51.14	17.11	70.65	38.77	80.80	17.97	35.78	36.30
39	Bahrain	39.27	51.47	18.85	52.42	50.15	84.34	20.30	27.52	38.39
137	Bangladesh	24.87	43.77	6.29	37.72	58.07	72.72	16.34	13.56	26.48
40	Barbados	25.02	52.99	21.07	76.39	49.52	80.37	21.42	23.77	37.97
68	Belarus	31.64	51.64	20.24	40.73	48.17	78.08	22.16	15.66	33.93
12	Belgium	35.14	79.53	23.18	83.84	50.12	84.14	29.89	23.13	44.67
74	Belize	24.34	46.41	9.13	48.61	40.10	78.02	17.94	56.34	33.50
162	Benin	17.12	37.25	5.57	48.28	51.47	76.87	15.09	9.38	23.59
121	Bhutan	21.91	46.04	8.24	63.98	41.93	73.46	16.22	21.76	29.53
131	Bolivia (Plurinational State of)	27.90	47.13	8.44	41.05	52.64	77.51	17.76	13.34	28.54
87	Bosnia and Herzegovina	28.02	53.73	13.70	47.93	49.99	80.34	21.77	14.75	32.59
117	Botswana	26.43	44.14	9.97	70.09	57.98	68.05	14.41	14.93	30.20
99	Brazil	26.81	56.87	13.34	51.74	45.06	75.92	23.29	11.27	31.40
61	Brunei Darussalam	37.09	50.51	13.67	67.62	38.48	82.30	16.81	23.04	34.74
59	Bulgaria	30.09	58.41	15.47	59.68	52.11	80.22	24.70	13.41	34.99
185	Burkina Faso	14.81	31.42	5.57	46.13	61.26	66.92	9.31	8.46	21.06
188	Burundi	14.79	35.89	4.20	23.96	67.55	65.63	10.51	12.72	20.54

Table 1
Productive Capacities Index data for 2016

Rank	Economy	Energy	Human capital	ICTs	Institutions	Natural capital	Private sector	Structural change	Transport	PCI
107	Cabo Verde	23.74	45.56	10.25	65.72	46.98	82.03	18.05	15.75	30.74
144	Cambodia	19.43	43.03	7.43	37.71	46.48	80.12	14.66	16.15	25.96
168	Cameroon	21.55	36.56	6.29	33.77	47.14	74.57	15.83	9.45	23.34
16	Canada	37.60	72.24	23.55	93.10	42.69	81.47	25.23	23.87	43.35
192	Central African Republic	16.66	27.34	3.59	20.46	56.13	53.24	11.56	14.13	18.91
193	Chad	12.88	28.55	4.11	24.49	59.57	39.74	5.08	13.58	16.70
51	Chile	30.77	56.02	14.45	78.57	54.79	86.59	20.87	15.44	36.27
35	China	30.89	59.85	13.25	46.23	55.58	86.21	34.11	29.51	39.10
10	Hong Kong SAR	33.97	65.12	27.52	87.56	41.94	94.93	24.32	31.65	44.84
34	Macao SAR	28.40	49.19	23.75	77.81	47.01	84.45	17.38	32.01	39.31
93	Colombia	29.29	52.76	12.34	51.32	49.02	74.86	19.95	15.34	32.00
157	Comoros	22.33	39.66	4.79	37.25	57.56	76.37	10.47	17.34	24.41
180	Congo	15.46	36.96	5.92	31.43	48.34	55.70	15.52	11.72	21.86
58	Costa Rica	28.06	56.66	14.10	69.22	44.64	81.36	19.80	20.55	35.08
160	Côte d'Ivoire	21.16	33.31	7.50	42.27	54.81	75.77	13.70	8.74	24.03
50	Croatia	28.88	58.67	17.63	65.04	46.04	81.65	24.70	16.63	36.28
115	Cuba	27.43	55.14	7.06	44.37	52.47	74.27	19.81	18.96	30.21
33	Cyprus	32.14	57.07	21.50	74.93	46.02	91.42	23.04	20.29	39.41
28	Czechia	33.28	67.52	19.67	76.52	51.27	80.95	26.41	19.91	40.60
190	Democratic Republic of the Congo	14.29	31.32	4.04	28.49	52.98	61.14	14.01	9.28	19.59
7	Denmark	32.87	86.46	25.52	93.09	54.56	91.96	26.07	23.32	46.16
135	Djibouti	22.61	40.54	5.17	35.40	59.88	78.50	19.19	19.17	27.09
71	Dominica	24.26	47.29	14.91	68.24	43.18	81.18	16.05	24.85	33.62
92	Dominican Republic	29.47	46.21	10.61	51.35	49.05	82.17	20.09	18.96	32.14
106	Ecuador	28.94	53.11	11.03	42.89	44.59	76.59	17.65	18.35	30.77
126	Egypt	29.46	46.55	9.25	35.81	50.82	80.90	20.29	13.71	29.14
91	El Salvador	27.36	47.45	10.21	50.13	58.02	81.98	21.08	17.78	32.30

Table 1
Productive Capacities Index data for 2016

Rank	Economy	Energy	Human capital	ICTs	Institutions	Natural capital	Private sector	Structural change	Transport	PCI
170	Equatorial Guinea	21.87	34.48	5.90	23.97	44.23	70.07	16.12	15.99	23.24
184	Eritrea	19.59	30.01	3.11	19.15	67.83	65.53	17.47	17.06	21.54
136	Eswatini	21.27	40.70	6.67	41.05	56.48	73.82	19.69	14.62	27.02
31	Estonia	31.96	63.44	22.29	82.40	43.46	87.17	24.21	19.27	40.02
174	Ethiopia	16.23	36.78	5.04	34.72	61.59	67.17	12.56	13.46	22.80
98	Fiji	27.45	48.80	9.09	54.67	43.16	83.49	19.45	20.42	31.43
24	Finland	35.33	81.53	21.88	94.94	36.52	87.83	24.41	18.47	41.41
14	France	34.78	66.04	20.37	94.25	52.78	84.88	28.68	25.97	44.26
146	Gabon	24.02	39.82	9.22	40.05	39.67	71.44	14.75	12.69	25.65
158	Gambia	17.87	34.57	7.33	37.50	52.49	79.72	14.21	11.71	24.21
78	Georgia	29.01	53.21	13.30	64.97	47.29	84.30	20.14	13.87	33.23
4	Germany	34.50	77.79	26.73	89.86	49.45	85.64	35.62	24.62	47.03
143	Ghana	22.93	37.92	8.20	54.50	58.93	75.92	13.81	8.73	26.01
43	Greece	31.02	66.35	19.82	58.97	52.73	80.64	22.86	17.45	37.70
63	Grenada	23.69	51.74	14.27	65.68	42.56	81.19	19.63	24.11	34.22
124	Guatemala	24.67	42.41	9.02	42.02	49.25	75.79	20.06	17.86	29.21
169	Guinea	15.51	33.33	5.32	35.01	72.41	76.01	14.59	11.22	23.30
109	Guyana	26.45	42.80	9.55	50.83	54.24	81.25	15.16	20.95	30.60
176	Haiti	9.85	39.09	4.90	28.12	59.78	74.06	13.27	19.44	22.28
132	Honduras	20.04	44.85	7.60	40.38	47.37	79.65	18.97	18.54	27.89
38	Hungary	30.58	61.14	18.96	65.34	53.07	81.10	24.55	21.24	38.86
5	Iceland	44.71	78.49	31.05	88.66	49.66	84.22	17.91	30.70	46.59
112	India	23.78	45.42	6.96	51.15	55.92	75.70	25.95	17.14	30.37
122	Indonesia	27.61	44.02	8.45	51.02	50.09	81.46	22.15	11.92	29.44
114	Iran (Islamic Republic of)	31.60	51.92	13.91	36.56	58.38	77.78	16.68	11.04	30.23
175	Iraq	22.25	39.85	6.48	22.32	59.25	54.18	13.84	11.87	22.58
9	Ireland	35.02	71.26	20.90	87.23	55.42	83.23	23.15	34.63	45.00
29	Israel	33.65	85.51	19.92	73.73	49.61	83.89	22.55	16.72	40.06

Table 1
Productive Capacities Index data for 2016

Rank	Economy	Energy	Human capital	ICTs	Institutions	Natural capital	Private sector	Structural change	Transport	PCI
53	Italy	28.57	66.65	16.12	60.52	46.27	77.27	23.21	17.05	35.68
90	Jamaica	25.21	47.68	10.96	58.99	49.54	77.79	17.62	22.46	32.30
8	Japan	34.15	79.19	24.24	86.24	37.52	90.17	40.65	22.50	45.22
111	Jordan	29.41	50.53	12.44	53.75	50.56	83.42	21.40	8.47	30.56
110	Kazakhstan	33.58	47.58	15.32	45.32	69.54	53.17	18.09	10.26	30.56
149	Kenya	18.57	40.41	6.28	42.14	56.96	74.42	16.57	11.93	25.27
133	Kiribati	25.59	45.93	4.94	58.50	50.16	80.59	9.28	24.41	27.33
72	Kuwait	38.10	48.02	12.98	50.55	58.40	82.45	16.98	16.43	33.57
134	Kyrgyzstan	24.42	45.48	9.18	37.70	63.69	53.84	17.19	13.17	27.19
138	Lao People's Democratic Republic	22.99	40.15	7.17	39.71	45.99	77.48	20.57	12.51	26.47
44	Latvia	30.00	55.55	17.58	73.38	43.86	84.92	24.31	20.58	37.61
77	Lebanon	30.19	51.56	15.73	37.46	55.48	80.77	22.96	16.27	33.36
128	Lesotho	20.08	38.05	7.08	48.95	85.12	72.53	19.07	15.82	28.95
173	Liberia	14.90	38.70	5.18	37.42	63.81	74.78	13.68	10.41	22.91
153	Libya	19.47	46.98	9.32	13.02	61.20	76.01	16.15	15.81	24.55
42	Lithuania	28.00	59.92	17.47	76.68	49.42	85.08	23.95	18.64	37.86
3	Luxembourg	41.93	66.80	30.32	93.25	49.34	86.36	24.93	30.57	47.45
178	Madagascar	18.82	34.55	4.08	39.11	63.35	76.32	14.93	7.28	21.98
164	Malawi	16.64	40.95	4.28	44.48	58.87	69.30	12.78	13.44	23.43
62	Malaysia	32.49	56.93	13.80	62.66	42.03	89.29	22.01	15.56	34.60
73	Maldives	28.05	55.89	13.45	46.59	50.22	76.74	14.74	28.82	33.56
186	Mali	15.80	30.57	6.35	37.38	61.69	69.47	8.10	9.57	21.02
26	Malta	33.14	61.76	27.28	78.32	51.72	85.44	18.98	21.98	41.05
119	Marshall Islands	27.27	49.98	6.26	51.93	44.61	81.13	14.36	25.99	29.66
172	Mauritania	21.30	35.19	6.01	37.52	69.75	73.92	15.32	5.85	22.99
47	Mauritius	31.15	50.42	15.50	73.93	50.95	87.38	21.13	18.17	36.39
97	Mexico	29.50	50.88	11.96	48.94	51.20	81.22	23.57	12.35	31.87
96	Mongolia	28.51	46.00	8.76	55.90	83.25	69.85	16.11	17.69	31.87

Table 1
Productive Capacities Index data for 2016

Rank	Economy	Energy	Human capital	ICTs	Institutions	Natural capital	Private sector	Structural change	Transport	PCI
79	Montenegro	26.36	53.05	16.36	56.69	40.82	82.65	19.36	16.90	33.07
118	Morocco	27.86	49.90	10.19	49.44	58.00	86.02	19.17	10.18	30.15
163	Mozambique	16.92	33.91	5.39	36.68	55.89	76.57	15.10	12.79	23.52
167	Myanmar	20.94	41.81	6.42	36.29	48.88	77.95	14.76	7.68	23.34
127	Namibia	20.79	43.80	8.32	62.97	56.98	77.71	19.22	12.29	28.99
147	Nepal	17.60	45.41	6.95	39.17	52.34	70.63	15.61	14.83	25.63
2	Netherlands	35.22	75.26	30.03	93.47	53.80	88.38	31.85	26.60	48.37
19	New Zealand	33.10	71.32	23.26	97.14	48.02	91.25	21.40	20.60	42.33
113	Nicaragua	22.68	49.03	8.10	41.75	53.36	79.91	17.93	25.07	30.36
189	Niger	14.84	25.53	4.22	40.29	67.87	58.08	11.10	8.85	19.93
182	Nigeria	20.06	32.64	6.19	31.74	60.30	74.65	10.82	7.87	21.71
84	North Macedonia	26.80	52.24	14.16	52.66	51.98	81.73	19.89	15.73	32.94
22	Norway	30.91	69.36	20.26	91.96	43.81	87.86	27.73	21.44	41.70
67	Oman	36.84	46.01	12.80	60.25	54.53	85.87	18.32	15.75	33.95
152	Pakistan	24.54	35.55	5.64	32.78	56.35	77.44	17.64	11.87	24.89
82	Palau	31.71	42.79	13.68	59.73	32.28	78.97	15.50	32.31	33.03
60	Panama	29.22	48.84	13.38	58.79	42.01	85.31	22.60	23.62	34.79
151	Papua New Guinea	21.60	34.14	4.72	42.50	46.60	75.99	16.57	17.79	25.04
130	Paraguay	27.14	49.52	9.35	45.87	54.64	73.86	17.40	11.64	28.78
100	Peru	28.36	49.38	10.29	53.51	47.53	82.46	20.03	15.47	31.36
120	Philippines	27.58	43.52	9.83	47.56	51.18	80.40	19.62	12.78	29.54
36	Poland	32.03	60.69	18.11	71.86	51.10	81.24	27.89	18.33	39.02
37	Portugal	30.32	68.74	20.03	79.06	47.87	86.37	26.27	14.81	38.96
30	Qatar	47.11	49.32	16.12	66.55	51.27	83.78	19.11	32.35	40.05
11	Republic of Korea	35.42	86.67	29.40	72.50	39.32	91.34	28.58	24.15	44.80
89	Republic of Moldova	26.04	51.54	15.74	45.33	59.92	76.63	19.18	14.75	32.49
65	Romania	29.60	52.28	14.34	51.04	53.87	80.31	23.79	15.70	34.10
76	Russian Federation	33.83	60.25	17.00	38.86	45.75	77.22	21.51	15.43	33.48

Table 1
Productive Capacities Index data for 2016

Rank	Economy	Energy	Human capital	ICTs	Institutions	Natural capital	Private sector	Structural change	Transport	PCI
150	Rwanda	15.34	41.25	5.61	54.52	61.24	69.71	14.21	13.25	25.06
75	Saint Lucia	24.69	50.32	12.40	67.56	44.40	81.80	17.57	23.81	33.49
70	Saint Vincent and the Grenadines	24.46	49.29	13.99	68.38	39.98	83.05	17.72	24.32	33.67
101	Samoa	26.79	46.70	6.80	67.66	39.73	83.42	18.42	26.53	31.35
46	San Marino	26.49	47.19	18.22	62.25	44.15	85.41	24.46	25.11	36.69
140	Sao Tome and Principe	19.34	42.90	6.81	48.67	46.76	75.81	15.25	15.23	26.26
57	Saudi Arabia	37.64	53.16	13.82	51.26	66.21	81.51	17.66	17.03	35.09
142	Senegal	23.48	37.62	6.87	52.30	51.57	78.58	17.80	9.21	26.03
56	Serbia	28.12	60.36	16.26	54.94	52.28	79.77	22.74	16.14	35.13
55	Seychelles	26.81	46.43	15.73	62.14	32.99	79.65	17.74	42.54	35.30
187	Sierra Leone	14.60	38.17	5.75	39.48	63.17	76.19	5.90	10.07	20.88
13	Singapore	36.80	76.63	20.98	91.87	43.26	92.52	23.66	29.40	44.41
45	Slovakia	32.98	60.33	16.84	71.22	46.99	79.76	23.03	17.37	37.08
32	Slovenia	32.83	71.40	20.00	76.37	41.95	80.37	25.80	19.99	39.74
145	Solomon Islands	21.24	39.19	5.23	48.27	44.63	81.05	12.95	20.71	25.92
191	Somalia	16.42	30.02	4.39	7.39	72.99	74.73	13.04	15.36	19.07
69	South Africa	29.27	48.84	10.72	59.35	63.64	82.01	22.99	15.34	33.72
159	South Sudan	16.09	36.10	5.51	39.24	64.09	69.57	14.13	14.42	24.10
27	Spain	31.66	68.10	20.00	74.79	49.26	85.85	29.21	19.56	40.87
108	Sri Lanka	27.17	47.36	9.23	52.63	48.97	80.25	20.51	15.57	30.68
183	Sudan	21.26	37.85	6.05	18.15	55.00	65.97	10.97	13.53	21.61
105	Suriname	29.73	45.69	12.75	52.20	36.82	72.82	15.70	21.99	30.92
17	Sweden	32.90	85.34	25.28	94.83	37.04	89.56	27.07	20.48	43.31
20	Switzerland	33.72	67.19	20.07	87.52	48.94	83.10	28.04	21.93	42.14
155	Syrian Arab Republic	28.04	36.38	8.05	10.64	60.76	76.89	22.44	14.07	24.48
165	Tajikistan	24.32	41.60	7.00	29.42	56.42	38.10	15.37	12.88	23.36
64	Thailand	29.89	54.03	12.04	48.61	50.32	88.69	26.02	17.04	34.20
129	Timor-Leste	24.90	40.67	7.21	55.06	44.85	75.91	16.34	21.12	28.79

Table 1
Productive Capacities Index data for 2016

Rank	Economy	Energy	Human capital	ICTs	Institutions	Natural capital	Private sector	Structural change	Transport	PCI
179	Togo	8.01	38.39	5.33	39.96	70.66	79.10	15.01	9.66	21.91
86	Tonga	28.51	47.58	8.43	57.05	53.47	81.94	19.84	23.99	32.86
48	Trinidad and Tobago	41.22	47.77	16.15	57.75	43.82	79.03	19.99	23.77	36.31
85	Tunisia	28.44	56.11	10.47	49.97	57.84	83.64	21.40	15.82	32.88
66	Turkey	29.85	55.71	12.23	45.74	53.15	83.44	24.91	17.31	33.98
148	Turkmenistan	33.95	40.09	8.73	22.05	63.06	53.16	13.92	14.45	25.46
80	Tuvalu	28.31	36.50	11.00	59.70	51.75	86.74	17.65	26.47	33.05
156	Uganda	17.01	37.19	5.46	42.01	63.63	70.04	16.44	12.00	24.45
88	Ukraine	29.95	53.02	13.05	38.57	60.33	75.88	21.48	16.16	32.58
23	United Arab Emirates	40.23	54.04	18.39	70.57	50.37	88.01	21.87	33.28	41.68
6	United Kingdom of Great Britain and Northern Ireland	33.10	71.39	26.56	87.81	56.04	89.24	31.79	23.58	46.17
161	United Republic of Tanzania	17.55	41.11	5.30	41.79	59.94	68.69	13.47	11.98	23.89
1	United States of America	38.26	78.68	23.61	83.74	48.72	91.80	48.67	45.47	52.64
52	Uruguay	27.93	55.24	17.88	74.73	61.27	79.89	20.44	13.11	35.81
139	Uzbekistan	29.62	45.17	9.89	29.52	63.41	51.04	13.52	13.96	26.44
123	Vanuatu	22.98	41.03	6.42	55.63	46.24	80.16	17.85	24.22	29.28
141	Venezuela (Bolivarian Republic of)	25.36	48.79	12.08	20.69	46.65	52.19	16.04	17.73	26.08
103	Viet Nam	27.03	50.58	10.68	47.70	51.25	86.06	19.86	14.57	31.16
171	Yemen	24.66	37.24	6.49	14.11	55.81	74.53	16.81	14.46	23.24
154	Zambia	17.97	38.01	6.11	47.47	56.80	54.59	15.13	14.11	24.53
166	Zimbabwe	18.04	37.60	6.45	27.62	53.44	54.81	17.79	14.08	23.36
104	State of Palestine	28.27	45.80	10.91	43.44	54.89	75.23	21.00	16.58	31.13
54	Aruba	23.74	43.12	15.93	82.86	48.25	78.93	18.26	25.73	35.31
18	Bermuda	25.19	51.39	30.08	78.89	44.40	84.67	19.76	52.63	43.15
83	Cayman Islands	19.15	45.20	12.06	53.08	45.63	79.65	18.95	36.97	33.02
94	Curaçao	21.14	43.44	12.17	53.33	50.75	77.85	18.81	24.63	31.97
41	Guam	28.74	55.57	11.42	55.65	40.73	80.77	45.37	28.12	37.90

Source: UNCTAD.

Abbreviation: SAR, Special Administrative Region.

Table 2
Productive Capacities Index data for 2018 (estimates)

Rank	Economy	Energy	Human capital	ICTs	Institutions	Natural capital	Private sector	Structural change	Transport	PCI
178	Afghanistan	26.57	37.01	5.33	19.13	57.64	40.82	16.65	14.58	22.12
102	Albania	24.55	53.68	12.45	55.09	50.43	81.82	17.32	15.58	31.65
133	Algeria	29.15	51.90	11.25	35.47	54.22	77.94	16.23	8.52	27.76
23	Andorra	29.24	56.20	17.10	63.23	52.93	87.31	40.21	28.48	41.85
177	Angola	22.77	35.89	4.99	32.18	51.94	65.58	12.33	10.54	22.16
85	Argentina	29.75	55.38	16.49	50.41	55.34	73.51	21.86	11.65	33.03
96	Armenia	28.33	48.10	13.13	48.47	57.08	78.71	20.09	14.61	32.16
19	Australia	36.19	78.22	23.64	91.26	57.92	89.25	21.84	15.69	42.59
15	Austria	33.56	80.28	25.97	88.82	44.54	85.34	29.24	20.25	43.97
119	Azerbaijan	29.58	46.83	14.40	39.94	58.87	72.21	15.21	13.51	30.22
51	Bahamas	24.25	51.59	17.63	69.53	38.76	80.47	17.97	34.90	36.28
39	Bahrain	39.22	54.08	20.14	53.35	50.10	84.62	20.21	27.57	39.03
140	Bangladesh	25.30	44.69	6.68	37.74	58.07	72.74	16.50	13.59	26.85
40	Barbados	25.13	53.27	22.32	77.76	49.40	79.80	21.59	23.90	38.40
66	Belarus	31.76	51.73	22.05	41.68	48.07	77.72	22.08	15.72	34.39
12	Belgium	35.01	81.34	23.92	83.70	50.08	84.33	29.83	23.32	44.98
69	Belize	24.48	46.78	9.60	48.24	40.11	77.85	18.94	60.59	34.26
163	Benin	17.20	37.97	6.03	46.85	51.61	77.35	15.09	9.39	23.84
120	Bhutan	22.37	46.53	9.22	63.28	41.55	73.86	16.66	21.74	30.11
129	Bolivia (Plurinational State of)	27.91	47.22	8.99	40.77	53.00	77.64	19.31	13.34	29.08
88	Bosnia and Herzegovina	28.20	54.12	14.21	47.83	50.23	80.21	22.04	14.76	32.86
116	Botswana	27.16	45.09	10.15	70.34	58.15	68.46	14.71	14.96	30.59
100	Brazil	26.91	57.85	14.21	51.74	45.25	75.94	23.07	11.21	31.69
58	Brunei Darussalam	37.13	50.75	14.90	68.71	38.48	82.22	16.81	22.92	35.19
59	Bulgaria	30.25	58.98	15.74	59.52	52.01	80.05	24.38	13.55	35.09
183	Burkina Faso	14.41	32.83	5.98	46.50	61.77	67.04	10.76	8.39	21.70
188	Burundi	14.82	36.61	4.47	25.55	67.55	66.33	9.88	12.72	20.79
108	Cabo Verde	23.90	45.87	10.97	66.63	46.96	82.10	18.06	15.75	31.11

Table 2
Productive Capacities Index data for 2018 (estimates)

Rank	Economy	Energy	Human capital	ICTs	Institutions	Natural capital	Private sector	Structural change	Transport	PCI
142	Cambodia	19.88	43.53	7.76	38.22	47.08	81.31	15.14	16.15	26.46
166	Cameroon	21.66	38.23	6.98	33.25	47.92	74.72	15.85	8.81	23.60
20	Canada	37.64	72.66	23.83	92.76	42.68	80.75	25.23	19.50	42.30
192	Central African Republic	16.61	28.13	3.70	20.93	56.14	53.32	11.58	9.03	18.06
193	Chad	13.24	29.68	4.41	24.11	60.20	39.59	5.19	14.42	17.14
49	Chile	30.75	56.64	15.10	81.78	54.53	86.89	20.91	15.14	36.61
33	China	31.05	60.53	14.75	46.08	55.96	86.40	34.22	31.03	40.00
8	Hong Kong SAR	34.21	65.48	29.87	87.54	42.17	94.93	25.43	32.53	45.81
36	Macao SAR	28.47	48.80	25.33	74.82	46.84	85.93	17.38	31.92	39.46
91	Colombia	29.69	53.49	13.22	51.52	49.45	75.10	20.00	15.31	32.45
156	Comoros	22.25	40.23	4.95	37.74	57.61	76.47	10.49	17.34	24.60
180	Congo	15.37	37.81	6.03	31.56	48.26	55.99	15.53	12.08	22.06
56	Costa Rica	27.94	57.31	15.25	69.45	44.45	81.72	19.78	20.60	35.48
159	Côte d'Ivoire	20.97	34.24	8.25	42.69	54.88	75.64	13.91	8.68	24.43
50	Croatia	28.91	58.58	18.67	64.41	46.05	81.54	24.59	16.68	36.48
115	Cuba	27.39	55.18	7.68	44.18	52.68	74.94	20.00	19.07	30.62
34	Cyprus	32.17	57.62	23.23	76.74	46.02	89.70	22.71	20.34	39.80
27	Czechia	33.32	67.39	22.42	76.76	51.25	80.96	26.41	19.88	41.27
190	Democratic Republic of the Congo	14.29	32.40	4.16	28.87	53.02	61.24	14.37	9.28	19.85
7	Denmark	32.69	88.38	24.29	94.09	54.69	91.68	26.51	23.32	46.12
134	Djibouti	21.73	41.56	5.55	37.01	59.74	78.48	19.08	19.17	27.41
70	Dominica	24.41	47.43	15.85	69.33	43.37	81.18	16.05	25.72	34.15
92	Dominican Republic	29.64	46.78	11.41	51.28	48.63	82.13	20.00	18.96	32.45
106	Ecuador	29.31	54.63	11.48	44.20	46.50	76.74	17.22	18.82	31.38
125	Egypt	29.47	47.22	9.80	35.05	51.43	81.37	20.39	13.67	29.39
93	El Salvador	27.75	47.16	10.43	50.00	58.09	81.90	21.14	17.81	32.42
170	Equatorial Guinea	21.83	35.14	6.41	24.61	42.01	70.45	16.02	16.07	23.47
185	Eritrea	19.71	30.42	3.14	18.95	67.84	65.43	17.83	17.01	21.64

Table 2
Productive Capacities Index data for 2018 (estimates)

Rank	Economy	Energy	Human capital	ICTs	Institutions	Natural capital	Private sector	Structural change	Transport	PCI
30	Estonia	32.15	64.03	23.24	82.70	43.36	87.14	24.08	19.17	40.26
135	Eswatini	21.39	42.44	7.11	41.39	56.28	73.99	19.58	14.60	27.40
169	Ethiopia	16.42	37.58	5.89	34.92	61.04	67.27	13.07	13.80	23.53
101	Fiji	27.55	49.00	9.84	53.43	43.05	83.85	19.33	20.45	31.67
24	Finland	35.38	85.89	21.97	95.15	36.52	87.79	24.52	18.70	41.81
14	France	34.91	66.38	20.44	94.70	52.82	85.07	28.70	25.92	44.36
146	Gabon	24.24	40.58	9.90	39.08	41.19	71.80	14.74	12.63	26.01
155	Gambia	17.95	35.30	7.89	37.40	52.45	79.73	14.69	11.71	24.61
75	Georgia	29.00	54.14	14.44	67.69	47.33	84.94	20.31	13.89	33.89
5	Germany	34.47	78.07	27.65	90.71	49.46	85.13	35.62	25.09	47.38
139	Ghana	23.60	38.98	9.03	55.21	58.65	75.74	13.90	9.69	26.90
44	Greece	31.04	67.97	20.88	58.28	52.56	80.39	22.80	17.26	37.91
65	Grenada	23.69	52.19	15.37	64.64	42.57	81.77	19.83	24.20	34.60
130	Guatemala	24.69	43.14	9.94	42.29	49.25	75.79	20.20	14.43	28.91
165	Guinea	15.66	34.37	5.79	34.76	72.46	76.01	14.66	11.21	23.66
111	Guyana	26.54	43.34	10.21	50.07	54.24	81.33	15.44	20.95	30.94
176	Haiti	9.89	37.91	5.16	28.96	59.84	74.69	13.52	19.33	22.49
131	Honduras	19.82	45.03	7.86	40.79	47.75	79.59	18.97	18.54	28.04
38	Hungary	30.56	61.62	20.21	64.25	53.10	81.07	24.77	21.10	39.13
3	Iceland	44.58	78.81	32.56	88.35	49.64	84.88	17.96	36.56	47.96
112	India	24.36	45.98	7.80	49.56	56.08	76.08	25.93	17.36	30.90
121	Indonesia	27.88	44.99	9.07	51.64	50.45	81.64	22.32	11.95	29.94
114	Iran (Islamic Republic of)	31.73	52.32	15.51	35.82	58.72	78.08	16.73	11.13	30.69
175	Iraq	22.28	40.55	7.19	22.65	59.12	54.35	13.62	11.84	22.92
9	Ireland	35.14	72.36	21.30	87.12	55.44	83.85	22.75	37.07	45.54
31	Israel	33.78	84.52	20.67	73.30	49.61	83.89	22.66	16.72	40.20
53	Italy	28.62	66.79	16.61	60.59	46.39	77.61	23.84	17.06	35.99
89	Jamaica	25.30	48.36	11.86	57.87	49.49	77.72	17.69	22.46	32.63

Table 2
Productive Capacities Index data for 2018 (estimates)

Rank	Economy	Energy	Human capital	ICTs	Institutions	Natural capital	Private sector	Structural change	Transport	PCI
10	Japan	34.14	79.57	25.16	86.31	37.48	90.25	40.67	21.83	45.29
110	Jordan	29.42	51.28	13.44	53.70	50.45	84.11	21.76	8.51	31.01
118	Kazakhstan	33.58	47.47	15.47	45.72	69.54	52.88	17.36	10.34	30.48
148	Kenya	18.70	41.72	7.02	42.00	56.99	74.54	16.47	11.93	25.73
132	Kiribati	25.40	46.22	5.89	57.23	51.62	80.78	9.28	24.30	27.94
74	Kuwait	38.20	48.30	13.48	50.93	60.36	83.15	16.96	16.50	33.98
136	Kyrgyzstan	24.39	45.91	9.48	37.48	63.69	52.73	17.37	13.58	27.37
138	Lao People's Democratic Republic	23.54	41.04	8.17	40.09	46.01	78.05	20.57	12.51	27.12
43	Latvia	30.41	55.76	18.48	73.83	43.96	84.75	24.30	20.58	37.96
78	Lebanon	30.27	50.89	16.71	38.23	55.43	81.07	23.02	16.27	33.68
128	Lesotho	20.31	39.63	7.54	49.74	85.12	72.92	19.07	14.59	29.15
172	Liberia	14.35	39.41	5.56	37.94	61.31	75.26	14.71	10.76	23.31
162	Libya	19.80	47.23	9.47	10.10	60.90	76.01	17.79	15.77	24.16
42	Lithuania	28.29	59.92	18.25	77.38	49.27	85.16	23.42	18.65	38.04
4	Luxembourg	42.02	66.96	30.57	94.03	49.34	86.34	24.92	30.80	47.62
179	Madagascar	18.75	35.12	4.20	38.66	63.73	76.55	15.14	7.20	22.10
171	Malawi	16.77	42.13	4.61	45.35	58.73	69.67	13.12	11.49	23.44
62	Malaysia	32.54	58.08	14.26	63.06	42.08	89.26	21.84	15.94	34.94
72	Maldives	28.50	56.26	14.81	46.59	50.21	76.62	14.82	29.19	34.13
187	Mali	16.11	31.51	6.17	37.35	61.71	69.31	8.27	9.54	21.11
26	Malta	33.13	62.52	29.46	79.93	51.72	85.40	19.02	21.98	41.62
113	Marshall Islands	27.55	50.10	7.50	51.95	45.88	81.36	13.69	28.82	30.71
174	Mauritania	21.50	35.86	6.28	37.27	69.29	74.01	15.32	5.49	22.98
46	Mauritius	31.39	51.06	16.76	73.73	50.73	87.48	21.30	20.40	37.39
95	Mexico	29.45	51.34	12.70	49.05	51.44	81.71	23.51	12.34	32.18
94	Mongolia	28.77	47.41	9.47	54.91	83.29	70.34	16.11	17.68	32.29
83	Montenegro	26.17	53.06	17.18	56.35	40.82	82.58	19.44	16.92	33.24
117	Morocco	28.06	51.13	10.74	49.47	57.94	86.05	19.35	10.20	30.51

Table 2
Productive Capacities Index data for 2018 (estimates)

Rank	Economy	Energy	Human capital	ICTs	Institutions	Natural capital	Private sector	Structural change	Transport	PCI
167	Mozambique	17.17	34.59	5.55	34.74	55.95	76.64	15.35	12.72	23.59
158	Myanmar	21.22	42.50	7.83	41.97	49.06	78.27	14.56	7.80	24.49
123	Namibia	20.98	44.68	9.33	61.71	57.01	77.71	19.40	12.29	29.48
143	Nepal	18.29	46.23	7.84	39.92	52.26	70.57	15.90	14.83	26.32
2	Netherlands	35.19	75.97	31.04	93.31	53.84	88.36	31.88	24.90	48.22
18	New Zealand	33.17	71.77	24.34	97.44	48.09	91.54	21.88	20.60	42.77
109	Nicaragua	22.84	49.87	8.98	41.85	53.32	80.47	18.08	25.87	31.03
189	Niger	14.84	26.53	4.55	40.56	68.02	58.32	10.44	8.76	20.08
184	Nigeria	20.26	33.11	6.67	31.79	59.41	74.43	11.15	6.88	21.65
82	North Macedonia	26.91	52.53	14.96	53.44	52.05	81.54	20.23	15.65	33.32
25	Norway	30.93	69.44	20.06	91.79	43.84	87.97	27.74	21.42	41.65
64	Oman	36.84	46.38	13.33	60.10	60.23	87.23	18.32	15.59	34.60
151	Pakistan	24.75	36.59	5.88	32.66	56.46	77.75	17.84	11.84	25.17
80	Palau	32.04	43.31	14.56	60.32	31.92	78.97	15.54	32.81	33.45
60	Panama	29.32	48.59	13.88	58.53	42.08	85.22	23.07	23.97	35.08
152	Papua New Guinea	21.78	34.47	5.02	41.83	45.53	75.55	15.67	17.78	24.97
127	Paraguay	27.19	49.77	10.15	46.07	54.97	73.65	17.53	11.64	29.16
98	Peru	28.81	49.64	11.03	53.29	47.58	82.63	20.33	16.00	31.91
122	Philippines	27.86	43.99	10.35	47.07	51.26	81.01	20.02	12.82	29.88
35	Poland	32.22	61.13	20.29	72.25	50.77	81.34	27.89	18.36	39.65
37	Portugal	30.32	69.77	21.68	78.49	47.91	85.75	26.27	14.85	39.37
29	Qatar	47.11	49.58	17.37	67.22	51.26	83.88	19.08	34.41	40.81
11	Republic of Korea	35.57	89.13	30.21	72.89	39.28	91.85	28.56	24.26	45.21
87	Republic of Moldova	26.03	51.84	16.75	46.15	59.89	76.51	19.30	14.78	32.87
67	Romania	29.66	52.07	15.03	51.51	53.42	80.13	23.88	15.68	34.30
76	Russian Federation	33.83	60.72	17.99	38.30	45.75	76.84	22.03	15.73	33.85
150	Rwanda	15.49	41.73	5.76	57.03	61.31	70.55	14.35	13.25	25.42
77	Saint Lucia	24.69	50.37	12.86	68.22	44.44	81.26	18.22	23.93	33.84

Table 2
Productive Capacities Index data for 2018 (estimates)

Rank	Economy	Energy	Human capital	ICTs	Institutions	Natural capital	Private sector	Structural change	Transport	PCI
71	Saint Vincent and the Grenadines	24.58	49.98	15.01	68.88	39.99	83.03	17.93	24.43	34.14
103	Samoa	26.94	46.62	7.40	66.94	39.71	83.76	18.42	25.70	31.54
48	San Marino	26.51	47.27	18.67	62.37	44.17	85.32	23.71	25.04	36.66
141	Sao Tome and Principe	19.56	43.72	7.17	48.42	46.70	75.81	16.27	15.23	26.73
63	Saudi Arabia	37.98	53.40	13.74	50.07	68.51	81.89	16.87	16.04	34.73
144	Senegal	24.24	39.21	7.32	51.78	51.60	78.64	17.42	9.01	26.31
55	Serbia	28.26	61.50	17.16	57.26	52.39	79.61	22.74	16.10	35.65
54	Seychelles	26.99	46.31	17.14	62.03	32.88	79.45	17.78	42.56	35.68
186	Sierra Leone	13.49	39.56	6.69	39.93	63.17	76.09	6.95	10.02	21.62
13	Singapore	36.93	77.48	21.08	92.87	43.26	92.54	23.15	29.42	44.46
45	Slovakia	32.97	60.84	17.86	72.15	47.00	80.14	23.03	17.36	37.48
32	Slovenia	32.97	71.83	21.02	76.25	41.91	80.52	25.79	20.04	40.05
145	Solomon Islands	21.24	39.97	5.55	46.91	44.71	81.05	13.46	20.68	26.21
191	Somalia	16.20	31.05	4.60	7.90	72.59	74.96	13.04	15.27	19.37
73	South Africa	29.35	49.78	11.33	59.71	63.70	81.86	23.55	14.90	34.05
157	South Sudan	16.04	37.00	6.29	39.09	63.31	69.65	14.34	14.47	24.58
28	Spain	31.64	68.14	20.92	73.55	49.12	85.51	29.43	19.55	41.02
105	Sri Lanka	27.81	47.36	10.07	52.07	49.16	80.61	20.77	16.78	31.44
181	Sudan	21.54	38.59	6.43	18.15	56.74	65.80	11.30	13.48	22.01
104	Suriname	29.63	45.80	14.20	52.86	36.82	72.93	15.84	22.59	31.54
17	Sweden	32.73	85.46	25.99	95.08	37.05	90.12	27.05	20.45	43.48
22	Switzerland	33.78	67.59	20.19	87.61	49.01	83.23	28.02	21.99	42.25
154	Syrian Arab Republic	27.96	36.92	8.54	10.15	60.76	76.96	23.18	14.14	24.67
168	Tajikistan	24.66	41.78	7.49	28.91	56.47	37.97	15.34	12.90	23.55
61	Thailand	30.01	55.87	13.60	49.08	50.45	88.75	26.14	17.14	34.99
126	Timor-Leste	25.18	41.45	7.83	55.60	45.01	76.29	16.34	21.15	29.28
182	Togo	8.20	39.50	6.10	39.43	70.77	79.27	14.73	8.08	21.85
86	Tonga	28.60	47.35	8.78	55.83	53.55	81.94	19.89	23.99	32.95
47	Trinidad and Tobago	41.23	48.12	16.85	57.64	45.60	79.03	19.84	23.77	36.68
84	Tunisia	28.52	56.81	11.22	49.64	58.01	83.75	21.49	15.82	33.24

Table 2
Productive Capacities Index data for 2018 (estimates)

Rank	Economy	Energy	Human capital	ICTs	Institutions	Natural capital	Private sector	Structural change	Transport	PCI
68	Turkey	29.89	56.82	12.67	44.03	53.13	83.78	24.90	18.22	34.29
147	Turkmenistan	34.18	40.47	9.70	22.82	63.06	52.05	13.83	14.47	25.88
79	Tuvalu	28.35	36.83	12.08	60.54	51.63	86.94	17.65	26.51	33.55
153	Uganda	17.04	38.48	5.98	41.95	63.87	70.30	16.77	12.00	24.91
90	Ukraine	29.97	53.18	13.24	38.38	60.56	75.06	21.57	16.16	32.63
21	United Arab Emirates	39.84	54.31	19.70	70.22	51.37	88.58	21.57	34.85	42.30
6	United Kingdom of Great Britain and Northern Ireland	33.10	71.73	26.80	89.24	56.05	89.39	31.58	23.03	46.18
161	United Republic of Tanzania	17.67	41.26	5.61	42.35	59.61	69.48	13.91	11.85	24.22
1	United States of America	38.21	78.83	24.43	83.41	48.70	91.80	33.84	45.60	50.51
52	Uruguay	27.98	55.44	18.95	74.09	61.27	80.02	20.44	13.08	36.05
137	Uzbekistan	29.54	45.56	11.95	29.44	63.79	50.23	14.05	13.96	27.18
124	Vanuatu	23.07	41.23	6.71	55.50	46.21	80.38	17.75	24.18	29.44
149	Venezuela (Bolivarian Republic of)	26.35	49.21	12.20	18.12	46.86	49.65	15.53	17.73	25.59
99	Viet Nam	27.36	50.93	11.53	47.72	51.67	86.71	20.07	14.84	31.71
173	Yemen	25.11	37.50	6.82	13.06	54.74	74.54	17.52	14.38	23.28
160	Zambia	18.02	38.75	6.58	47.44	56.93	54.59	15.20	11.59	24.24
164	Zimbabwe	17.91	38.41	7.06	27.80	53.73	54.30	18.41	13.74	23.70
107	State of Palestine	28.27	45.85	11.72	42.79	54.89	75.26	21.20	16.36	31.34
57	Aruba	23.76	43.53	16.43	82.46	48.25	79.12	18.02	25.86	35.45
16	Bermuda	25.19	51.51	36.06	78.00	44.40	85.06	18.25	52.69	43.68
81	Cayman Islands	19.14	45.30	12.76	52.96	45.53	80.21	19.01	38.10	33.40
97	Curaçao	21.17	42.60	12.60	53.46	50.79	77.91	18.86	25.12	32.14
41	Guam	28.99	56.02	11.97	55.36	40.76	80.77	45.32	28.67	38.27

Source: UNCTAD.

Note: With regard to PCI values and ranking, small island developing States appear to perform better than other developing countries. However, this performance must be interpreted with caution and understood in the context of their unique geographical and structural characteristics. Due to their demographic features (small population) and smaller size and/or surface area, small island developing States perform better statistically when measured using indicators that utilize population or geographical ratios as units of measurement. An additional substantive reason for the better-than-expected PCI performance of small island developing States compared with other developing countries is the relative shift of their economic activities towards the services sector, in particular financial intermediation and tourism and other intangible services.

Abbreviation: SAR, Special Administrative Region.

INFOGRAPHICS

The overall objective in developing PCI was to support the formulation and implementation of holistic, coherent and evidence-based policies in developing countries. The index is designed with the aim of improving the quality of trade and development policies by placing the fostering of productive capacities and structural transformation at the centre.

The PCI methodology, indicators and data sources, together with the complete scores for the 193 economies and related analytical papers, reports and operational manuals are available on the UNCTAD website dedicated to PCI (pci.unctad.org), along with PCI data, which are also available on the UNCTADstat data centre (<https://unctadstat.unctad.org/wds/>) on a dedicated page with textual and interactive data visualizations (<https://unctadstat.unctad.org/EN/Pci.html>), as well as on the dedicated page of the Division for Africa, LDCs and Special Programmes (<https://unctad.org/topic/vulnerable-economies>).

The following sections provide insights into the following:

- (a) Correlations between PCI and key indicators, including the Sustainable Development Goals;
- (b) Regional, interregional and intraregional trends and comparisons;

- (c) Trends and evolutions in the eight categories of the index.

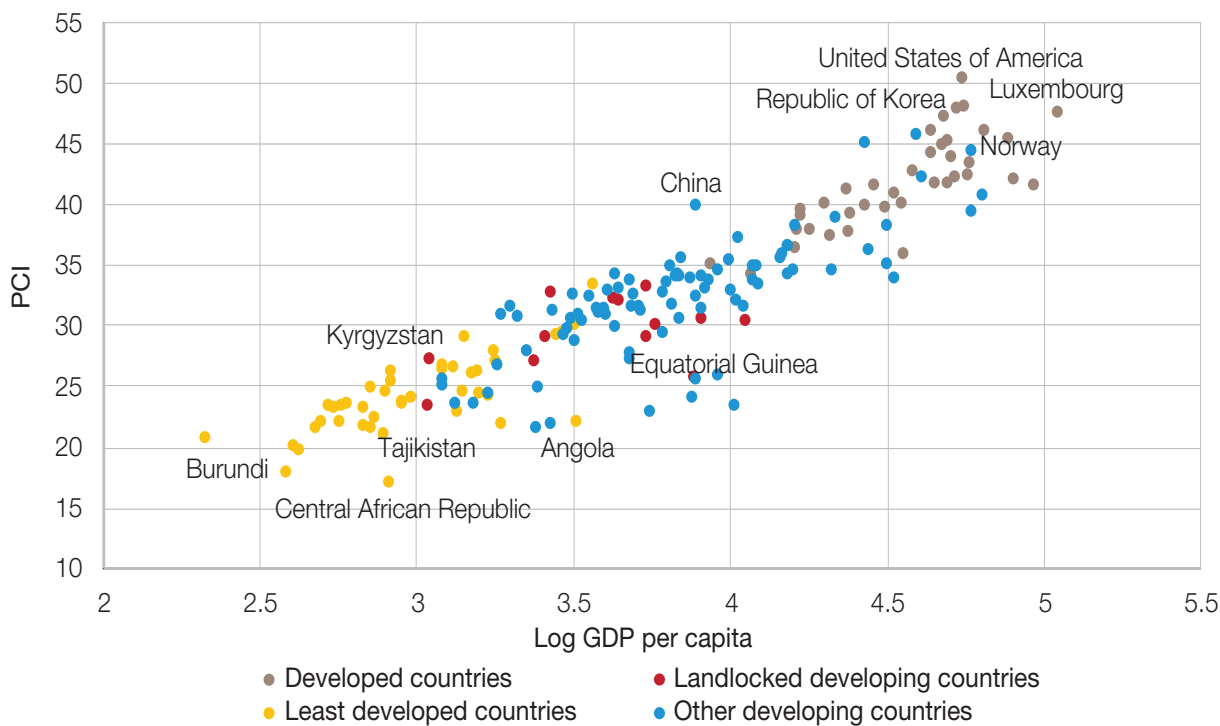
A. Correlations between the Productive Capacities Index and key indicators, including the Sustainable Development Goals

PCI scores and GDP per capita levels are closely intertwined, as a higher PCI score is often associated with greater GDP per capita (see figure 4).

The highly positive correlation coefficient between PCI and GDP per capita (0.91) demonstrates the close relationship that the fostering of productive capacities can have with GDP overall, thereby propelling a rise in GDP per capita. The strong and high degree of correlation means that the poorest countries, in particular LDCs and LLDCs, are at the bottom of the distribution and clearly indicates that a low level of GDP per capita is directly related to low levels of productive capacities. This is to be expected, as productive capacities determine the capacity of an economy to produce goods and services. PCI can also help a country foresee the trajectory of its respective economy and the approximate time frame to achieve a given level of GDP per capita. In addition, it can enable policymakers to understand the time and capacities needed to break the middle-income trap and lay the foundation for inclusive and sustainable economic

Figure 4
Correlation between the Productive Capacities Index and gross domestic product per capita

($\rho = 0.91$)



Source: UNCTAD.

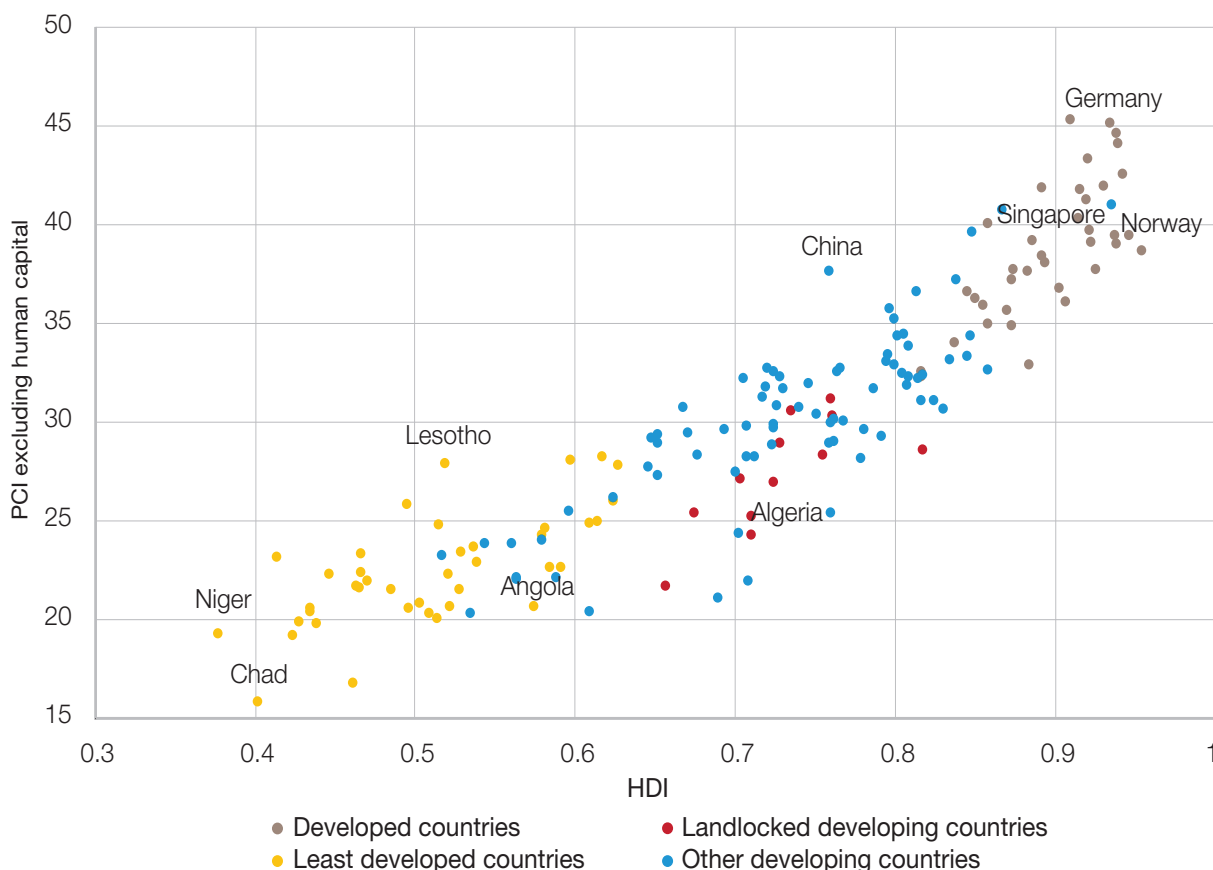
growth and development. The multidimensional nature of PCI and its categories are key in accelerating transformational, inclusive growth and development. For this reason, the use of PCI for policy formulation and implementation needs to take into account the evolution of the constituent categories, which provide further statistical information on areas in which a given country may be progressing or lagging behind.

As with the correlation between PCI and GDP per capita, a high level of association links PCI and the Human Development Index (see figure 5).

The two variables have a strong and positive correlation coefficient (0.92). In general, countries or economies with high levels of productive capacities also show high levels of human development, as captured in the Human Development Index. This also means that other categories, such as structural change, functioning institutions and a thriving private sector, all require, or are influenced by human development. Developed countries are at the top end of the distribution, whereas poorer economies in Africa, including LDCs and LLDCs, are at the bottom of the distribution. Other developing countries lie in

Figure 5
Correlation between the Productive Capacities Index and the Human Development Index

($\rho = 0.92$)



Source: UNCTAD.

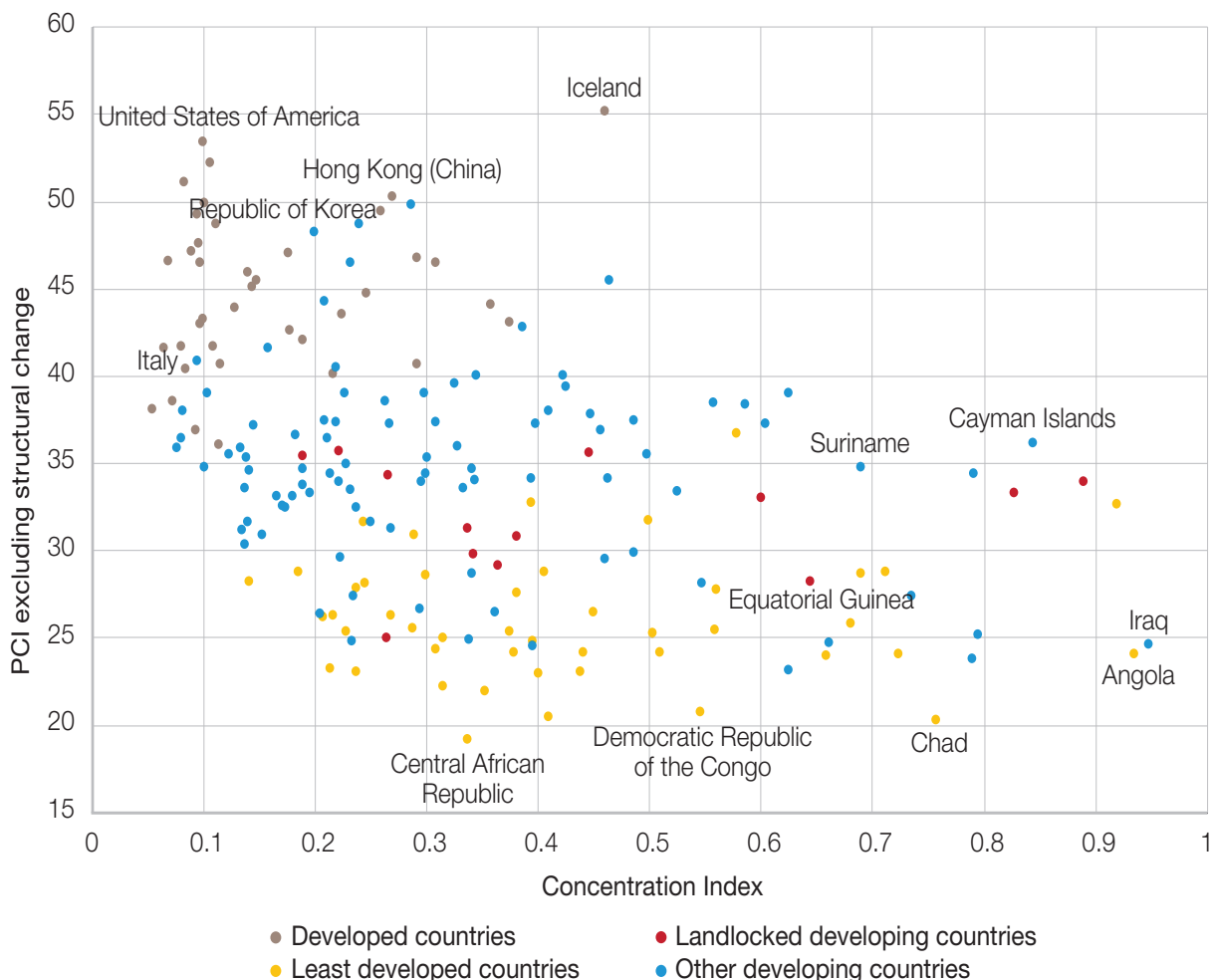
between developed countries and the worst-performing LDCs and LLDCs, while advanced developing countries such as Singapore converge towards the average scores of developed economies.

There is an inverse relationship between PCI and the Merchandise Export Concentration Index, that is, economies with higher productive capacities have a lower Merchandise Export Concentration Index score (see figure 6).

Conversely, countries that have the highest Merchandise Export Concentration Index scores, such as Angola and Iraq, are those with the weakest productive capacities. Furthermore, they exhibit little or no signs of structural transformation in their economies. This means that dependence on the export of a few commodities and vulnerability to negative external shocks may be diminished by fostering productive capacities. In turn, productive capacities enhance the

Figure 6
Correlation between the Productive Capacities Index and the Merchandise Export Concentration Index

($\rho = 0.43$)



Source: UNCTAD.

diversification of exports and can promote structural transformation. Economic diversification and structural transformation are closely interrelated and, as discussed in UNCTAD (2006), both features are intimately connected with the building of productive capacities. Structural transformation is one of the core processes that spur the development of productive capacities. However, the relationship is mutually

reinforcing, and the positive impact of strengthened productive resources on diversification and structural change is one example.

The multidimensional nature of PCI provides a coherent and readable measure of a country's social and economic performance or progress. It also indicates the untapped potential, or unexplored areas that can be

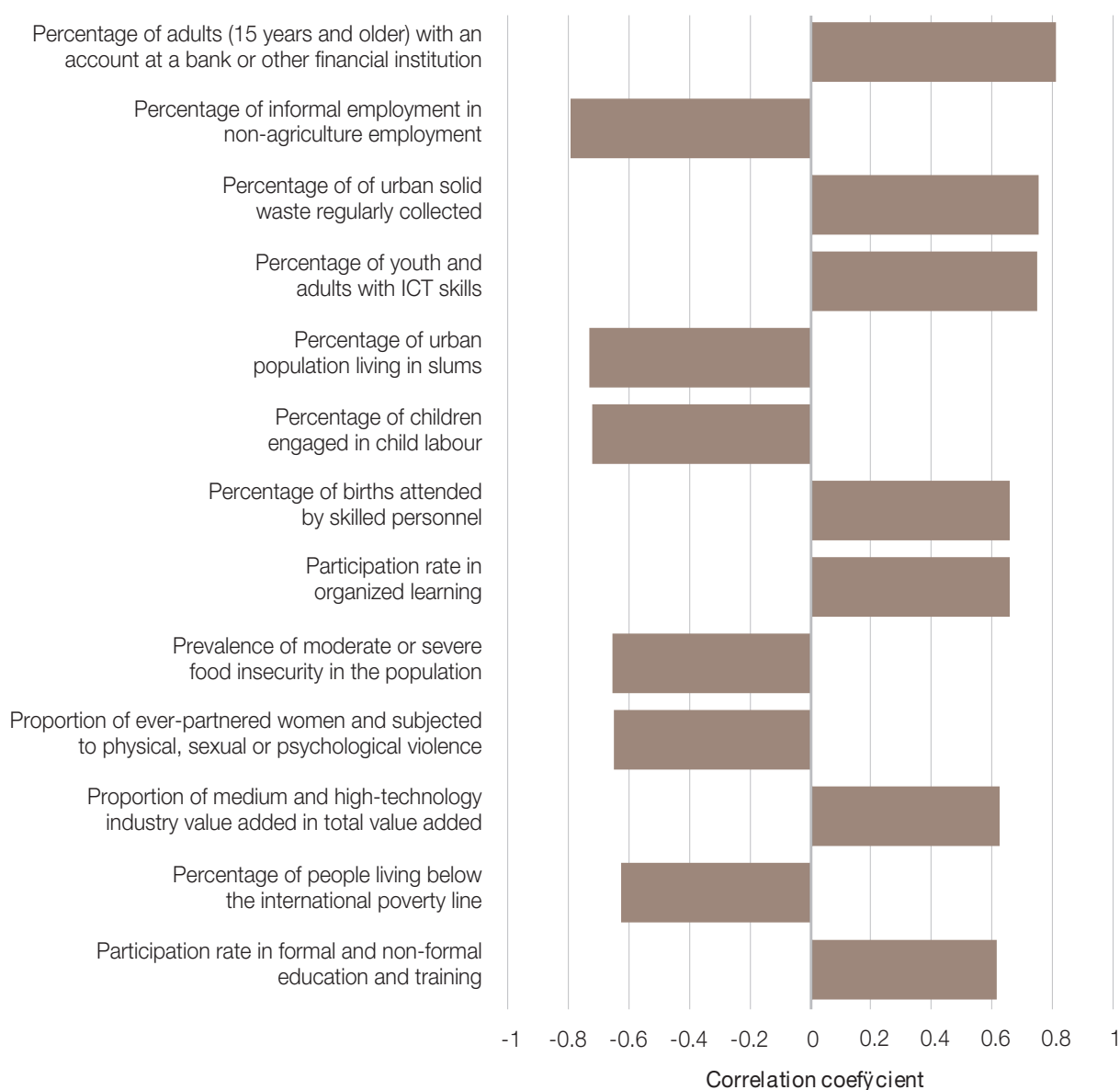
explored for further socioeconomic improvements and, eventually, development. PCI can also help in undertaking national or regional comparisons by measuring the driving forces that fuel progress towards the Sustainable Development Goals. In other words, PCI can serve as a powerful tool to monitor or measure country-level performances vis-à-vis key Goals-related indicators. In this regard, the regression results for PCI and selected Goals provides interesting insights into the need to foster productive capacities to achieve the Goals and the importance of measuring progress and monitoring performance (see figure 7).

Productive capacities can trigger sound structural change and thereby contribute to long-term structural transformation and the achievement of the Goals. In sum, the relationship between PCI and the Goals suggests that high levels of productive capacities are often associated with significant achievements in relation to the sustainable development outcomes enshrined in the 17 Goals. Specifically, the eight categories used to develop PCI together contribute to the achievement of development outcomes, creating synergies with other key indicators. For example, improvements under the health and education indicators (human capital) significantly affect not only the defined objectives to improve the human capital indicators, but also generate positive spillovers on transformational development. For

example, policy actions leading to an improved human capital PCI score can directly contribute to improving under other indicators that are key for fostering productive capacities and structural transformation, such as ICTs, institutions, the private sector and gender equality.

Final PCI scores are often positively correlated with achievements under many of the 247 indicators under the Goals, although in a few cases the relationship appears to be statistically spurious. The conceptual and analytical foundation of productive capacities provides a solid logical explanation for the high degree of correlation observed between PCI and the Goals. For the purpose of clarity in the context of figure 7, only targets under the Goals with a correlation threshold of ± 0.6 are considered. This is intended to statistically remove indicators with weaker correlations, while improving the visibility and clarity of the presentation. Overall, economies that have higher levels of productive capacities also have a greater percentage of adults (15 years and above) with bank accounts and lower shares of the workforce employed in the informal sector. This helps to identify stronger ties with Goals 1–4, 8, 9 and 11 and clearly indicates that productive capacities are key in fostering structural transformation, which, in turn, serves as a driver of poverty reduction and can enhance progress towards achieving the food security, education and urbanization-related indicators under the Goals.

Figure 7
Correlation between the Productive Capacities Index and selected Sustainable Development Goals



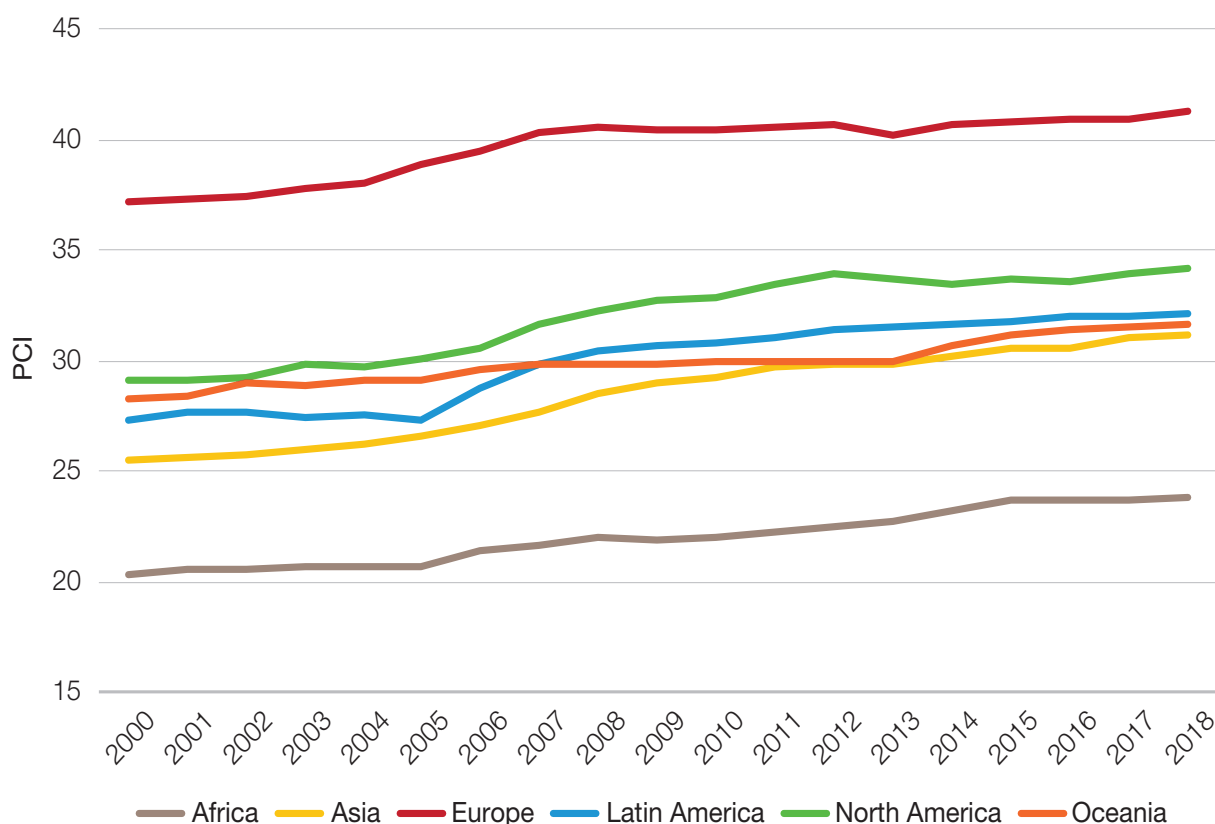
Source: UNCTAD.

B. Regional, interregional and intraregional trends and comparisons

PCI trends in 2000–2018 show improvements across all regions, although to varying degrees (see figure 8).

In terms of regional performance, developed economies in Europe outperform the other regions, followed by North America. The performance of Europe also shows that productive capacities are evenly distributed across the continent. However, closer comparison at the

Figure 8
Regional and interregional trends and comparisons



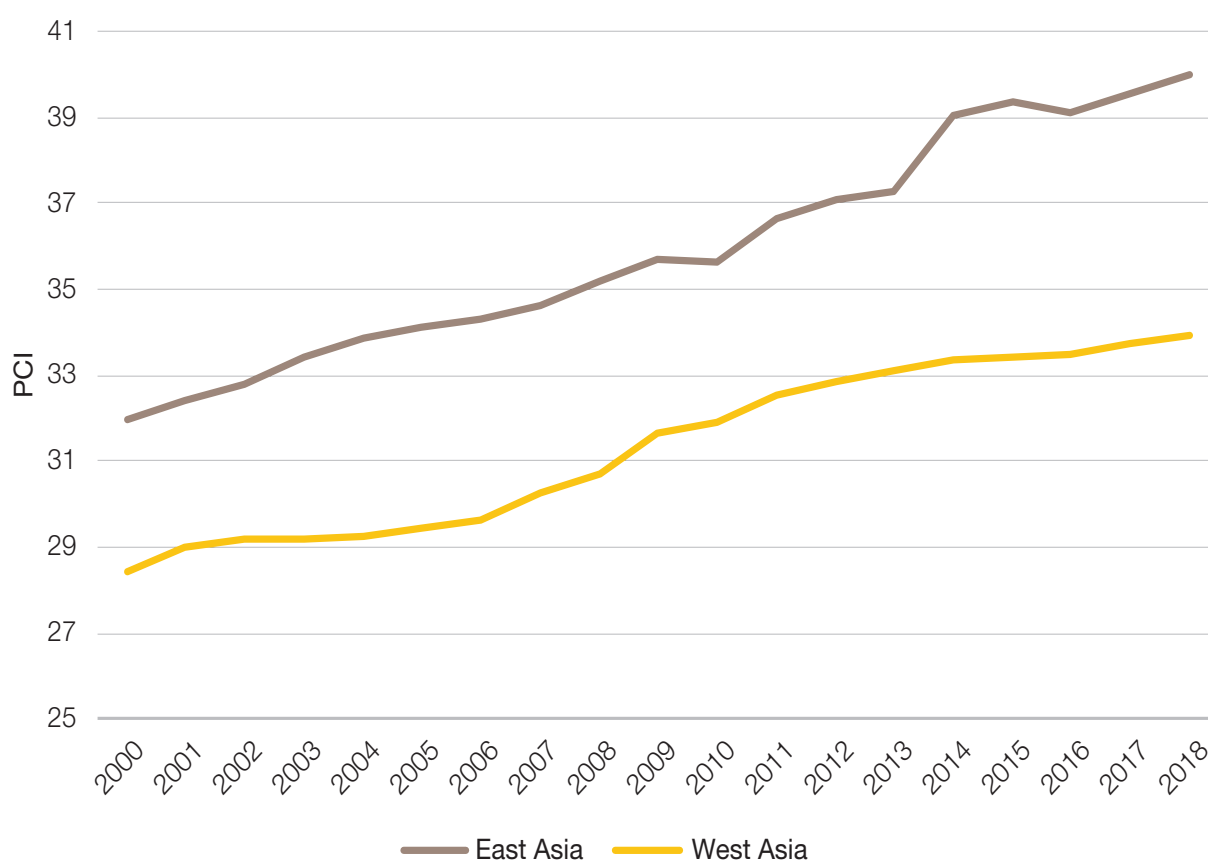
Source: UNCTAD.

Note: For analytical and comparative purposes in this document, North America includes countries geographically north of the Panama Canal, and Europe includes developed, developing and transition economies in Eastern Europe.

country level indicates that the United States and Canada lead the rest of the world in productive capacities. Among the other regions, the highest median PCI score is in Latin America, followed by Asia and Oceania. The performance of Oceania is slightly lowered by the relatively weaker performance of Pacific island States. However, it is worth noting that there is an increasing convergence between Asia, Latin America and Oceania. Furthermore, the three regions, over the two decades, show accelerated growth

in their respective levels of productive capacity. Finally, the performance of Africa remains comparatively the weakest and lowest among all regions, although it has moderately improved over the years. The weak productive capacities in Africa are causes and consequences of the region's persistent socioeconomic vulnerabilities to negative external shocks, although its aggregate performance masks considerable variations in country-specific performances.

Figure 9
Productive Capacities Index for Asia: Intraregional comparison



Source: UNCTAD.

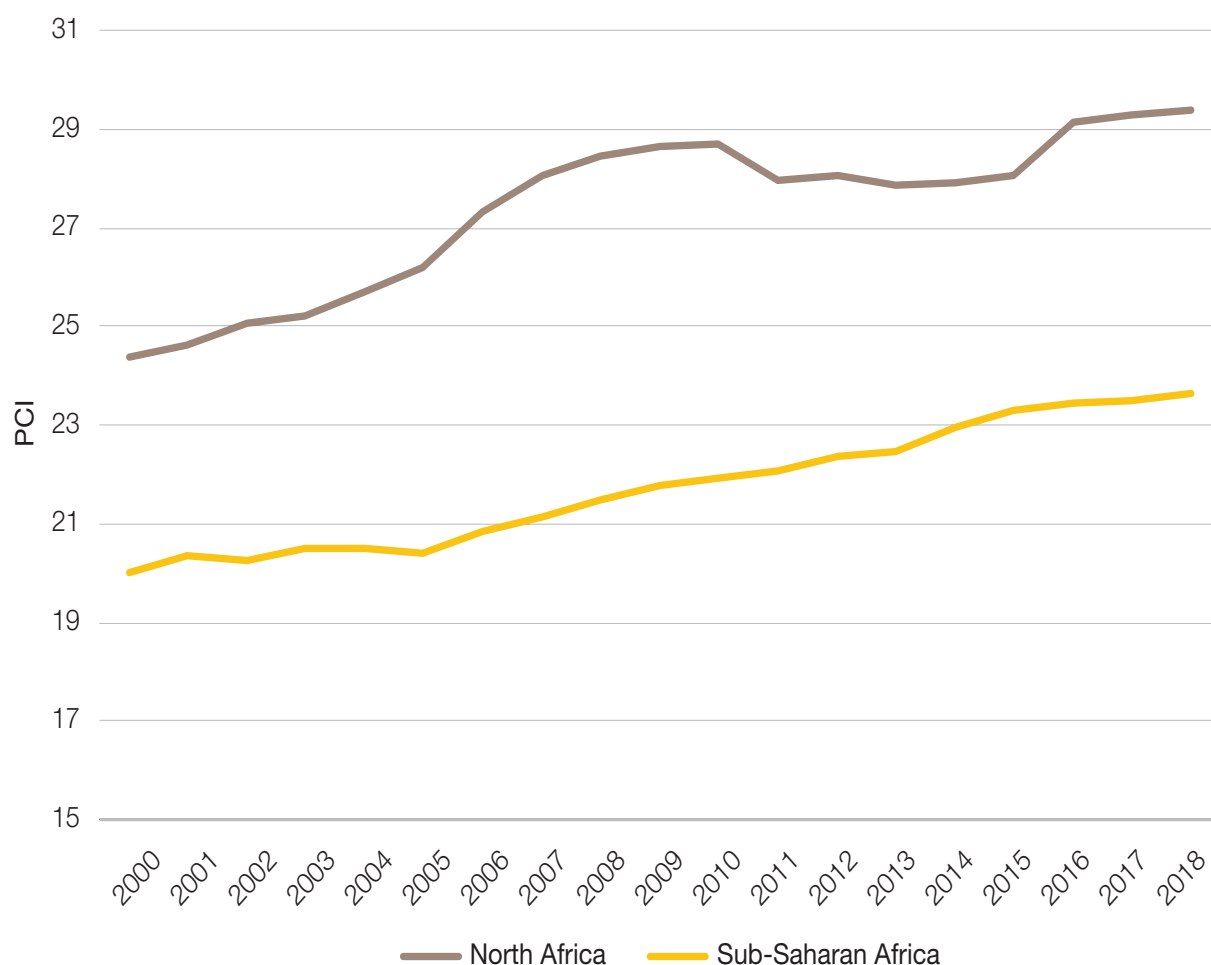
In Asia, productive capacities are unevenly distributed, not only among countries, but also between East Asia and West Asia (see figure 9).

The achievements of countries in East Asia have not been able to propel the performance of the region as a whole due to the rising levels of inequality in productive capacities in the region. There is a significant gap between the scores of the best performers in East Asia, including China, the Republic of Korea and Singapore, and those of the best performers in West Asia, namely, Armenia, the Islamic Republic of Iran

and Turkey.¹ The average PCI score in East Asia is almost comparable to that of developed economies, reflecting the successful and transformational development evidenced in the region since the 1970s. On the other end of the distribution are countries such as Afghanistan, Iraq and Yemen, which have experienced instability and conflict. Their poor PCI performance lowers the average score in West Asia and more broadly, Asia as a whole.

¹ For the purpose of this PCI analysis, Qatar and the United Arab Emirates are not geographically categorized as West Asia.

Figure 10
Productive Capacities Index for Africa: Intraregional comparisons



Source: UNCTAD.

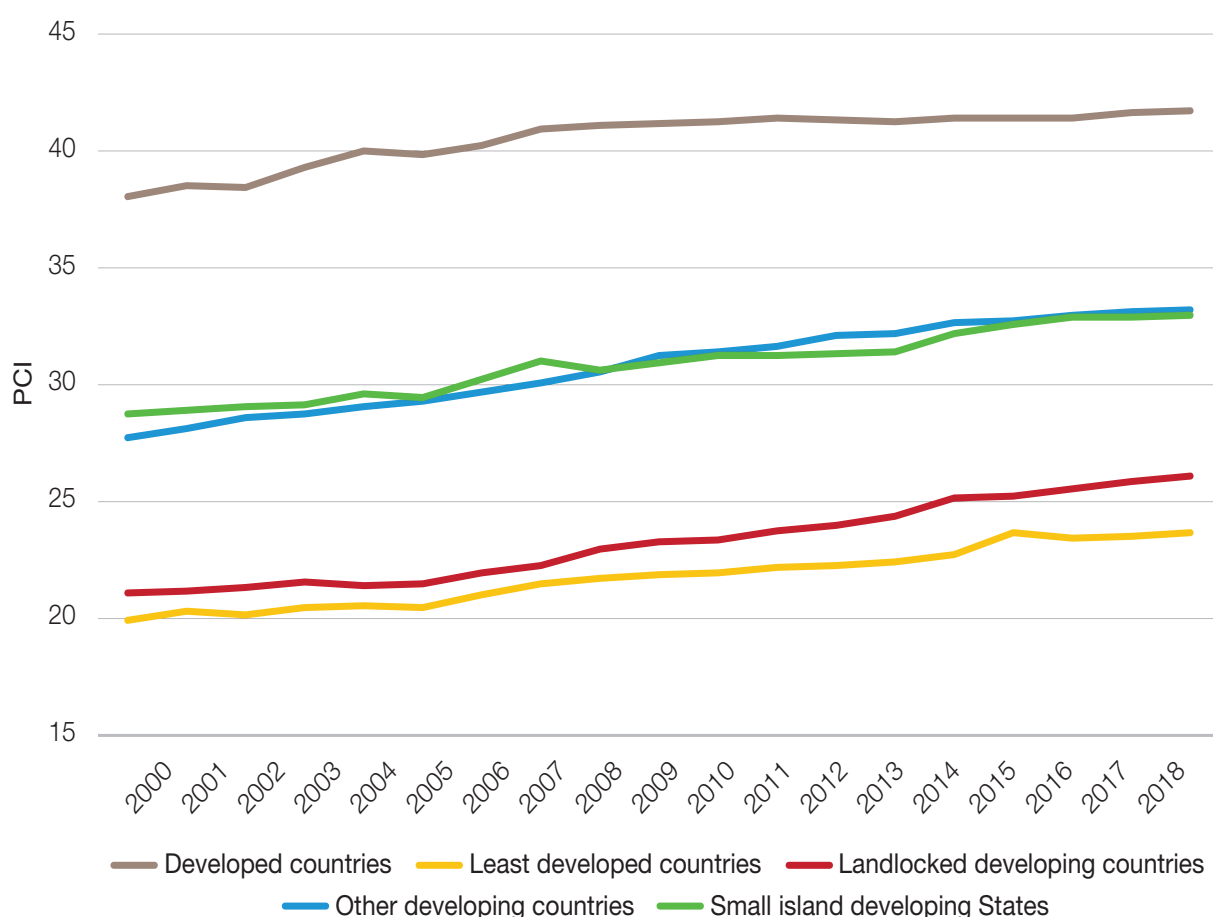
The weak productive capacities in these countries makes their economies fragile and heightens their vulnerability to the vagaries of external shocks.

The gap in performance between North Africa and sub-Saharan Africa is evident (see figure 10).

The group average masks considerable intraregional variations and it is therefore instructive to compare the performance of North

Africa with that of sub-Saharan Africa. The relatively better performance of North Africa provides further insights into interregional experience-sharing between countries in the region. Against this background, it is worth noting that there are a few countries, such as Libya, Somalia and South Sudan, that have experienced instability and conflict. These countries constitute unavoidable outliers, for which stand-alone analysis may be necessary, and also lower the group

Figure 11
Productive Capacities Index: Comparison of country groups



Source: UNCTAD.

score, in particular with regard to the institutions category.

Average overall PCI scores for all economic groups improved in 2000–2018, although to varying degrees (see figure 11).

However, there are significant gaps in the average scores observed across and between the different groups. With regard to LDCs and LLDCs, their overall PCI scores was driven by their high levels of natural capital, which entrenches increased

commodity dependence rather than facilitating economic diversification or structural transformation. Overall trends also show communality among all groups, namely, a steeper rise in the first half of the period and a more moderate increase in the second half. The tapering off of PCI growth seems to begin in 2008, at the onset of the global financial crisis. The pattern of PCI growth remained constant in developed economies during and immediately after the crisis, while weaker economies, such as those of LDCs, LLDCs and small island

developing States, experienced greater contractions or volatility. Other developing economies, including dynamic economies in East Asia and other financial centres, although affected, succeeded in dealing with or withstanding the impacts of the crisis. Consequently, they show a great degree of convergence with developed economies in fostering productive capacities and structural transformation. Overall, as expected, developed countries have the leading overall PCI scores. LDCs and LLDCs are at the bottom of the distribution and other developing countries and small island developing States are in the middle, offering interesting cases for interpretation.

C. Trends and evolutions in the eight categories

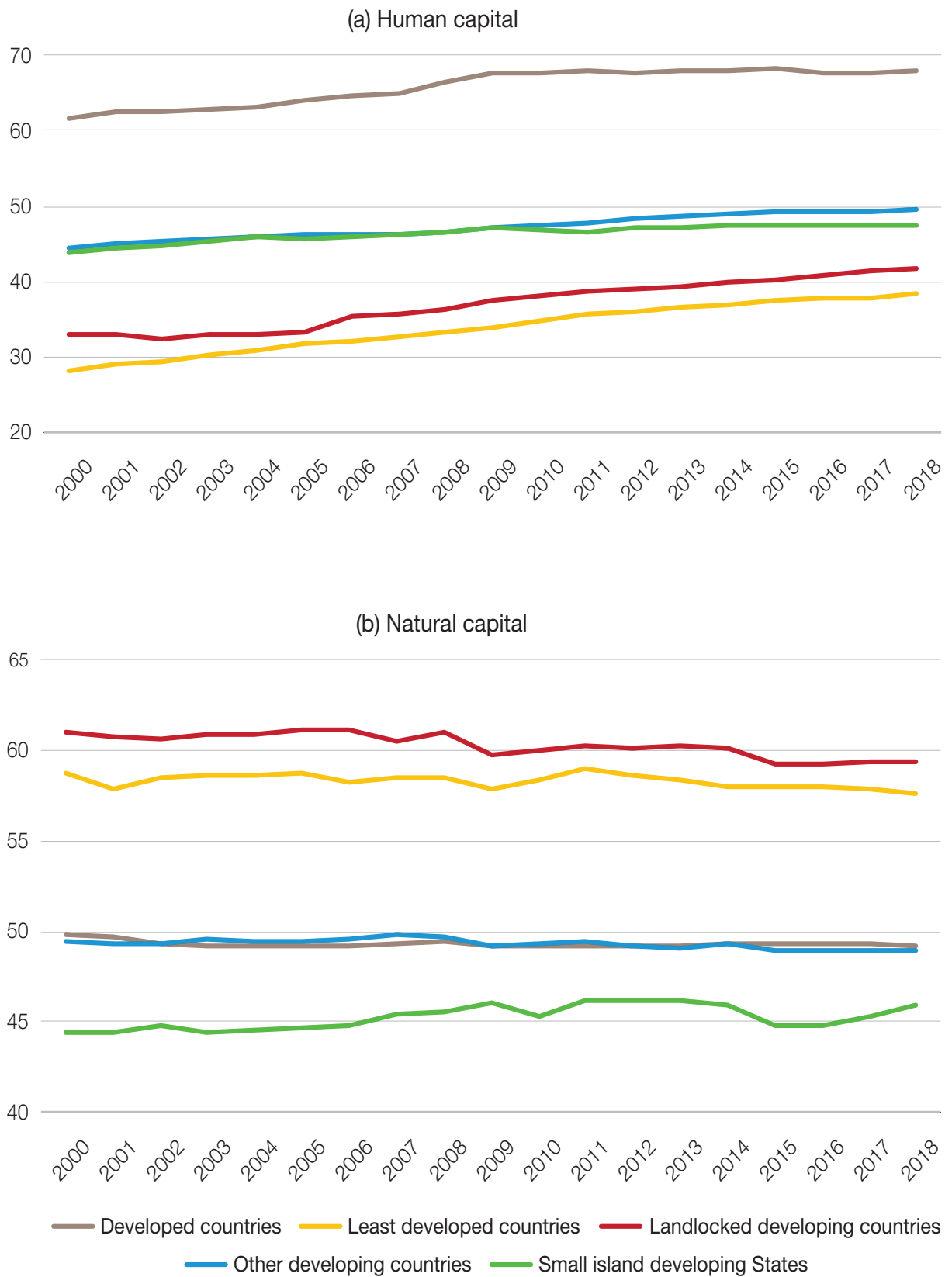
The final PCI score is the geometric average of the values for the eight PCI categories, which aim to guide development policies to place equal emphasis on each of the three pillars of productive capacities. The eight categories which form the multidimensional PCI are energy, human capital, ICTs, institutions, natural capital, the private sector, structural change and transport. However, category-specific scores also provide useful insights into the challenges or gaps at the national level. Category-specific scores also help in comparing national performances across the pillars, to identify domestic gaps and

limitations, together with policies and strategies required to address related challenges. The values are standardized, ranging between 0 and 100, to provide a readable interpretation of the PCI categories by clustering all single variables into homogeneous groups.

Human capital and natural capital are part of the productive resources (factors of production) in the conceptual definition of UNCTAD of productive capacities (see figure 12).

The human capital category of PCI is composed of health and education metrics, while natural capital refers to the availability and use of ores, oil, agricultural land and forests, etc. There is an inverse relationship between the level of economic development and natural capital wealth and between the latter and the human capital category. That is, developed countries, as a group, are at the bottom of the distribution for the natural capital category and poorer and weaker economies, such as those of LDCs and LLDCs, outperform the other groups. Similarly, but not surprisingly, developed countries outperform the other groups with regard to the human capital category and LDCs and LLDCs lag behind the other groups. In other words, poorer and weaker economies that score higher with regard to natural capital are at the bottom of the distribution with regard to human capital. Three additional observations can be made

Figure 12
Evolution of human and natural capital categories



Source: UNCTAD.

with regard to this phenomenon. First, the high level of natural capital in LDCs and LLDCs entrenches the high level of commodity dependence of exports and the constrained economic diversification in the two groups. Second, poorer economies have not yet captured their natural capital wealth in advancing their human resources development and structural transformation. Third, these countries have significant untapped potential that, if effectively harnessed, can greatly enhance their human capital development, diversification and structural transformation. Small island developing States, which have the lowest score under the natural capital category, demonstrate a relatively higher level of human capital development, principally due to the small sizes of their populations.

The ICTs and structural change categories are two key areas that starkly divide country groups in PCI measurement and performance (see figure 13).

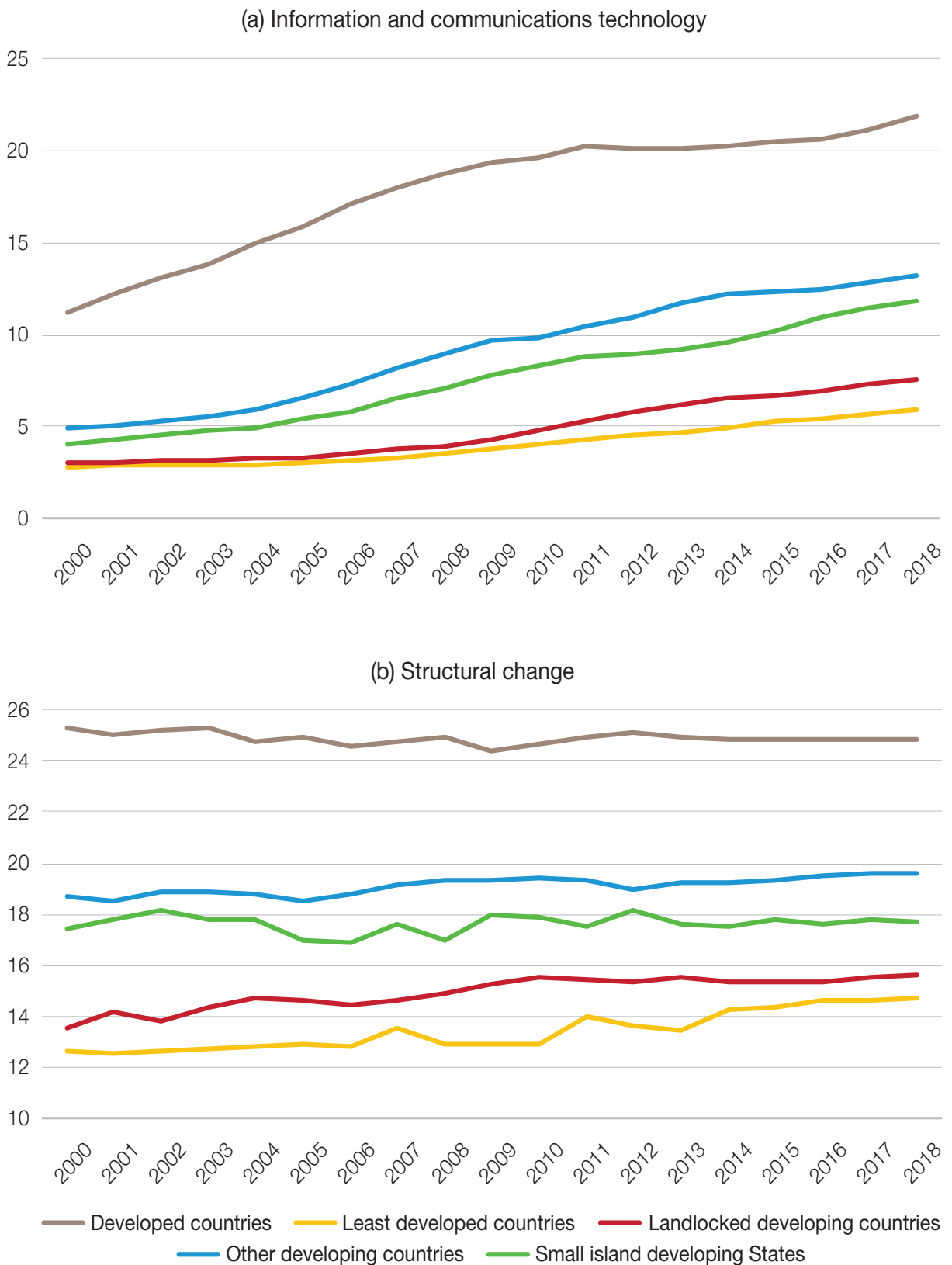
The gap between developed and developing countries is significantly greater in these areas than under the other categories. Scores under the ICT category are steadily rising among almost all groups, but to different degrees. A closer examination of the evolution of indicators and improvements in the ICTs category in LDCs, LLDCs and several other developing countries shows that it is driven largely by a substantial increase

in mobile telephone subscriptions. Access to broadband Internet and the use of ICTs in business and productive purposes have remained stagnant over the years. As with the overall PCI score, the performance of the various groups under the two categories is similar. That is, developed countries are at the top of the distribution and LDCs and LLDCs are at the bottom, indicating a continuously widening digital divide. Several developing countries, in particular in East Asia, have successfully tapped the potential of ICTs and their performance under the structural change category is better than those of the other developing regions. The poor performance of LDCs and LLDCs with regard to the structural change category indicates their dependence on commodities exports and their lack of integration into both regional and global commodity value chains.

The energy category is another area in which there are significant gaps between different groups of countries (see figure 14).

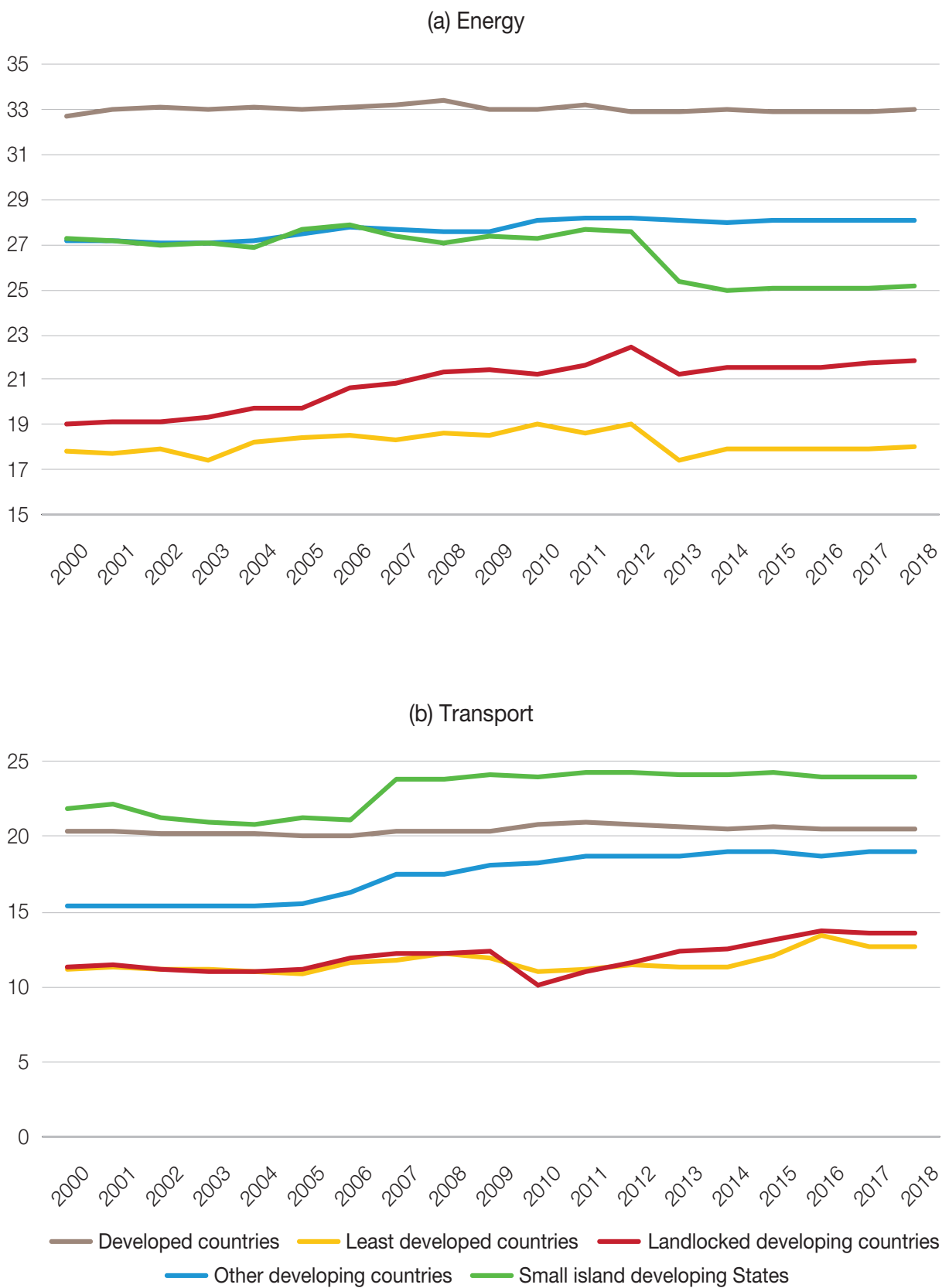
This category provides a composite measure of energy availability and access according to consumption, dispersion and efficiency data. It also captures environmental sustainability through the inclusion of the share of renewable energy resources. As anticipated, LDCs and LLDCs are experiencing weak levels of improvement, although the usage of sustainable and renewable power

Figure 13
Evolution of information and communications technologies and structural change categories



Source: UNCTAD.

Figure 14
Evolution of energy and transport categories



Source: UNCTAD.

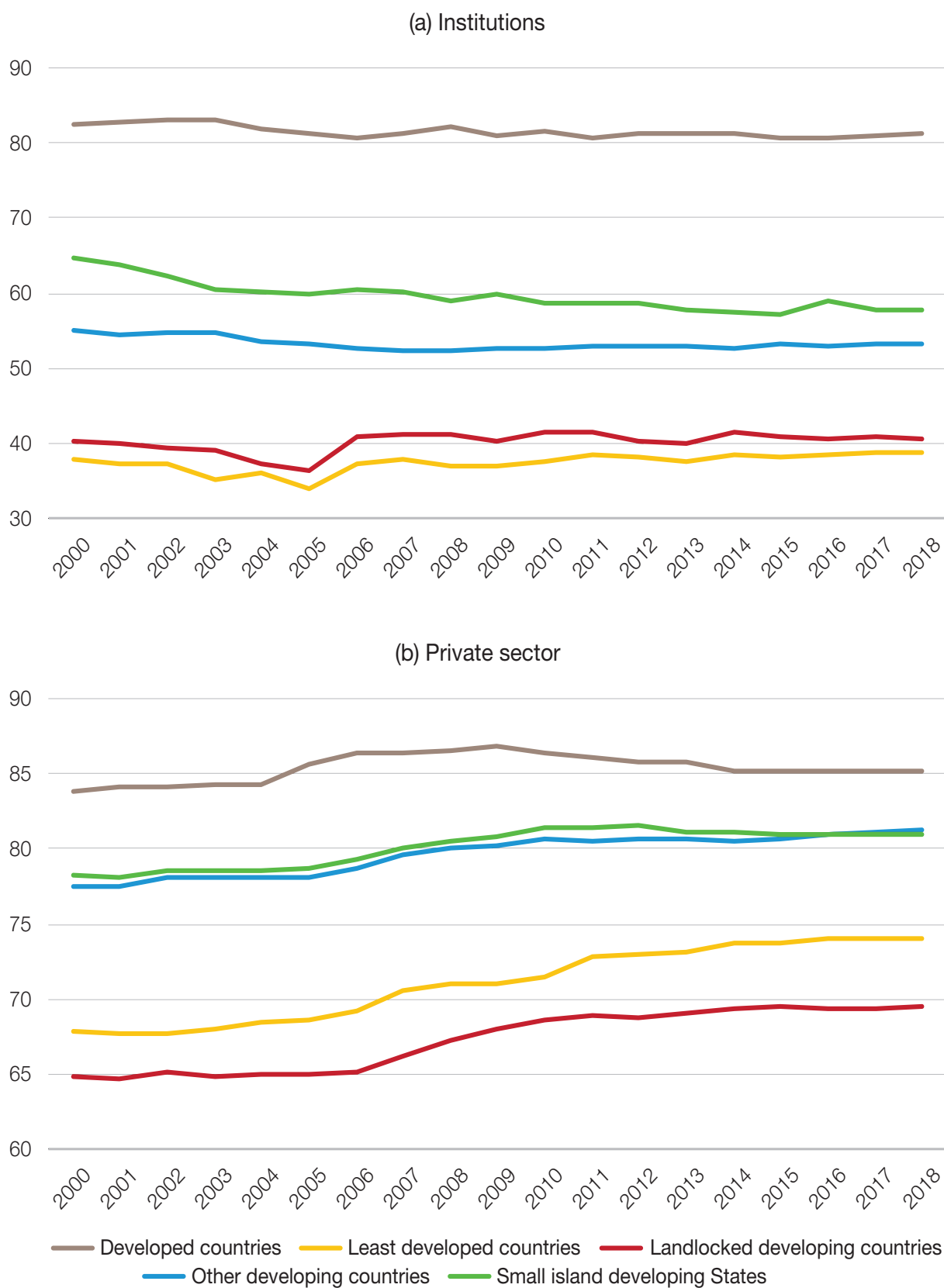
sources is unevenly scattered and subject to access and availability. Similarly, energy access is often concentrated in urban regions and leaves rural areas with significant shortages, and an efficient use of energy, particularly electricity, remains a target that has not yet been achieved in many countries. Finally, in the last decade, the downward spike in performance under this category, in particular in LDCs, is due to the increased availability of data and statistical information. However, the use of energy for productive purposes is a challenge in many poor and structurally weak economies, undermining the capacity of firms to competitively produce and export. With regard to the transport category, the indicators used include road, air and rail passengers, as well as physical infrastructure, namely roads, airlines and railways. Small island developing States lead the various groups due to their demographic features (small population) and smaller size and/or surface area, when measured using indicators that utilize population or geographical ratios as units of measurement. Therefore, it is important to note that the seemingly higher performance of small island developing States under this category must be interpreted with caution and understood in the context of their unique geographical and structural characteristics. As with the other categories, LDCs and LLDCs are at the bottom of the distribution due to their limited road and railway networks, as well as the numbers of passengers.

Specifically, in LLDCs, lack of access to the sea determines their reliance on the networks and institutions of transit countries and the high transit transport cost that undermines their export competitiveness.

Institutions are a further area in which there are gaps between the various groups (see figure 15).

In recent years, these gaps have been widening, indicating an increased divergence between developed and developing countries and among the various groups of developing countries. Functioning institutions capable of formulating and implementing development policies are critical, not only to generate economic growth, but also to ensure the inclusivity and sustainability of such growth. Developed countries often exhibit higher PCI scores, while developing countries display a considerable degree of variance and divergence. Similarly, LDCs and LLDCs are at the bottom of the distribution and often characterized by weak capacities to form effective policies and further weakened capacities to implement them, as well as poor institutional coordination and fragmented or disjointed rules and regulations. Several countries in these groups are also experiencing conflict, corruption and a lack of accountability, thereby undermining the effective functioning of institutions. Weak institutions are also mirrors of poor levels of human capital, the use of ICTs and related

Figure 15
Evolution of institutions and private sector categories



Source: UNCTAD.

technologies and the low overall productivity of a given economy.

The private sector category is an important area in which there have been substantial improvements and increasing convergence between developing and developed countries. LDCs and LLDCs are at the bottom of the distribution. However, robust improvements may be observed in advanced developing countries, notably in East Asia, in both the aggregate and for the individual variables used.

Furthermore, the overall values show an increasing convergence between these economies and those of developed countries. There are also several other developing economies, particularly those that have recently emerged as financial centres, that have significantly higher scores than the average score for other developing countries, including Bahrain, Mauritius, Panama, Qatar, South Africa, the United Arab Emirates and Bermuda, all of which perform well above the average score of other developing countries.

APPENDIX I

INPUT VARIABLES

To compute PCI scores, the algorithm requires input variables and auxiliary data and three other fundamental files: PCI galaxy, PCI categories and data type. Input variables are stored in long format in Program/Data/variables/data.csv. To be properly read by the programme, new variables should follow the following format by either overwriting an existing variable or adding a new column:

Country code	Year	Variable 1	Variable 2	...	Variable 46
International Organization for Standardization 3166-1 alpha-3	Year	Value	Value	...	Value

APPENDIX II

INDICATORS

Category	Indicator	Source of data
Energy	Share of people with access to electricity	World Bank Sustainable Energy for All
	Transmission and distribution losses as share of primary supply	IEA Statistics, OECD
	Renewable energy consumption as share of total final energy consumption	World Bank Sustainable Energy for All database from the global tracking framework jointly led by the World Bank, International Energy Agency and Energy Sector Management Assistance Programme.
	GDP per kg of oil consumption	IEA Statistics, OECD 2014 (iea.org/stats/index.asp ; subject to https://www.iea.org/terms)
	Total primary energy supply per capita	IEA Statistics, OECD
	Total energy consumption per capita	IEA Statistics, OECD
Human capital	Expected years of schooling	United Nations Development Programme
	Research and development expenditure as share of GDP	UNESCO Institute for Statistics
	Researchers in research and development per million people	UNESCO Institute for Statistics
	Health adjusted life expectancy (years)	http://ghdx.healthdata.org/gbd-2017
	Health expenditures as share of GDP	World Health Organization global health expenditure database
	Fertility rate	United Nations Population Division: World Population Prospects (2019 revision) Census reports and other statistical publications from national statistical offices Eurostat demographic statistics United Nations Statistics Division, population and vital statistics report (various years) International database, Census Bureau, United States of America Secretariat of the Pacific Community statistics and demography programme
	ICTs	Number of fixed broadband subscriptions per 100 people
Number of mobile telephone subscriptions per 100 people		International Telecommunication Union, World Telecommunication/ICT Development Report and database
Number of fixed lines per 100 people		International Telecommunication Union, World Telecommunication/ICT Development Report and database
Secure Internet servers per million people		World Development Indicators (infrastructure)
Number of Internet users as share of population		International Telecommunication Union, World Telecommunication/ICT Development Report and database

Category	Indicator	Source of data
Institutions	Control of corruption	World Governance Indicators
	Government effectiveness	World Governance Indicators
	Political stability and absence of violence/terrorism	World Governance Indicators
	Regulatory quality	World Governance Indicators
	Rule of law	World Governance Indicators
	Voice and accountability	World Governance Indicators
Natural capital	Agricultural land as share of land area	Food and Agriculture Organization of the United Nations
	Forest area as share of land area	Food and Agriculture Organization of the United Nations
	Share of all extraction flows in GDP	http://www.materialflows.net/
	Material intensity (total extraction flows over industrial value added)	UNCTAD computation based on United Nations statistics for national accounts, analysis of main aggregates and http://www.materialflows.net/
	Total natural resources rent as share of GDP	Sustainable Development Goals data
Private sector	Domestic credit to private sector as share of GDP	International Monetary Fund, International Financial Statistics
	Cost to export a container	World Bank Doing Business project
	Time to export (days)	World Bank Doing Business project
	Cost to import a container	World Bank Doing Business project
	Time to import (days)	World Bank Doing Business project
	Enforcing of contracts (days)	World Development Indicators (private sector)
	Starting a business (days)	World Bank Doing Business project
	Trademark applications	WIPO
Patent applications	WIPO	
Structural change	Export concentration index	UNCTADStat database
	Economic complexity index	UNCTAD computation based on UNCTAD trade data
	Gross fixed capital formation as share of GDP	https://unstats.un.org/unsd/snaama/
	Industrial ratio (industry and services over total GDP)	UNCTAD computation based on United Nations statistics for national accounts, analysis of main aggregates
Transport	Air transport, registered carrier departures worldwide per 100 people	International Civil Aviation Organization
	Air transport, freight (million ton-km)	International Civil Aviation Organization
	Air passengers per capita	UNCTAD computation based on data from the International Civil Aviation Organization
	Logarithm of km of roads/100km ² land	International Road Federation, World Road Statistics
	Logarithm of total km of rail lines per capita	UNCTAD computation based on World Development Indicators database and web-based archives

APPENDIX III

SENSITIVITY ANALYSIS

The impact of different data selections on the PCI scores is assessed by comparing rankings across various specifications. The specifications vary in terms of the imputation and normalization strategies utilized. The results are encouraging, in that the correlations across all categories of PCI are often 0.8 or higher. A notable exception is the transport category, due to the high number of imputed values. However, in this case both the Dineof imputation strategy, based on Beckers and Rixen (2003) and the Amelia bootstrapping-based algorithm score above 0.93 in terms of final PCI values. Finally, the PCA rotation strategy does not have an impact on the PCI scores.

Correlation		Energy	Human capital	ICTs	Institutions	Natural capital	Private sector	Structural change	Transport	PCI
Imputation	Amelia	0.86	0.97	0.92	0.96	0.93	0.96	0.94	0.74	0.93
	Dineof	0.88	0.96	0.94	0.99	0.72	0.89	0.93	0.73	0.93
Rotation	Cluster	1	1	1	1	1	1	1	1	1
	No rotation	1	1	1	1	1	1	1	1	1

APPENDIX IV

MULTIVARIATE ANALYSIS

Step 1

An initial PCA is conducted for each PCI category. For structural change, PCA results in the following:

	PC1	PC2	PC3	PC4
Loading/eigenvalue	1.79	1.03	0.78	0.39
Variance explained	0.45	0.26	0.2	0.1
Cumulative variance explained	0.45	0.71	0.90	1

The factor loadings are as follows:

	PC1	PC2	PC3	PC4
Concentration	-0.81	0.21	0.36	0.41
Fitness value	0.87	-0.06	-0.16	0.46
Fixed capital formation	0.05	0.95	-0.32	-0.02
Industrial ratio	0.61	0.29	0.73	-0.11

Step 2

The principal categories are filtered by constraints imposed on each factor's eigenvalue and explained variance, as follows:

	Loading/eigenvalue	Variance explained	Cumulative variance explained
PC1	1.79	0.45	0.45
PC2	1.03	0.26	0.71

Step 3

The factors are rotated, resulting in the following:

	RC1	RC2
Concentration	-0.83	0.14
Fitness value	0.87	0.007
Fixed capital formation	-0.02	0.95
Industrial ratio	0.58	0.34

	Loading/eigenvalue	Variance explained	Cumulative variance explained
RC1	1.79	0.45	0.45
RC2	1.04	0.26	0.71

Specifically, RC1 and RC2 account for 63 and 37 per cent of the total 71 per cent of variance explained.

Step 4

For each factor, factor scores are computed and weighted by their share of variance explained. Then, they are used to calculate the PCI structural change category score as the standardized sum of the two weighted rotated factor scores, as follows:

$$X_i = \frac{F_{i,o} - F_{i,min}}{F_{i,max} - F_{i,min}}$$

Where $F_i = \sum_{k=1}^K F_k$ where K is the number of rotated factors. This also holds for $K = 1$.

APPENDIX V

CRONBACH'S ALPHA

Cronbach's alpha is a measure to assess the reliability, or internal consistency, of a set of scale or test items. Generally, the higher the Cronbach's alpha, the more intercorrelated the indicators are among themselves (see table). For this reason, Cronbach's alpha is widely used to assess the level at which a set of items measures a single unidimensional latent construct. Cronbach's alpha is defined as follows:

$$\alpha = \frac{M_i}{M_i - 1} \left(1 - \frac{\sum_{j=1}^{M_i} \sigma_{j,i}}{\sigma_i} \right)$$

Where M_i is the total number of weighted indicators in category i , $\sigma_{j,i}$ is the variance of the indicator j and σ_i is the variance of category i .

Productive Capacities Index categories: Cronbach's alpha

	Energy	Human capital	ICTs	Institutions	Natural capital	Private sector	Structural change	Transport
2000	0.07	0.84	0.84	0.97	-0.26	0.79	0.52	0.52
2001	0.06	0.84	0.85	0.97	-0.23	0.79	0.52	0.52
2002	0.06	0.85	0.85	0.96	-0.24	0.79	0.53	0.51
2003	0.07	0.84	0.86	0.96	-0.14	0.79	0.52	0.52
2004	0.08	0.84	0.86	0.97	-0.17	0.79	0.51	0.53
2005	0.09	0.84	0.88	0.97	-0.17	0.80	0.51	0.52
2006	0.12	0.83	0.88	0.96	-0.16	0.79	0.50	0.53
2007	0.14	0.83	0.86	0.96	-0.14	0.80	0.51	0.53
2008	0.17	0.84	0.88	0.96	-0.12	0.82	0.50	0.55
2009	0.17	0.84	0.87	0.96	-0.02	0.81	0.56	0.54
2010	0.16	0.83	0.82	0.96	-0.03	0.81	0.51	0.54
2011	0.17	0.84	0.81	0.96	-0.06	0.81	0.49	0.53
2012	0.16	0.84	0.80	0.96	-0.10	0.81	0.50	0.52
2013	0.34	0.84	0.81	0.96	-0.08	0.82	0.50	0.51
2014	0.34	0.84	0.79	0.96	-0.08	0.81	0.50	0.50
2015	0.35	0.84	0.79	0.96	-0.02	0.81	0.51	0.50
2016	0.35	0.84	0.78	0.96	-0.01	0.82	0.50	0.49
2017	0.34	0.84	0.76	0.96	-0.02	0.82	0.52	0.48
2018	0.34	0.84	0.75	0.96	-0.04	0.82	0.52	0.47

Source: UNCTAD.

Theoretically, Cronbach's alpha as a reliability test is justified through the assumption that, if two indicators were perfectly uncorrelated, the variance of their linear combination would be equal to the sum of their individual variances. Conversely, the more the indicators are correlated, the more the total variance increases by the effect of cross-correlations. For this reason, alpha values close to 0 indicate uncorrelated indicators, alpha values close to 1 indicate highly correlated indicators and negative alpha values indicate negatively correlated indicators. If the indicators are used to describe a single unidimensional latent construct, namely one of the PCI categories, the alpha values should be significantly different from 0.

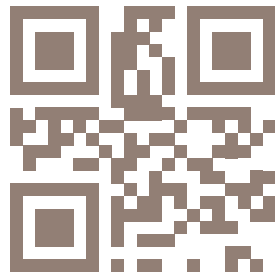
APPENDIX VI

CORRELATION MATRIX

	Energy	Human capital	ICTs	Institutions	Natural capital	Private sector	Structural change	Transport	PCI
Energy	1.00								
Human capital	0.73	1.00							
ICTs	0.75	0.85	1.00						
Institutions	0.62	0.79	0.81	1.00					
Natural capital	-0.35	-0.40	-0.42	-0.45	1.00				
Private sector	0.50	0.59	0.58	0.67	-0.41	1.00			
Structural change	0.59	0.73	0.65	0.59	-0.34	0.56	1.00		
Transport	0.42	0.39	0.53	0.49	-0.48	0.41	0.35	1.00	
PCI	0.82	0.89	0.93	0.88	-0.45	0.71	0.77	0.63	1.00

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