

# Acceleration towards SDGs: How to identify the top performers ?

## Technical Background Document for the Asia-Pacific SDG Partnership Report 2020

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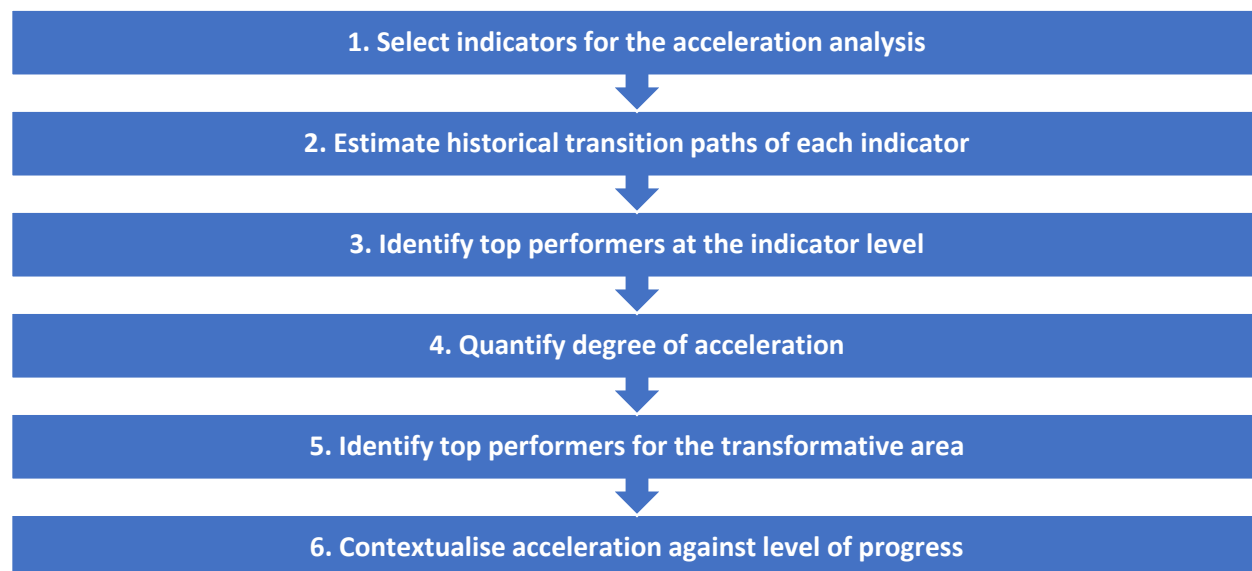
Azusa Reardon

### Introduction

This note introduces a methodology for identifying top performers in various aspects of sustainable development. Top performers demonstrate faster progress compared to historically observed progress patterns. The methodology can be applied to identify countries that are relatively making faster progress for each of the SDGs or transformative areas (or 'entry points') identified in [the Global Sustainable Development Report \(GSDR\) 2019](#) or the [SDSN \(2019\)](#) report.

The main idea behind the methodology is to compare, for any given measurable indicator, the recent rate of progress of countries against historically observed average rate of progress of performance for any specific level of performance. For example, in the case of expansion of electricity coverage in countries, the methodology estimates using historical data the average rate at which countries expanded their electricity coverage annually for each level of electricity coverage. The current performance of countries in terms of speed of expansion of electricity coverage is then compared against the historically observed rates of progress. The analysis helps to identify which of the countries are defying the historically observed path of progress and hence be tagged as top performers. It paves way for deeper analysis of these countries to learn lessons on acceleration of progress.

**Figure 1 : Six-step methodology to identify top performers**



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For each of the transformative areas in GSDR (2019) or SDSN (2019) or any of the SDGs, the proposed six-step methodology (see figure 1) can be applied to identify top performers. For the purposes of this note, the transformative areas in GSDR (2019) are used as an illustration. The transformative areas of GSDR (2019) are strengthening human well-being and capabilities; Shifting toward sustainable and just economies; Building sustainable food systems and healthy nutrition patterns; Achieving energy decarbonization and universal access to energy; Promoting sustainable urban and peri-urban development; and Securing the global environmental commons. The next section run in details through the six-step methodology for the specific transformative area on ‘Human capacity and well-being’.

## Six-step methodology to identify top performers

### Step 1: Select indicators for the acceleration analysis.

For each of the transformative area, we map out relevant full list of related SDG indicators. Number of indicators for each transformative area varies a lot. For example, while there are four indicators for achieving ‘energy decarbonization and universal access to energy’ under the SDG indicator list, there are over 40 indicators in the case of strengthening human well-being and capabilities.

A sub-set of indicators are used for conducting the acceleration analysis since the presence of too many indicators makes it difficult to identify the reasons for acceleration of countries. Hence, we can divide the transformative area into key dimensions and then select specific indicators to monitor performance in each of the dimensions.

For example, the human capacity and well-being transformative area of GSDR entail three key dimensions, namely, education, health and well-being. Four indicators of the Human Development Index can be used as a proxy in measuring progress along these three dimensions, namely, expected years of schooling and mean years of schooling for measuring performance on the education dimension, life-expectancy to measure the health dimension and the GNI per capita to measure the well-being dimension.

### Step 2: Estimate historical transition paths of each indicator.

For each of the indicator X, the historical transition path of countries will be estimated using a regression model. The transition path will estimate the average annual growth rate of progress of indicator for each level of the performance of the indicator using the global dataset spanning 1990-2018, depending on data availability<sup>2</sup>. This is estimated using a fractional polynomial method described in Royston, P., and W. Sauerbrei. (2008). The advantage of this approach is that the relationship is estimated using data itself rather enforcing a linear or polynomial relationship. The model with the best fit (i.e., the values of P1 and P2) are selected automatically by the model<sup>3</sup>, while corresponding  $\beta_1$  and  $\beta_2$  are estimated by the model.

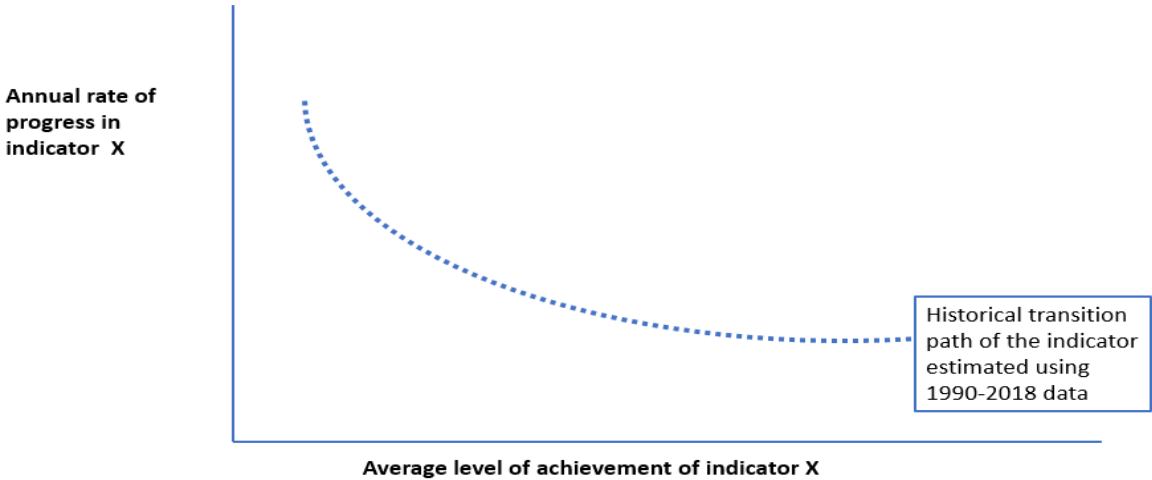
$$\begin{aligned} (\text{Annual growth rate of indicator})_{it} &= \beta_1(\text{level of indicator}_{it})^{p1} + \\ &\quad \beta_2(\text{level of indicator}_{it})^{p2} + \varepsilon_{it} \\ t \in (1990, 2018), i \in (\text{set of all UN member States}) &\quad \dots (1) \end{aligned}$$

Based on the estimated model, we can plot the relationship estimated for each indicator as shown in figure 1.

<sup>2</sup> The start and end year of data is based on data availability in the global SDG indicators database.

<sup>3</sup> This is implemented in Stata software using the package “fp”.

**Figure 2 : Estimated historical transition path of indicator X**



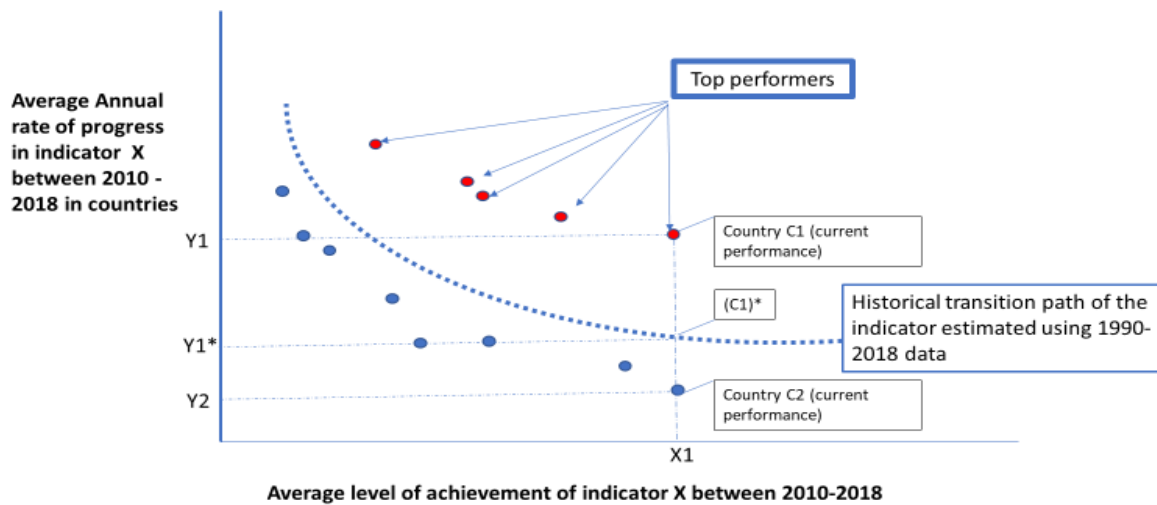
**Step 3: Identify top performers at the indicator level.**

Using the data points on indicator 'X' for each country for the Asia-Pacific region post-2010, we plot the annual average growth rate of indicator (Y- axis) and the average level of the indicator itself (X-axis). Figure 2 overlays this recent performance of countries in the region against the historic transition path estimated in Step 3.

We compare the recent annual rate of progress of indicator (post-2010) with predicted performance rate based on historical transition paths (see figure 2 below) to identify the top performers. Essentially, the top performers are those who have recorded much higher improvement in SDG indicator annual growth rate compared to their performance predicted by historical transition paths. All the countries in figure 2 who are above the historical transition path are top performers (red dots).

For country C1, the average yearly rate of growth observed for indicator X is given by Y1 and the level of the average level of the indicator is given by X1. Based on the historical transition path the expected annual rate of growth (represented by C1\* in figure 2) for the level X1 is given by Y1\*. Since  $Y1 > Y1^*$ , country C1 will be classified as a top performers. While country C2 is not classified as a top performer in terms of rate of progress as it exhibited an annual rate of growth (Y2) lower than the rate of growth predicted by historic transition path (Y1\*).

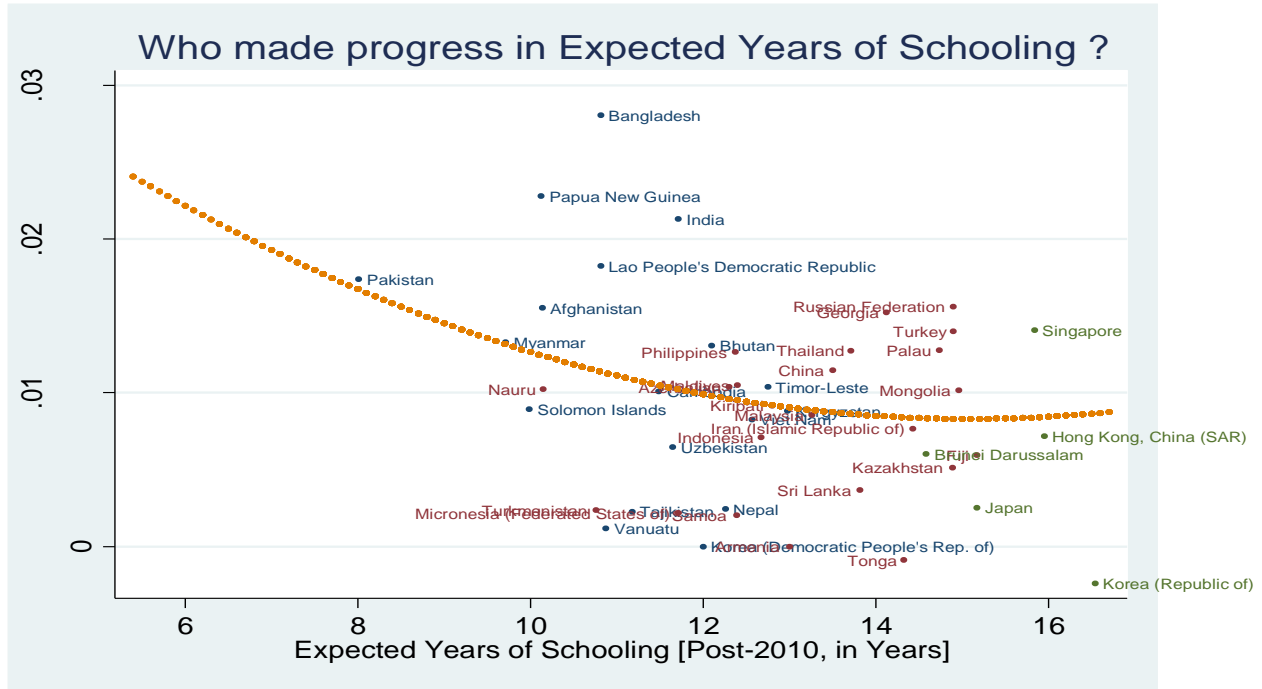
**Figure 3: Identifying top performers**



The following figure provides the analysis in the case of expected years of schooling, one of the indicators under the GSDR transformative area on 'Human Capacity and well-being' (see annex for similar analysis of the other three indicators). Countries like Bangladesh, India, Singapore, can be classified as top performers as they exhibit higher annual growth rate in expected years of schooling compared to historical transition path. Further interesting insights on the rate of progress of countries can be derived.

For example, Bangladesh is improving 'expected years of schooling' at 140 % higher than the rate at which countries historically improved their expected years of schooling at the at the current level of achievement (11 years). Similar information can be derived from this analysis for all indicators and sectors.

**Figure 4 : Who are the top performers for expected years of schooling ?**



#### Step 4: Quantify degree of acceleration

In order to quantify the acceleration of countries, an Z score of acceleration is calculated for each country 'c' for each of the indicator 'x'. The Z-score essentially tells the deviation of countries from historically observed rate of growth, and is calculated as follows.

$$Z \text{ score}_{c}^{x} = \frac{\text{average annual growth rate} - \text{expected annual growth rate}}{\text{standard deviation of the historical transition path}} \dots (2)$$

The expected annual growth rate is estimated using the relationship in model M1. So for the specific level of achievement 'X1' (which is the average level of achievement of country C1 for indicator X for during 2010-2018 period) expected annual growth rate (Y1\*) is obtained using the estimated historical transition relationship from step 3:

$$\text{Expected annual growth rate} = \beta_1(X1)^{p1} + \beta_2(X1)^{p2} \dots (3)$$

In the case of country C1, Z score<sub>C1</sub><sup>x</sup> will be positive (see figure 2)

$$Z \text{ score}_{C1}^{x} = \frac{Y1 - Y1^*}{\text{standard deviation of the historical transition path}} \dots (4)$$

While for country C2, Z score<sub>C2</sub><sup>x</sup> will be negative (see figure 2)

$$Z \text{ score}_{C2}^x = \frac{Y2 - Y1^*}{\text{standard deviation of the historical transition path}} \dots (5)$$

These Z-scores are compared across country-income grouping to identify top performers at the indicator level falling under different income groups. For example, the table below shows the top top performers for the indicator of ‘expected years of schooling’. Bangladesh has a score of 55, which implies that Bangladesh is currently improving its ‘expected years of schooling’ at 55 standard deviations higher than the historically expected rate of growth.

**Table 1: Top top performers counties based on Z-scores for the indicator ‘Expected Years of Schooling’**

Low-income	Middle-income	High-Income
Bangladesh (55.2)	Russian Federation (22.6)	Singapore (14.2)
India (37.6)	Georgia (21.2)	
Papua New Guinea (34.3)	Turkey (18.6)	
Lao People's Democratic Republic (22.7)	Thailand (12.09)	
Bhutan (11.08)	Philippines (10.5)	

Source: Authors’ calculation  
Notes: Z-score of acceleration in parenthesis,  
Country classifications based on ESCAP country-income groupings available here : [http://data.unescap.org/escap\\_stat/#methodDefinition](http://data.unescap.org/escap_stat/#methodDefinition)

### Step 5. Identify top performers for each of the transformative area

Aggregating the performance of countries across indicators for each of the transformative area is conducted as follows to identify countries that are top performers for each of the transformative area as a whole. Firstly, the individual Z-score for indicator is standardised for a value between 0 and 1 using the following formula. For country C1 for indicator X,

$$\text{Standardised Z score for acceleration}_{C1}^x = \frac{\text{Maximum (Z score}_{C}^x) - \text{Z score}_{C1}^x}{(\text{Maximum (Z score}_{C}^x) - \text{Minimum (Z score}_{C}^x)}} \dots (6)$$

Maximum (Z score<sub>C</sub><sup>x</sup>) and Minimum (Z score<sub>C</sub><sup>x</sup>) are the maximum and minimum Z-score for acceleration attained by any country.

In order to gauge the relative performance of countries in terms of their absolute level of achievement in for each of the indicator, we can also calculate the standardized level scores as follows.

$$\text{level score standardised } x_{c1} = \frac{\text{Maximum (level of progress } x_c) - \text{Level of progress } x_{c1}}{\text{Maximum (level of progress } x_c) - \text{Minimum (level of progress } x_c)} \dots (7)$$

Where, Maximum (level of progress  $x_c$ ) is the maximum value of level of progress registered by any country and Minimum (level of progress  $x_c$ ) is the minimum value of level of progress registered for the specific indicator.

Let, x, z, j be the three indicators for the transformative area 1, then the aggregate Z scores for acceleration (rate of progress) and level of achievement are given by the following with equal weightage given to each of the sub-themes represented by the indicator.

$$\text{Z score acceleration } x_{c1}^{\text{transformative area 1}} = (\text{Z score acceleration standardised } x_{c1} + \text{Z score acceleration standardised } y_{c1} + \text{Z score acceleration standardised } z_{c1})/3 \dots (8)$$

$$\text{Z score level of achievement } x_{c1}^{\text{transformative area 1}} = (\text{level score standardised } x_{c1} + \text{level score standardised } y_{c1} + \text{level score standardised } z_{c1})/3 \dots (9)$$

### **Weighting of indicators**

For the case of the transformative area of human capacity and well-being, four indicators of the Human Development Index are used in measuring progress along these three domains, namely, expected years of schooling and mean years of schooling for the Education domain, life-expectancy to measure the Health dimension and GNI per capita to measure the well-being. In aggregating the acceleration scores for this transformative area. Equal weights are given to indicators falling under each domain and each domain in turn gets equal weightage. Hence, expected years of schooling and mean years of schooling gets a weightage each of 1/6 each in the total scores so that the education dimension gets the weightage of 1/3, along with health and well being in the final scoring. Please see annex for the broad list of indicators used for the Asia-Pacific SDG Partnership Report 2020 and classification into various domains.

**Table 2: Standardized Z-scores of acceleration for the transformative area of Human Capacity and well being**

Low-income	Middle-income	High-Income
India (0.62)	Turkey (0.62)	Japan (0.47)
Lao People's Democratic Republic (0.59)	Nauru (0.52)	New Zealand (0.46)
Bangladesh (0.58)	China (0.51)	Korea (Republic of) (0.41)
Myanmar (0.52)	Russian Federation (0.46)	Singapore (0.41)
Vietnam (0.49)	Iran (0.45)	

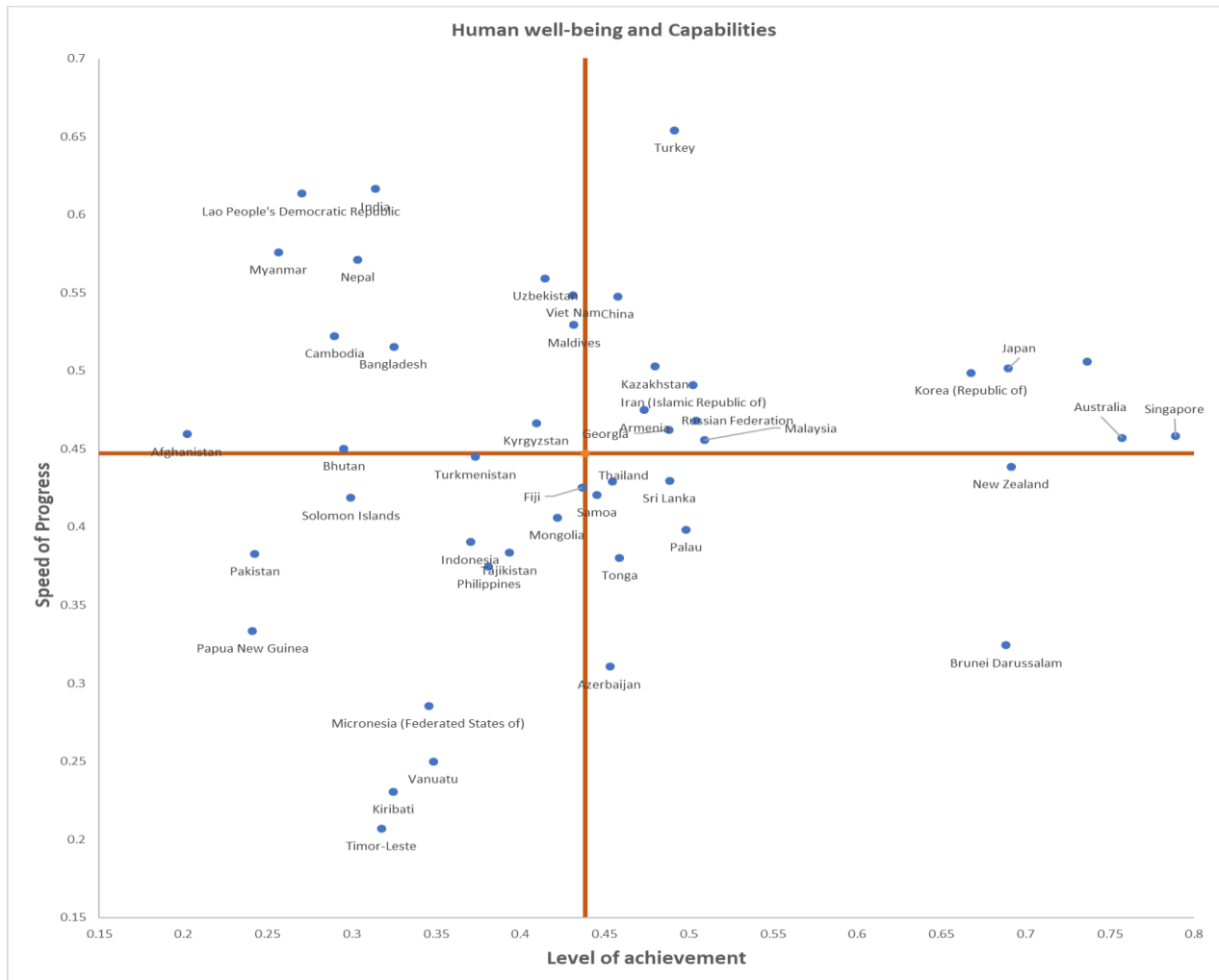
Source: Authors' calculation

Note: Country classifications based on ESCAP country-income groupings available here :

Step 6 : Contextualise acceleration against level of progress

Classifying countries into four quadrants based in relative performance of rate of progress and level of achievement. The standardized and aggregated Z score for acceleration and Z – score for level of achievement can be used to classify countries into four groups with specific policy implication. Figure 3 plots the Z score acceleration (Y axis) and Z score level of achievement (X- axis) for the case of the transformative area of human capacity and well-being. By comparing the individual performance of countries with the average performance, we can classify countries into four groups, namely, aspirants, Champions, Slow-starters and Last-mile challenge

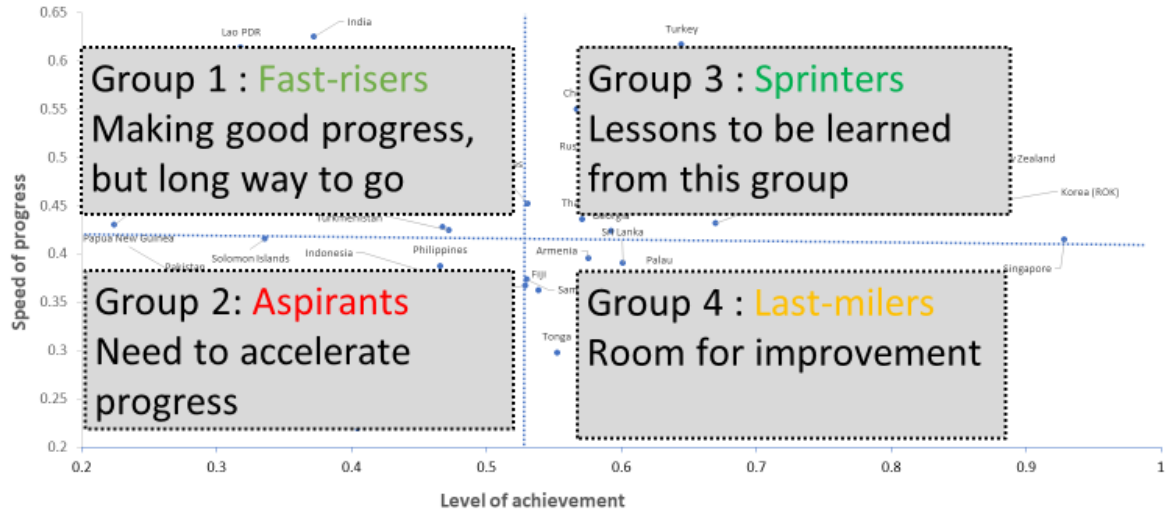
Figure 5.a : Quadrant analysis for human capacity and well-being



Source : Authors' calculation

Figure 5.b : Quadrant analysis for human capacity and well-being





Source : Authors calculation using SDG data sets

**Sprinters:** Countries that are making good rate of progress and have already covered good grounds in terms of level of achievement in the transformative area. From figure 5.a, some of the countries in this group for are China, Turkey, Malaysia, Japan, Korea, New Zealand, Kazakhstan, Iran, Thailand, Georgia.

**Fast risers:** Countries that are making good rate of progress in the transformative area, but the level of achievement is below average, hence till have a long way to go. From figure 5.a, some of the countries in this group for human capacity and well-being are India, Bangladesh, Lao PDR, Viet Nam, Myanmar, Uzbekistan.

**Aspirants:** Countries that are showing below average growth rate of progress as well as below average performance in terms of level of achievement in the transformative area. These countries are the ones that urgently need to accelerate their rate of progress in this transformative area. From figure 5.a, some of the countries in this group for human capacity and well-being are Philippines, Indonesia, Mongolia, Tajikistan, Papua New Guinea and Pakistan.

**Last-milers:** Countries that are performing relatively well in terms of level of progress but are experiencing slow rate of progress in tackling the last-mile challenges. This group can learn from the Champions group in terms of speeding up their progress. From figure 5.a, some of the countries in this group for human capacity and well-being are Azerbaijan, Armenia, Fiji, and Brunei Darussalam.

## Discussion and conclusion

The methodology has several advantages. Firstly, it compares the performance of countries against historically observed rates of progress for any given level, thereby comparing countries against realistic benchmarks. Secondly, by categorising countries into groups, such as champions or slow-starters, helps policy makers to identify areas where the country is lagging behind in terms of rate of progress and which countries to look for lessons for acceleration. However, the following caveats should guide the application of the methodology.

**The context of the level of progress:** The methodology tries to link the ‘acceleration of performance’ with the level of progress and it takes into account the fact that it often is easier for countries to make faster progress at low levels of achievement. The acceleration performance graphs (step 2) and the quadrant analysis (step 6) provides the context in terms of level of achievement, where countries are making faster progress. The estimated historical transition paths (see annex figures) are downward sloping in most instances, hence accounting for the fact that countries at the lower level of achievement tend to progress faster. However, it is possible that some of the top performers have made minimal progress in terms of level of achievement. Therefore, it is important to interpret results on acceleration along with the actual level of achievement.

**Caution on results at the tail-end:** The methodology, since it relies on past observed performance of countries, is not very robust to predict performance of countries at the tail-end of distribution (especially at very high level of performance). Mainly due to limited number of observations at this end. So the predictions on the expected growth rate can be unreliable at the tails.

**Impact of rapid change in technology :** For some of the areas, rapid and significant changes in technology would imply that the historical transition path may not be suited to judge current performance as most countries might be performing higher than the historically observed rates of progress from 1990 onwards. One obvious example is the case of renewable energy, where the cost of technology has dropped significantly over the years enabling countries to make rapid transitions. In such cases, the historical transition paths can be estimated using more recent years (post-2005 or post-2010).

## **Conclusion**

The purpose of the methodology presented in this note is to identify top performer countries by analysis recent performance with historically observed progress patterns. The analysis is meant to pave way for further deeper, qualitative and contextual research for reasons for acceleration.

## **Reference**

Royston, P., and W. Sauerbrei. 2008. *Multivariable Model-Building: A Pragmatic Approach to Regression Analysis Based on Fractional Polynomials for Modelling Continuous Variables*. Chichester, UK: Wiley.

SDSN (2019) : Sachs J D, Schmidt-Traub G, Mazzucato M, Messner D, Nakicenovic N, Rockström J (2019). Six Transformations to achieve the Sustainable Development Goals. *Nature Sustainability*. doi: DOI 10.1038/s41893-019-0352-9

GSDR (2019) : *The Future is Now: Science for Achieving Sustainable Development*, first Global Sustainable Development Report (GSDR) prepared by the Independent Group of Scientists appointed by the United Nations Secretary-General, <https://sustainabledevelopment.un.org/globalsdreport/2019>

## **Annex**

### **Results for ‘Human Capacity and Well-Being’**

#### **Figure 6 : Who are the top performers for ‘Life Expectancy’ ?**

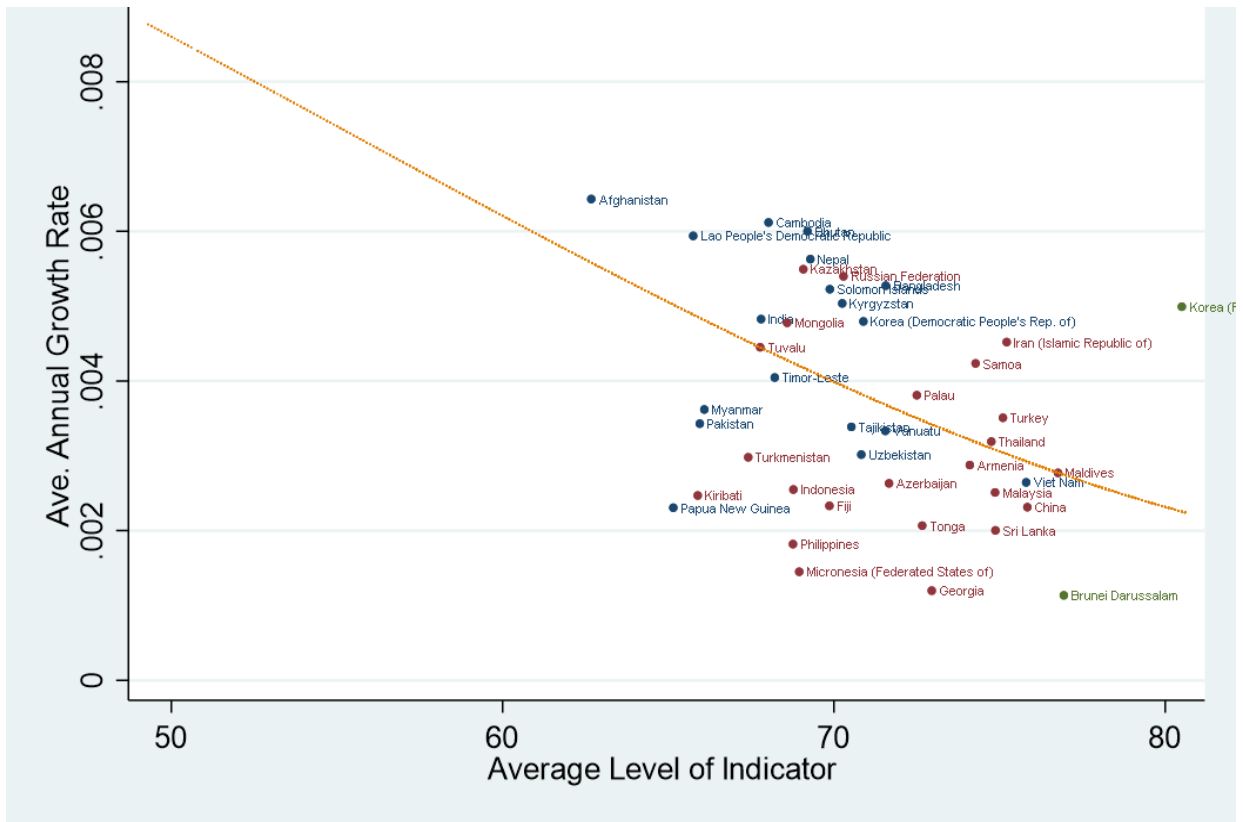


Figure 7 : Who are the top performers for 'Mean Years of Schooling'?

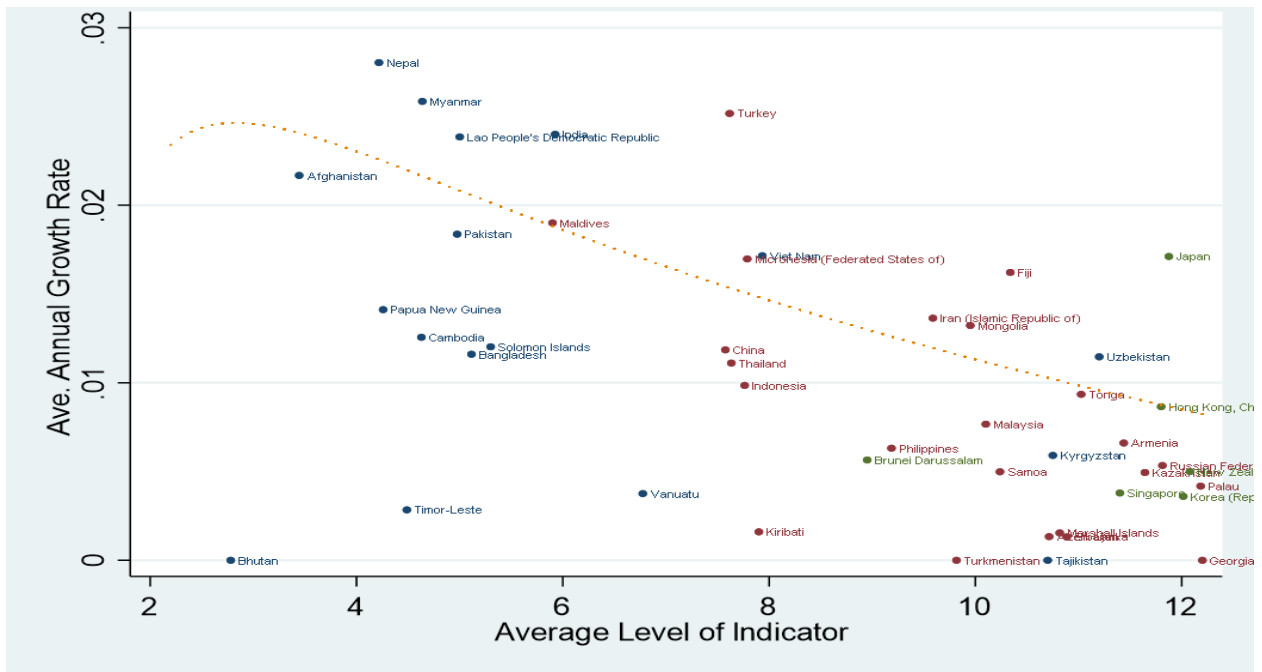
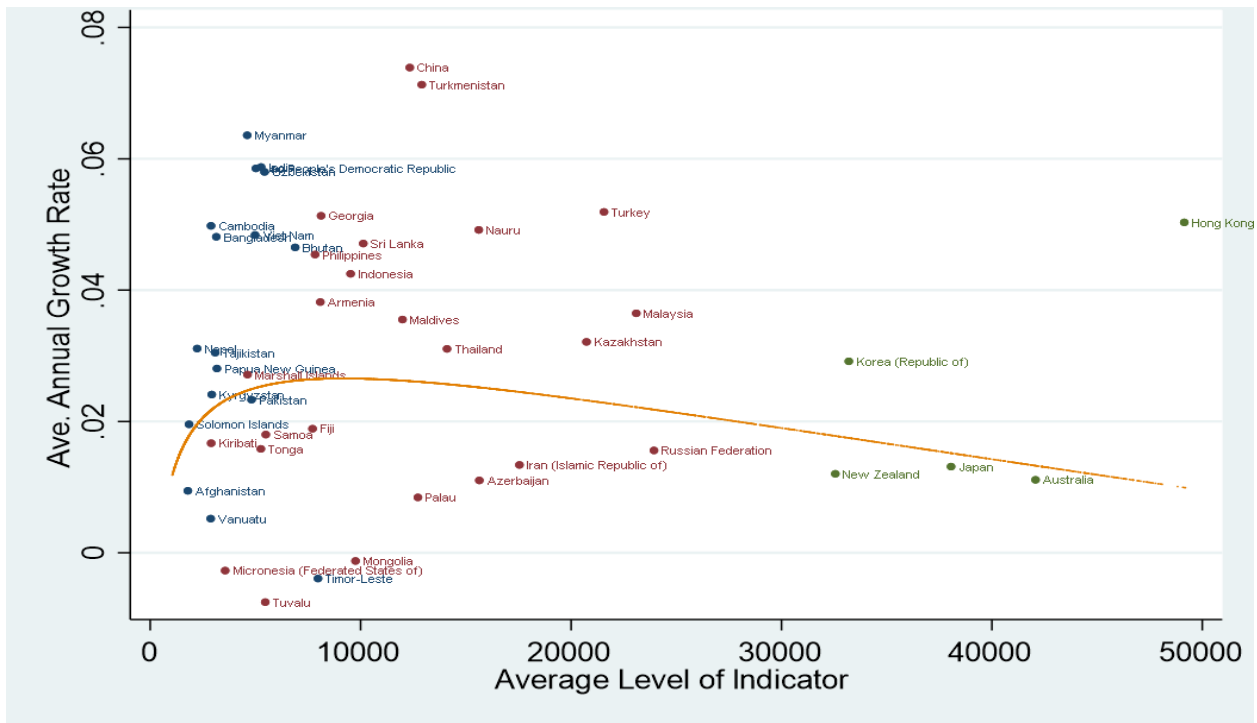


Figure 8 : Who are the top performers for 'GNI per capita' ?



List of indicators, entry point, target number and domains

SDG indicator number	Indicator	Domain
<b>ENTRY POINT 1: Strengthening human well-being and capabilities</b>		
	Life expectancy at birth (years)	Health
	Mean years of schooling (years)	Education
	Expected years of schooling (years)	Education
	Gross national income (GNI) per capita (2011 PPP \$)	Income
<b>ENTRY POINT 2: Shifting towards sustainable and just economies</b>		
8.2.1	Annual growth rate of real GDP per employed person	Income generation

8.4.2	Domestic material consumption per unit GDP	Resource efficiency
8.5.2	Unemployment rate,	Job generation
8.10.2	Proportion of adults (15 years and older) with an account at a bank or other financial institution or with a mobile-money-service provider	Financial inclusion
9.2.1	Manufacturing value added as a proportion of GDP	Industrialization
10.1.P1	Gini index,	Income inequality
<b>ENTRY POINT 3: Building sustainable food systems and healthy nutrition patterns</b>		
2.1.1	Prevalence of undernourishment (2000 - 2016)	Nutrition status
2.3.P1	Cereal Yield	Food production efficiency
2.4.1	Greenhouse gas (GHG) emissions from agriculture	Sustainability of food systems
2.a.1	The agriculture orientation index for government expenditures	Public investment
<b>ENTRY POINT 4: Achieving energy decarbonization and universal access to energy</b>		
7.1.1	Proportion of population with access to electricity, by urban/rural (%)	Energy access
7.1.2	Proportion of population with primary reliance on clean fuels and technology	Use of clean fuels
7.2.1	Renewable energy share in the total final energy consumption (%)	Renewable energy
7.3.1	Energy intensity level of primary energy (megajoules per constant 2011 purchasing power parity GDP)	Energy efficiency
<b>ENTRY POINT 5: Promoting sustainable urban and peri-urban development</b>		
7.1.1	Electricity access, % of urban population	Access to electricity
6.1.1	Safe drinking water, % of urban population	Access to water
11.1.P1	Population practicing open defecation, % of urban population	Sanitation

<b>11.6.P1</b>	% population exposed to levels exceeding WHO Interim Target-1 guidelines (35 microgram per cm <sup>3</sup> )	Air quality
<b>ENTRY POINT 6: Securing the global environmental commons</b>		
<b>8.4.1</b>	Material Footprint intensity Kg per 1 USD (2010) GDP	Drivers of environmental pressure
<b>12.2.2</b>	Domestic material consumption intensity, Kg per 1 USD (2010) GDP	Drivers of environmental pressure
<b>12.4.2</b>	Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment	Drivers of environmental pressure
<b>13.2.1</b>	Carbon dioxide (CO <sub>2</sub> ) emissions from fuel combustion per capita	Climate change mitigation
<b>9.4.1</b>	Carbon dioxide (CO <sub>2</sub> ) emissions from fuel combustion, Kg per 1 USD (2010) GDP	Climate change mitigation
<b>14.2.P1</b>	Ocean health index, Scores	Marine ecosystem
<b>14.5.1</b>	Proportion of marine key biodiversity areas covered by protected area status, Percentage	Marine ecosystem
<b>15.4.1</b>	Important sites for mountain biodiversity	Terrestrial ecosystem
<b>15.5.1</b>	Red list index total, Index	Terrestrial ecosystem
<p>See UNESCAP (2020) SDG progress report 2020, for further details of indicators used, available at :  <a href="https://www.unescap.org/sites/default/files/publications/ESCAP%20Asia%20and%20the%20Pacific%20SDG%20Progress%20Report%202020.pdf">https://www.unescap.org/sites/default/files/publications/ESCAP Asia and the Pacific SDG Progress Report 2020.pdf</a></p>		