UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

First Meeting of the Productive Capacities Index (PCI) **Statistical and Technical Task Team**

Background Note

This background note has not been formally edited.

First Meeting of the Productive Capacities Index (PCI) Statistical and Technical Task Team

Background Note[1]

1. Background

The Productive Capacities Index (PCI) is aimed at supporting developing countries in understanding the status of their productive capacities, the gaps and limitations thereof and how they can be improved. The Index is based on the United Nations Conference on Trade and Development (UNCTAD)'s three-pillar conceptualization of productive capacities as the productive resources, entrepreneurial capabilities and production linkages that, together, determine a country's ability to produce goods and services that enable it to grow and develop.

The first version of the PCI covered 193 economies over the period from 2000-2018. The set of productive capacities and their specific combinations are mapped across 46 indicators along eight components within the three broad pillars defined above. This makes the PCI multidimensional in its analytical abilities, statistical measurements, and capacity to set benchmarks. The PCI also allows for the assessment of existing gaps and limitations within and across countries and regions based on eight key components of productive capacities, namely: natural capital, human capital, energy, ICT, transport, structural change, institutions, and the private sector. The PCI is not only multidimensional. It is also interconnected, as improvements in one indicator are directly linked to improvements in other indicators.

The Index is designed to influence policy formulation and implementation at national and regional levels. This can be done through National Productive Capacities Gap Assessments (NPCGAs), with an aim to diagnose the areas where countries may be leading or falling behind, and spotlight where policies are working and where corrective efforts are needed. In essence, NPCGAs aim to operationalize the scores of the PCI by offering unique insights into the performance of economies based on the Index and assessments of domestic policy and institutional frameworks, underpinned by empirical research. As such, they help in the identification of comparative advantages and the articulation of key binding constraints to economic development. They are also instrumental in mapping intervention strategies. The novelty and value-added of NPCGAs lie in their consistent and systemic application of the eight components of the PCI, key indicators used in the construction of the Index and a closer examination of micro, meso and macroeconomic policies, institutional and governance frameworks, as well as the identification of domestic challenges and opportunities. In sum, NPCGAs and the PCI serve as recommendations for a roadmap for future policy actions and targeted interventions under each of the PCI's eight components.

The PCI was developed in response to the request by member States at the UNCTAD XIV Conference in Nairobi (the Nairobi Maafikiano Paragraph 76k) and the United Nations Economic and Social Council (E/RES/2017/29). The Index was peer-reviewed and validated at national and regional levels by leading technical experts across the United Nations system, as well as by academics and government stakeholders. It has also been enhanced by the

[1] This background note is prepared to provide information on the Productive Capacities Index (PCI) in order to facilitate the deliberations of the Statistical and Technical Task Team.

inclusion of productive capacities in the Istanbul Programme of Action for LDCs and the Vienna Programme of Action for LLDCs, as well as in the newly adopted Doha Programme of Action for LDCs as an important tool to address the development challenges of these groups of countries.

2. Eight components of the PCI:

- **The Human Capital** component captures the education, skills and health conditions possessed by population, and the overall research and development integration in the texture of society through the number of researchers and expenditure on research activities. The gender dimension is reflected by the fertility rate, which at each increase reduces the human capital score.
- **The Natural Capital** component estimates the availability of extractive and agricultural resources, including rents generated from the extraction of said natural resource, less the cost of extracting the resource.
- **The Energy** component measures the availability, sustainability, and efficiency of power sources. It is composed of indicators measuring the use and access to energy, losses in distribution and renewability of energy components and sources, and includes the GDP generated by each unit of oil to highlight further the importance of optimal energy systems.
- **The Transport** component measures the capability of a system to take people and goods from one place to another. It is defined as the capacity of an economy's roads and railways network, and air connectivity.
- **The Information and Communication Technology (ICT**) component estimates the accessibility and integration of communication systems within the population. It includes fixed line and mobile phones users, internet accessibility and server security.
- **The Institutions** component aims at measuring political stability and efficiency through its regulatory quality, effectiveness, success in fighting criminality, corruption and terrorism, and safeguard of citizens' freedom of expression and association.
- **The Private Sector** component is defined by the ease of cross-border trade, which includes time and monetary costs to export and import, and the support to business in terms of domestic credit, the speed of contract enforcement and time required to start a business.
- **The Structural Change** component refers to the ability to undergo effective structural economic transformation and the propensity a country can exhibit towards the process. This is currently captured by the sophistication and variety of exports, the intensity of fixed capital and the weight of industry and services in total GDP. While structural change may connote short-term shifts in economic parameters such as the change in the composition of the GDP or trade, structural transformation is viewed as long-term, profound, and systemic changes in key economic parameters such as technological embodiment of production or sophistication of exports.

2.1. Justifications behind the choice of components

The eight components of the PCI are chosen based on several considerations: The first consideration is the theoretical and empirical relevance of each of the components selected for production transformation. The second reason behind the choice of components is their

relevance for the socioeconomic development of developing countries. Thus, the PCI is not only a statistical tool, but also serves to guide the formulation and implementation of development policies and strategies in member States. The third important reason behind the choice of components is consistency and conformity with the emerging development paradigm, because a "business-as-usual" approach is no longer an option. Such an approach is necessary to guide the shift in domestic policies and strategies from the current short-term, sector-specific, and project-based interventions towards long term, comprehensive, economy-wide, and programme-based approaches to development. The final reason behind the choice of the components is the link that each category has with the fostering of productive capacities as key to kick start the process of structural economic transformation.

2.2. Justifications for the choice of indicators

For such a broad notion as productive capacities, it is important to justify as to why a given indicator is chosen over several others that can directly or indirectly influence the process of building productive capacities and fostering structural economic transformation. In this regard, special attention has been given to the input nature of the indicator to maximize a given output. That is to say, the PCI and the indicators used in constructing the Index are viewed as inputs rather than outputs.

The Index seeks to respond to the following questions: What level of productive capacities are needed to achieve inclusive growth and sustainable development as measured by indicators other than GDP growth? What mix of policies and strategies are needed to accelerate inclusive growth and development in developing countries? And what are the sources of such growth? Relationships and connections among the indicators used and the components selected are also important dimensions that were considered in the choice of indicators. The intention here is to emphasize causality more than correlation. Building on the existing literature and established conceptual framework, the PCI aims, for example, to assess how improvements in human capital help economies to harness the potential of the ICT or entrepreneurial capability of the private sector.

The availability of consistent, reliable, and internationally comparable data and statistics is a further consideration in the choice of indicators in each of the components of productive capacities. The PCI relies on a common core of globally harmonized and standardized data series available regardless of countries' development status and statistical capacity. This is because data scarcity and its low quality, as well as the fact that it may not be comparable across countries, add additional constrains to the selection process. Despite these challenges, deliberate efforts have been made to maintain the high level of methodological rigor of the Index, in parallel with the policy use and relevance of a given indicator. For instance, using too many indicators in the development of the PCI is avoided in order not to overburden policy interpretation and interventions at the national, sub-regional, regional and global levels.

Finally, because of systemic inconsistency and variation in methodologies, the use of other indices has been systematically avoided in the construction of the PCI. Exceptions to this consideration have been made for the use of the UNCTAD Merchandise Export Concentration Index and the Export Complexity Index. The statistical methodology and data quality of these

indices, in particular, are well known to UNCTAD. However, indicators used elsewhere have been included among specific components as necessary and relevant as possible. Another factor is to avoid including highly correlated input variables in the PCI, which measure the same aspects of productive capacities.

2.3. Peer reviews and pilot countries for the PCI

With a view to maximizing the use and application of the PCI and to examining its methodological and statistical consistency, a series of peer reviews, including academic and technical reviews were undertaken during several phases throughout the development of the PCI. This includes: (i) A brainstorming meeting which was held in Geneva in 2017 with the participation of experts drawn from relevant United Nations entities, international organizations, academics and national experts from selected institutions and countries; (ii) A meeting held in Windhoek, Namibia in April 2019, with the participation of policy experts, advisors, technocrats and statisticians drawn from several African countries; (iii) Academic reviews by selected academics and specialists who have expertise in developing regional and global composite indices; and (iv) Peer review of the methodology, indicators used and statistics (data) collected for the construction of PCI by the United Nations team of experts, including from the United Nations Development Programme (UNDP) and the UN Statistics Division (within UN Department of Economic and Social Affairs (UNDESA).

Further national and regional reviews and validation of the PCI have also taken place in Gaborone, Botswana (2015, 2019); Santiago, Chile (2019); Almaty, Kazakhstan (2018); Vientiane, Lao PDR (2018, 2019, 2020); Ulaanbaatar, Mongolia (2018); Windhoek, Namibia (2019); Abuja, Nigeria (2019); Kigali, Rwanda; (2017, 2019 and 2020) and Bangkok, Thailand (2019). The Index has also been piloted in several countries and led to the formulation of National Productive Capacities Gap Assessments (NPCGAs) for Angola, Ethiopia, Kenya, Nigeria, and Zambia.

2.4. Key desirable features of the PCI

As discussed above, the primary objective of the PCI is to change policy narratives and intervention strategies at the national, regional and global levels. The PCI should, therefore, be viewed as an" integrated whole" where interventions in one area will have spillovers in another area, signalling the need for holistic, multi-sectoral and multiyear programmes.

The Index has several further attributes: First, it is aligned with the theoretical and conceptual framework of productive capacities advanced by UNCTAD. Likewise, the choice and selection of indicators are also theoretically grounded with a focus on those which are directly relevant for transformation; thus, indicators and the composite Index have intrinsic meaning and relationships for policy formulation and implementation.

Second, the Index shows the evolution overtime within a given country as this is key to identify areas where progress or lack thereof is observed. Both the overall PCI and its components should be capable of tracing changes over time. This is important in order to map intervention strategies for governments and stakeholders and bridge the gap(s) through the

National Productive Capacities Gap Assessments (NPCGAs), which are part of the workstream guided by the PCI.

Third, the PCI, although not intended to rank countries, is designed to enable development experts and policymakers to compare progress between their respective countries and their neighbouring countries, other comparable countries, and regions. Regional aggregation is equally necessary for regional comparability to facilitate information sharing on best practices between and among countries and regions. In this regard, the PCI enables policy-consistent comparison between countries and regions.

Fourth, the PCI attaches equal importance to its eight components because each of the dimensions is critically and equally important for production transformation. This is consistent with empirical and historical evidence gathered from country-level development experiences. For example, several countries where transport infrastructure has developed or where energy (electricity) is a major export item, regardless of the real economy such as agriculture, industry or the services sectors, show weak or poor transformation. In some cases, where micro and macroeconomic fundamentals are sound and institutions vibrant, the role of the private sector is negligible. This is also consistent with UNCTAD's argument that each component and interconnections among them are critically important. Hence, policy aspirations should aim at developing economy-wide productive capacities for which holistic and multisectoral approaches are necessary.

Fifth, there are also intrinsic relationships between each of the components, whether the components are positively correlated with the PCI or with one another. For instance, fostering human capital is key for tapping the potential of the ICT sector or enhancing the role of the private sector. Likewise, natural capital holds the potential for structural transformation. It is also vital for mobilizing public investments in the form of rents from such natural capital to improve human capital or infrastructure, for example. In short, the overall Index and the PCI components may not necessarily have a uni-directional relationship, and as such, use internationally comparable and publicly accessible, as well as verifiable data to the extent possible.

Sixth, the PCI is designed to have the flexibility to be aggregated at different levels, such as by income groups, geography and regional economic groupings. This shows the importance of the overall composite Index, as well as component-specific scores (values).

Finally, in the construction of the PCI, comparability of components across and within countries is a further desirable feature. This is believed to enhance the analysis of gaps and limitations in productive capacities, as well as facilitate the interpretation and application of the PCI in domestic policy formulation and implementation.

2.5. Tasks accomplished

After four and half years of conceptualisation, mapping and development, the PCI was officially launched in February 2021 by the Secretary-General of UNCTAD. Since the launch, several operational and substantive activities have been undertaken by using the Index. The key ones include: (a) Engaging with member States at national, regional and global levels regarding the Index and its policy implications; (b) Sensitizing Governments and national

stakeholders including the private sector and civil society on country-specific performance on the Index and policy implications, as well as intervention strategies needed to foster productive capacities and structural transformation; (c) Identifying gaps and limitations in a given economy and devising ways and means for fostering productive capacities, which ultimately lead to effective policy formulation aimed at accelerating structural transformation, economic diversification and enhancing the process of sustainable development; and (d) Preparing analytical studies containing tailored policy recommendations to address development challenges stemming from the lack of productive capacities. Relevant publications include:

- *UNCTAD Productive Capacities Index: Methodological Approach and Results,*
- *Achieving Graduation with Momentum through the Development of Productive Capacities,*
- *UNCTAD Productive Capacities Index: Focusing on Landlocked Developing Countries,*
- *Enhancing Productive Capacities in Rwanda: A Coherent and Operational Strategy,*
- *Building and Utilizing Productive Capacities in Africa and the LDCs: A Holistic and Practical Guide,*
- *Benchmarking productive capacities in least developed countries*,
- *Harnessing the Potential of Nutraceutical Products for Export Diversification and Development in Landlocked Developing Countries (LLDCs): Assessment of Comparative Advantages and Binding Constraints.*

Moreover, a dedicated webpage was created for the PCI (available at *https://pci.unctad.org*), while the Index and related metadata and methodological considerations have become part of the UNCTADstat database.

Further application of the PCI has been extended to other topical areas of trade and development research, including:

- The PCI of Small Island Developing States (SIDS) has been analysed in the UNCTAD DGFF 2021 and DGFF 2021 (*https://dgff2021.unctad.org/economy/productive-capacity/*) and SDG –Pulse 2022 publication, together with policy implications (*https://sdgpulse.unctad.org/fostering-productive-capacities-to-graduate-with-momentum/*)
- *National Productive Capacities Gap Assessment (NPCGA) of Zambia*.

UNCTAD has also undertaken several important activities at the country level. The following countries have so far benefited from UNCTAD's engagement and work on building domestic productive capacities: Angola, Bolivia, Botswana, Ethiopia, Kenya, Lao PDR, Mongolia, Namibia, Nigeria, Paraguay, Rwanda, and Zambia. In order to enhance the understating and utilisation of the PCI as an instrument to address the capacity gaps in policy formulation and economic sectors, stakeholders in most of these countries have been trained how to use the Index in their development policymaking processes and a number of trainings for statisticians were held. Consultations are ongoing for the further expansion and deepening of UNCTAD's support to countries and regions such as Kazakhstan and other Central Asian countries, Asia-Pacific LDCs, including Cambodia, Bangladesh, Bhutan, Lao PDR, Nepal, and Timor-Leste, as well as African countries, including, Malawi, Mozambique, and Zimbabwe, among others.

With the view to expanding the PCI to the policy frontiers and making domestic polices centred on the fostering of productive capacities, National Productive Capacities Gap Assessments (NPCGAs) have been concluded for Angola, Ethiopia and Zambia and validated by the respective national governments. Two additional NPCGAs (that of Kenya and Nigeria) have also been completed. Similar efforts are in the pipeline for the Comoros, Djibouti and Senegal.

3. Updating the PCI

For maintaining the stability and predictability of the multidimensional and global Index, as well as ensuring its policy relevance and consistency, frequent updates and changes are not advisable. However, periodic updates and revisions are necessary to reflect evolving changes in factors and their intensity, influencing the development trajectories of nations. Updating is also necessary to capture the impact of unforeseen global shocks such as COVID-19 or the ongoing war in Ukraine, as well as the increasing impact of long-term crises such as climate change. These require not only updating the Index but also exploring new dimensions, changing indicators, as well as revising the methodology used in the construction of the PCI.

3.1. Regional PCI scores

To date, there has not been a standard aggregation method for regional values. For the purposes of simple comparison, UNCTAD, in its various analyses, has been using values or scores of a central tendency such as the arithmetic mean or median. However, the researchers are aware of the challenges of passing statistical scrutiny when applying central tendency combining scores of countries that are different in their economic, demographic, or geographical specificities.

The first meeting of the Statistical and Technical Task Team is expected to provide guidance on the best statistical or technical approach to the regional aggregation method. Regional values are required to compare a given country's performance to a typical country in the regional group – in which case an aggregation method resembling the median or arithmetic mean can be useful. However, to compare groups and regions, an aggregation that weighs countries by the size of the economy, population, etc. might be more useful.

3.2. PCI scores, robustness and scale issues

The previous methodology for calculating the PCI involved a statistical method that took the deviation of the observed value for any given indicator from its observed minimum and divided it by the difference between the observed minimum and maximum. In the process of standardisation, the minimum and maximum values of the entire data set for each indicator — rather than the minimum and maximum of each year — were used to normalize variations in the distribution of raw indicator values. This led to raw indicators with theoretical values ranging between 0 and 100, after which a Principal Component Analysis was applied to extract a unique score for each component of the PCI. The final score of the Index is the geometric mean of the values of the eight components.

Moreover, to ensure internal consistency and the robustness of each of the components, different sensitivity analyses were employed, including comparing rankings across the components and specifications. In all cases, the correlations between the PCI and the components were positive and often at 0.7 or higher, except for the natural capital component. In addition to ranking based on correlations, Cronbach's alpha technique was used, which also yielded correlation coefficients above 0.5, except for the energy (0.3) and natural capital (-0.1) components, although there is no cut off value for the technique. However, the values of the indicators have not been converted to a uniform scale for the main reason that there are no historical minimum and maximum values for most of the indicators used in developing the PCI. The statistical formula used is available for consultation in the methodological handbook, *UNCTAD Productive Capacities Index: Methodological Approach and Results,* and on the UNCTADstat database.

The Statistical and Technical Team may reflect on scaling and provide further guidance, should this be of statistical benefit or significance to the PCI.

3.3. Factoring and capturing exogenous shocks

External or internal shocks – be they economic, financial, health-related, or otherwise can have undesirable impacts on productive capacities and the key components captured in the Index. However, the updating exercise thus far reveals no substantial change in the countries' productive capacities scores or global positions. This may be because the PCI measures productive capacities and the countries' ability to produce goods and services which evolve over time. In other words, most of the dimensions measured in the PCI will not change markedly due to external shocks such as COVID-19. For instance, while the number of passengers of any given means of transport may change temporarily during the lockdown, this will correct itself when the lockdown ends. Moreover, some of the physical or natural capital will not be impacted due to the pandemic, although in the long run the impact of COVID-19 on human capital may, indeed, become more visible. Overall, as evidenced in the data released so far, the PCI does not seem to be a volatile index or highly sensitive to exogenous shocks, unlike other macroeconomic and financial indexes. This shows that only generalized shocks that simultaneously affect all dimensions of productive capacities are expected to have highly visible impacts on countries' national PCI performance. Other shocks will tend to translate more into a progressive and insidious gradual "eroding" process if the consequences of these events linger for longer than expected.

Following from the methodological implications of the use of Principal Component Analysis (PCA), negative external shocks, such as from the COVID-19 pandemic are captured differently by the PCI depending on their nature. If the shock does not affect the underlying linkages between the different concepts and dimensions defining productive capacities, a natural disaster for instance which only has an ad-hoc or temporary effect on a large variety of productive capacities' components, will be reflected by a decline in the value of the PCI as long as the effects persist. However, in the end, the PCI will naturally return to its initial trajectory. Alternatively, if the shock has an impact on the linkages across productive capacities, for instance, a shock which profoundly depresses the ability of the manufacturing sector to support exports, it will also have a repercussion on the assessment of productive capacities over the whole time period of the study: the general trajectory of the PCI will be

affected, tending to shift downwards. This is because the loadings of the PCA, in the current methodology, are fixed over time. Other specifications are possible for the "loadings", but they come with major methodological challenges, identification issues and technical complexity, against which their potential value added in factoring in structural shocks should be assessed.

Another challenge as to capturing shocks lies in the availability of timely data. Most data series used in the PCI are harmonized at the international level to ensure comparability but are in return released with a one- or two-year lag at best. It is then difficult to deliver "real-time" estimates of the PCI to inform policy making during the onset of major crises with pressing needs, such as the COVID-19 pandemic or the war in Ukraine. Real-time estimates are needed for forecasting the PCI based on the scores of the most recent years allowing policy recommendations to be based on the areas where the country risks falling behind under the assumptions of the forecast.

The Statistical and Technical Task Team is expected to provide guidance as to how to best address these challenges in factoring in shocks and capturing productive capacities under potentially changing circumstances.

3.4. Exploring new additional dimension(s): Environment and climate change

Since the launch of the PCI, capturing environmental and climate change dimensions in the Index has been at the centre of conversations at various forums. However, the same factors considered as key components or categories of the PCI are directly related to environment or climate change aspects. Therefore, the way forward on how to taper the positive and negative aspects of the categories needs to be explored.

For instance, factors that are considered critically important for productive capacities such as energy and transport can have adverse impacts on the environment and may increase carbon emissions in the atmosphere causing climate change. Likewise, the proportion of agricultural land in total land area or percentage of rents from natural capital can also impact on the environment and the climate necessitating environmental policies. In sum, whereas all current PCI components contribute to productive capacities in the same direction, the *prima facie* picture is more nuanced when it comes to adding a potential component or dimension on the environment and climate change. Such a component would not aggregate into the overall PCI score as straightforwardly as others. There is a need to assess the extent to which productive capacities are aligned with environmental policies and climate change-resilient development. Also, it is vital to find a set of indictors or variables that are statistically measurable and consistent with the theoretical or analytical framework regarding the nexus between the environment and development on the one hand, and climate change and development on the other.

Another critically important global issue that merits serious consideration in constructing multidimensional indices is climate change and its impacts on socioeconomic development, livelihood, survival, and, indeed, the overall development of nations. The Intergovernmental Panel on Climate Change (IPCC) has been at the forefront of scientifically articulating the increasing risks and dangers of climate change and its devastating consequences on the poor

and vulnerable people and societies, as well as global policies and strategies to facilitate climate change adaptation.

Currently, there are two main indices with environmental dimensions or indicators worth considering: The UN Environment Programme's Environmental Performance Index (EPI) and UNCTAD's Inclusive Growth Index. The EPI ranks countries' performance on high-priority environmental issues in two areas: the protection of human health and the protection of ecosystems. Within these two policy objectives, the EPI scores national performance on nine issue areas comprised of more than 20 indicators. EPI indicators measure a country's proximity to meeting internationally established targets or, in the absence of agreed targets, how nations compare to one another.

UNCTAD's Inclusive Growth Index shows countries' performance across four pillars: economy, living conditions, equality, and environment. Pillar 1. "Economy" considers GDP, national income, power consumption, employment, and trade. Pillar 2. "Living conditions" focuses on social and health conditions and logistics and finance. Pillar 3. "Equality" refers to labour participation, income inequality, school enrolment, political participation, gender socio-reproduction. Pillar 4. "Environment" includes natural capital protection (water, land, gas emissions) and energy intensity. Each of the pillars is composed of a set of correlated indicators.

The key questions, however, are: Will statistical measures and indicators of vulnerability and exposure fully capture the gravity and impact of climate change on economies, societies, and nations? How can the development impacts of climate change and adaptation policies and strategies such as a reduction in greenhouse gas emissions be accurately assessed? How to respond to these and related questions, as well as address the developmental impacts of environmental degradation and climate change through the PCI? And what indicators need to be used or are issues that need collective reflection and specialized technical and statistical knowledge? These and related issues will also be discussed and agreed upon by the Statistical and Technical Task Team (STTT).

Factoring in the environment and climate change in the PCI requires a theoretical framework which enhances or revisits the concept of productive capacities in light of the climate change challenges. Depending on the findings, two main approaches are possible as to implementing this framework empirically. First, mainstreaming the environment in all existing components by including new indicators that have environmental links or implications, or by examining the relationships between existing indicators and sustainable economic growth. Second, creating a standing alone component which may or may not be eventually combined with other components. The selected approach should also consider data availability, which remains scarce in this area.

3.5. Revisiting indicators used in the PCI

When the PCI was developed and launched, it was stressed that other indicators that may add value to the Index would be revisited in the future processes of expanding, updating and enriching the Index. For example, in the current PCI, under the human capital component six indicators are used: expected years of schooling, health-adjusted life expectancy, health

expenditure as a percentage of GDP, R&D expenditure as share of GDP, number of researchers in R&D per million people and the fertility rate. While some of these indicators can be used to assess the quality of education and health, there could be additional indicators that measure the quality of education and health services.

The Human Capital Index of the World Bank and the education quality indicators of the United Nations Educational, Scientific and Cultural Organization (UNESCO) include harmonized and standardized test scores, learning-adjusted years of schooling, among others, disaggregated by gender as a proxy for quality. Moreover, in the PCI, the fertility rate is used to include the gender dimension, instead of gender-disaggregated data under other indicators. Fertility rates are used as a proxy for several indicators used in the Gender Equality Index developed by the European Institute for Gender Equality, which uses about 15 indicators for which consistent and comprehensive global data are not readily available for all the countries.

This does not mean that other indicators do not exist or are less important. However, obtaining data for all relevant indicators and for all the countries is not straightforward, particularly, in the least developed countries (LDCs), landlocked developing countries (LLDCs) and small island developing States (SIDS). Revamping the selection of input variables should also go hand-in-hand with the strengthening of the macroeconomic concepts and theoretical basis underpinning each component of the PCI.

Regarding the Private Sector component, some indicators and related data used were from the World Bank's Ease of Doing Business Ranking and its Enterprise Surveys. The World Bank has recently changed and modified some indicators, which inevitably affects the private sector component of the PCI. Consequently, the Doing Business Ranking has undergone several technical amendments apparently due to some political policy reiterations through "visible hands", which put to question the legitimacy in the ranking itself. ***The question that arises in such circumstances is whether some of the indicators used in the PCI are still useful for inclusion. If yes, what concomitant changes are required?***

3.6. Enhancing the methodology

The PCI went through a rigorous and well-recognized, step-by-step methodological process. This involved identifying indicators, mapping data sources, imputing missing data forecasting, carrying out multivariate analysis, weighting and aggregation, computation, and sensitivity analysis – each with their distinct steps and features.

The PCI is developed by using "R" – statistical software that is widely used for data management, synthesis, and analysis and is freely available. The Index is calculated as a geometric average of the above-discussed eight components, with the scores ranging between 0 and 100. It went through various iterations and steps, including peer reviews by academics and statistical experts while "ground-truthed" in several pilot and other interested countries. Moreover, the PCI is not static but a dynamic index in a sense that it is subject to updating when better indicators are found; the methodology is reviewed consistently to capture potential changes in the statistical methodology and application of software.

This does not mean that the Index addresses all the issues related to productive capacities in an exhaustive manner. Like many other indices, the PCI may have its own inherent limitations and shortcomings, some of which stem from data availability or quality, or necessary choices and assumptions regarding the specifications of the statistical model. ***These and related limitations call for regular exchanges of views on the best available methodology to maximize the policy relevance and statistical scrutiny of the PCI.***

During 2022 updated data were collected for the input indicators. Together with this updating, some limited adjustments to the methodology were explored and, in some cases, implemented.

In the current updating exercise, UNCTAD is examining the best imputation techniques that could potentially replace "geographical proximity" used in the first version of the PCI. Such imputation, inspired from "gravity models", is not necessarily relevant for indicators unrelated to trade. It is expected to be replaced by a combination of imputation techniques contingent on the "circumstances" of the missing data: through either interpolation or machine learning algorithms ("MissForest").

The updated PCI will also offer possibilities for double exponential smoothing for the forecasting stage aiming to produce "real-time" estimates and short-term projections, in addition to ARIMA models that have been used so far but which are more constraining.

UNCTAD is also re-examining the required transformations of the input indicators to ensure their conformity with the assumptions from the diverse statistical techniques used along the PCI process (normalisation, stationarisation, etc.). The main challenge with these time series is that they tend to greatly differ from standard macroeconomic time series describing business or financial cycles for which such statistical methods were initially developed and used in the economic literature.

In this last update, UNCTAD identified the input data series in the PCI expected to be drastically impacted by the COVID-19 pandemic (e.g., tourism, etc.) and used a GDP series to adjust forecasting accordingly. Other approaches and/or auxiliary data series might be considered, subject to availability.

Furthermore, UNCTAD explored whether indicators on cost and time to import and export from the World Bank Doing Business Project in the Private Sector component could be replaced with newer versions of the same indicators. Considering the fact that the new versions did not perfectly correspond to the old and that further updates were not expected, UNCTAD explored if the Private Sector component could be made up out of the remaining six indicators in the category.

Lastly, UNCTAD considered improvements in the interpretability of the PCI though adjustment of the scaling of component scores and adjusting the scaling of indicators in the Natural Capital component.

Building on the above-discussed issues in the PCI updating process, UNCTAD considers the following three versions as outputs:

- **PCI Version I:** Extends the current PCI to 2021 with no changes to the indicators and methodology used, continuing the estimations based on the existing indicators with new data only.

- **PCI Version II**: Extends the current PCI to 2021 while changing some indicators and/or their dimensions without adjusting the methodology.

- **PCI Version III**: Extends the current PCI to 2021, changing indicators, dimensions, and elements of the methodology.

In the longer-term, UNCTAD is also considering the option of introducing dynamic regression to enhance the Principal Component Analysis (PCA). Moving to dynamic factor models may offer more flexibility in specifying the economic assumptions underpinning productive capacities, more options to cluster the PCI scores across components or regions and more robustness as to imputations and forecasting by using Kalman filtering for instance. However, this may in turn substantially increase the complexity of the tool, including for use by policy makers, as well as the costs for maintenance and updates.

The Statistical and Technical Task Team is invited, in addition to the methodological challenges described above, to review these latest series of adjustments to the methodology. In all the review processes, ensuring integrity and consistency of the PCI with the analytical framework and policy narratives should be the primary guiding principle.

4. The way forward

The key value of the PCI 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. That is, the PCI is at its most useful as an indication of what types of productive capacities are leading the way, and conversely, are lagging behind. It also serves a powerful purpose for cross-country comparison to aid benchmarking.

This does not mean that the PCI is meant to be the one, perfect, and only definitive assessment of productive capacities in the world's economies and should not be taken as such. Rather, it is a dynamic tool that can be further improved, updated, and enriched in the future. With the recalibration of the PCI and its components, ***UNCTAD seeks the guidance of the PCI Statistical and Technical Task Team to facilitate the process of: (a) Broadening the dimensions and the incorporating of new factors and elements; (b) Examining and proposing potential indicators for the new dimensions; and (c) Adjusting the methodology and addressing the questions pertinent to the process.*** These are key to enhance the accuracy and the relevance of the PCI and its components, including its multidimensional and holistic character.