Analysis instead of summation: Why indices are not enough for ICT policy and regulation

Analysing ICT indicators, based on benchmarking provides a far more valid evidence-base for ICT policy and regulation than using the ranking of a country on one of the global ICT indices. Both approaches use the same data but differ in how the data is analysed. The benchmarking approach is a starting point for further analysis, showing clearly the linkages between individual indicators. Global ICT indices, as they are currently formulated, disguise these linkages by providing a composite measure, and often only display normalised indicators that cannot be verified by the user. This encourages the perception that the index is the end result of the analysis, rather than the beginning.

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Indices produce arbitrary results

The most basic measures of ICT access (penetration) and prices are not reflected in country rankings, leading to bizarre country rankings.

Indices mostly track GDP per capita

Ranking all countries, from poorest to the richest, leads to an automatically high correlation of an index to GDP per capita, making the latter the best predictor for the index score. The five indices reviewed here mostly track GDP per capita, something ICT policy makers and regulators can do little about.

Affordability indices cannot explain price

None of the indices reviewed significantly explains price differences between countries, while being highly correlated to prices expressed as a share of GDP per capita. A change in affordability is likely the result of changes in GDP per capita or foreign exchange fluctuations or both.

No shortcut for ICT policy makers and regulators

Indices look convenient and are readily available for integration into policy briefs and reports. However, they are neither suitable to assess policies or regulatory interventions nor to identify bottlenecks that require attention.

Introduction

Global ICT indices (or rankings) have never been more popular. Some of those most widely promoted include the World Economic Forum's Network Readiness Index (NRI), the ITU's ICT Development Index (IDI), the Alliance for Affordable Internet's Affordability Drivers Index (ADI), the World Wide Web Foundations Women Rights Online Index and GSMA's Mobile Connectivity Index. The latest addition is the Inclusive Internet Index (3i) from the Economist Intelligence Unit, launched in collaboration with Facebook this year.

While indices have been used successfully to track prices, inflation, construction costs and the evaluation of conduciveness of doing business, the implementations of global ICT   indices have yet a purpose to be discovered from them other then triggering controversy and encourage data collection.

Global ICT indices are less useful than the primary indicators they are using because of the following factors:

- They encourage simplistic, non-causal explanations.
- Changes in index ranking may have nothing to do with the ICT sector. For example, GDP per capita explains 85% of the variation in the index rankings from the EIU's 3i. The drop in oil prices in the last few years have benefited some countries and harmed economic growth of oil producing countries such as Brazil, Venezuela, Nigeria and Angola. GDP per capita is not something ICT regulators and policymaker can influence.
- Global ICT indices use definitions that are too broad, or applicable to the developed world only.
- The conceptual frameworks used to inform many indices are typically based on loose association instead of economic theory or empirical evidence.
- Indices are mostly a simple addition of indicators, thus implying equal weights, while some factors are clearly more important than others. The ITU's IDI, for example, ranks all indicators in each of its three sub-indices equally. It then weights its three sub-indices.

Table 1: Comparing rankings against selected ICT indicators	Rankings					ICT Indicators		
	ADI	**3i**	**IDI**	**NRI**	**MCI**	**1 GB prepaid data USD**	**Active SIM cards per 100**	**Fixed-line per 100**
Nigeria	13	45	137	119	98	3.20	83	0.10
Kenya	30	51	129	86	105	5.00	82	0.19
Ghana	**26**	49	112	102	96	**2.46**	**128**	1.01
Namibia	31	NA	120	99	NA	5.89	99	7.42
Brazil	**10**	18	63	72	56	**8.48**	**124**	**21.01**
Sources	A4AI 2017	EIU 2017	ITU 2016	WEF 2016	GSMA 2016	RIS / RIA Q4 2016	ITU 2016	ITU 2016

Indices produce arbitrary results

Indices not only contradict common sense but also expert views on the performance of ICT sectors backed up by data.

Table 1 shows the ranking of Indices, the price of 1GB of data, active SIM cards and fixed line penetration per 100 inhabitants in order to illustrate how arbitrary the rankings are. Two results of this summary are in particular puzzling:

- Brazil scores best in this comparison, but has the highest mobile broadband prices and the only 2nd highest mobile penetration
- Nigeria scores better the Ghana but Ghana is cheaper and has higher penetration of SIM cards and fixed-lines

The most basic measures of ICT access (penetration) and prices are not being reflected in the ranking of countries in this example.
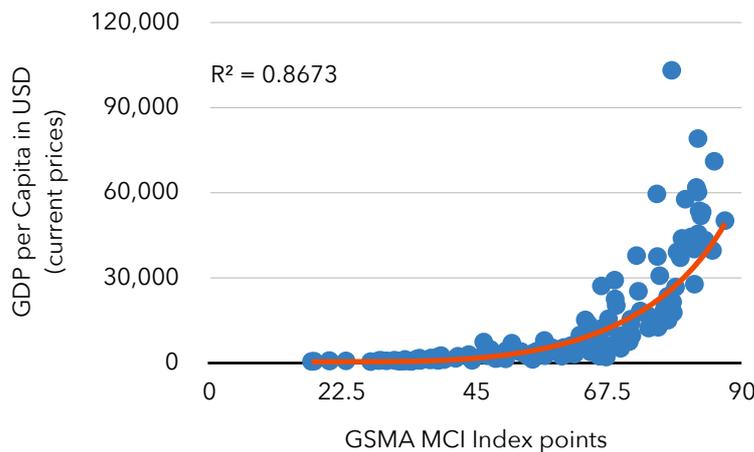
Indices mostly track GDP per capita

When plotting indices against GDP per capita the results is that typically above 80% of the variation in index scores is explained by GDP per capita.
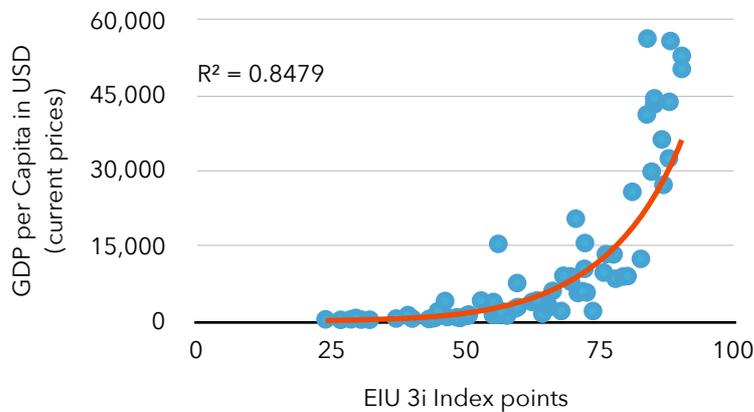
Figure 1: Variation in the EIU 3i (2017) explained by GDP per Capita current prices for 2016

Figures 1 and 2 provide examples for two of the global ICT indices.

Figure 2: Variation in the MCI (2017) explained by GDP per Capita current prices for 2016

Ranking all countries, from poorest to the richest, leads to an automatically high correlation of an index to GDP per capita, making the latter the best predictor for the index score.

Affordability indices cannot explain prices

A country's affordability ranking should only improve if prices have dropped more for a country compared to other countries. While this sounds straightforward, it is actually something that existing

indices get wrong. Affordability indicators may change not because of prices changes but because of changes in GDP per capita, something ICT policy makers and regulators have little control over.

Table 2: R² NRI link to prices	NRI	Affordability
1GB Basket USD	0.03	0.08
1GB Basket % GDP per Capita: Exponential	**0.58**	**0.28**
OECD 30 calls 100 SMS basket in USD	0.01	0.17
OECD 30 calls 100 SMS basket in % GDP per Capita: Exponential	**0.62**	**0.32**

The effect of well designed regulatory interventions may be masked by other economic events and their impact on GDP per capita including currency fluctuations. This means that policy makers are better served by looking at simple, individual indicators rather than composite indices.

Table 3: R² ITU IDI link to prices	IDI 2016
1GB Basket USD	0.0001
1GB Basket % GDP per Capita: Exponential	**0.64**

Tables 2 to 6 show how much of the variation of the index scores are explained by prices for mobile prepaid data data for 1GB monthly use or for a voice and SMS basket (which is also an index).

Table 4: R² EIU 3i link to prices	3i	Affordability
1GB Basket USD	0.03	0.03
1GB Basket % GDP per Capita: Exponential	**0.79**	**0.67**

Generally, actual prices expressed in USD do not contribute to explaining an index score for any of the five indices reviewed.

Table 5: R² A4AI ADI link to prices	ADI
1GB Basket USD	0.03
1GB Basket % GDP per Capita: Exponential	**0.44**

Only when expressed as a share of per capita income, in other words, affordability, are prices able to explain index scores. Though the A4AI affordability index has the lowest score with only 44% of variation explained. Here it is not the price, but the denominator, GDP per capita, that explains the index score. ICT policies or regulation can only influence the numerator (price) not the denominator (GDP per capita) of these affordability indicators.

Table 6: R² GSMA MCI link to prices	MCI	Affordability
1GB Basket USD	0.00	0.01
1GB Basket % GDP per Capita: Exponential	**0.64**	**0.68**

The other problem is that very few indices have up-to-data pricing data, especially for developing countries. Prices used by the ITU, for example, can be two years old when they form part of their index - light years in pre-paid mobile markets.

No short cut for ICT policy makers and regulators

From a policy or regulatory point of view, there are three criteria for an index to be useful:

- A change in an index value reflects progress or regress. Policy makers and regulators must be able to use index values to monitor the health of the ICT sector or a sub sector.
- Changes in index rankings shows which countries improved their ICT sector performance disproportionally and can be studied to establish best practice.
- The index and sub indices identify potential bottlenecks to improve ICT sector performance.

Table 1 shows how different the rankings depending on the chosen

index and how they often contradict obvious facts.

Benchmarking differs from ranking of indices in that the analysts need to select the countries to benchmark against. A Zambian regulator will be more interested in comparing Zambia to Uganda (also land-locked) and Botswana (a neighbouring country) than Luxembourg and South Korea. Being ranked hundred-something in the world says little, even when considering sub-indices. While another country paying only half the amount for mobile prepaid broadband sparks many questions and further investigations on how to improve the mobile ecosystem.

The mAccess Diagnostic Tool - developed by Research ICT Solutions - illustrates how to benchmark a country effectively with a set of indicators that link policy and regulatory objectives to outcomes. The interlinked indicators of affordability, access, usage, infrastructure and competition enable the identification of regulatory intervention points for the ICT sector. This is demonstrated with the example of Zambia below.
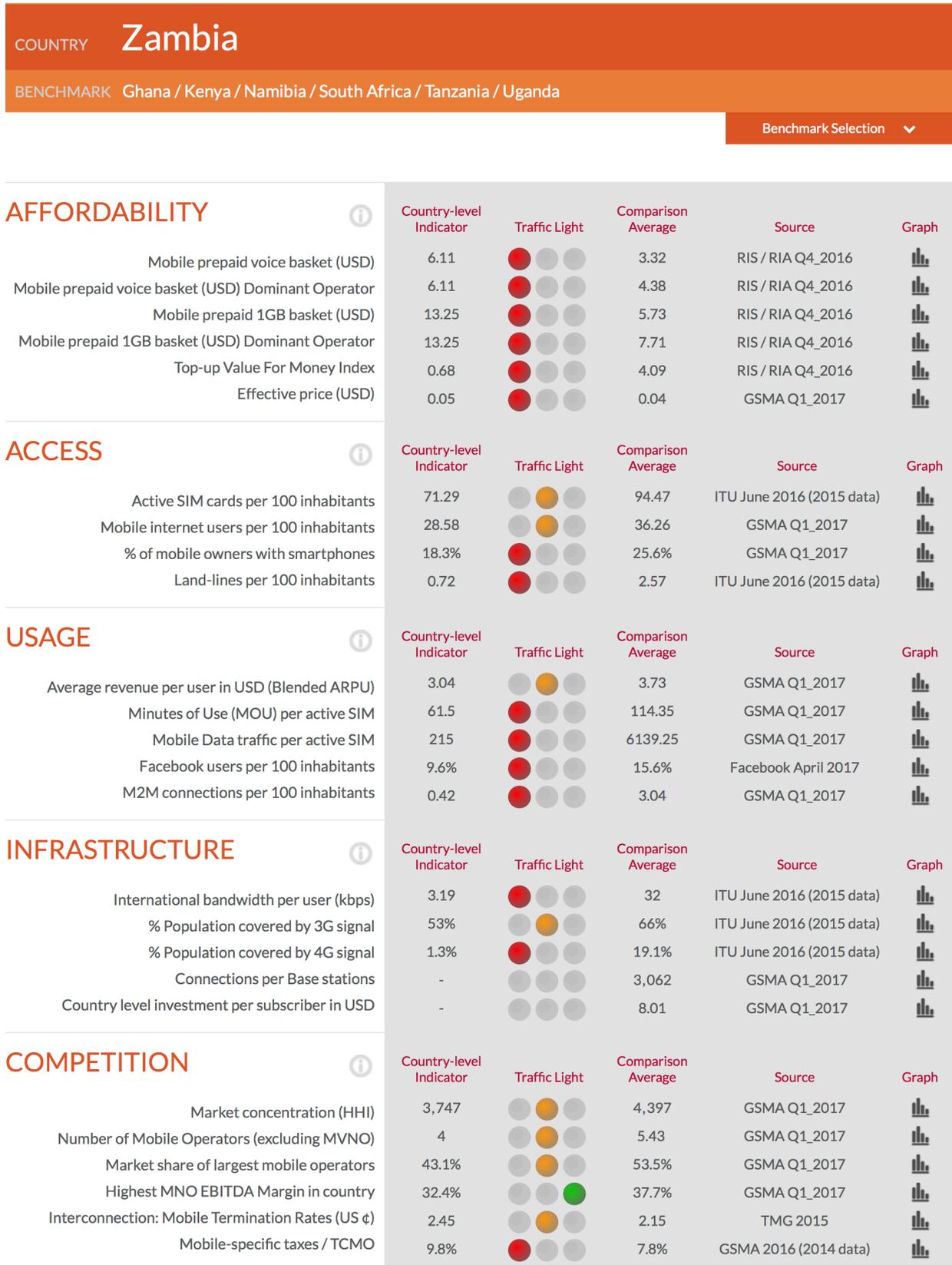
COUNTRY	Zambia
BENCHMARK	Ghana / Kenya / Namibia / South Africa / Tanzania / Uganda

Benchmark Selection ⌄

AFFORDABILITY ⓘ

	Country-level Indicator	Traffic Light	Comparison Average	Source	Graph
Mobile prepaid voice basket (USD)	6.11	🔴⚪⚪⚪	3.32	RIS / RIA Q4_2016	📊
Mobile prepaid voice basket (USD) Dominant Operator	6.11	🔴⚪⚪⚪	4.38	RIS / RIA Q4_2016	📊
Mobile prepaid 1GB basket (USD)	13.25	🔴⚪⚪⚪	5.73	RIS / RIA Q4_2016	📊
Mobile prepaid 1GB basket (USD) Dominant Operator	13.25	🔴⚪⚪⚪	7.71	RIS / RIA Q4_2016	📊
Top-up Value For Money Index	0.68	🔴⚪⚪⚪	4.09	RIS / RIA Q4_2016	📊
Effective price (USD)	0.05	🔴⚪⚪⚪	0.04	GSMA Q1_2017	📊

ACCESS ⓘ

	Country-level Indicator	Traffic Light	Comparison Average	Source	Graph
Active SIM cards per 100 inhabitants	71.29	⚪🟠⚪⚪	94.47	ITU June 2016 (2015 data)	📊
Mobile internet users per 100 inhabitants	28.58	⚪🟠⚪⚪	36.26	GSMA Q1_2017	📊
% of mobile owners with smartphones	18.3%	🔴⚪⚪⚪	25.6%	GSMA Q1_2017	📊
Land-lines per 100 inhabitants	0.72	🔴⚪⚪⚪	2.57	ITU June 2016 (2015 data)	📊

USAGE ⓘ

	Country-level Indicator	Traffic Light	Comparison Average	Source	Graph
Average revenue per user in USD (Blended ARPU)	3.04	⚪🟠⚪⚪	3.73	GSMA Q1_2017	📊
Minutes of Use (MOU) per active SIM	61.5	🔴⚪⚪⚪	114.35	GSMA Q1_2017	📊
Mobile Data traffic per active SIM	215	🔴⚪⚪⚪	6139.25	GSMA Q1_2017	📊
Facebook users per 100 inhabitants	9.6%	🔴⚪⚪⚪	15.6%	Facebook April 2017	📊
M2M connections per 100 inhabitants	0.42	🔴⚪⚪⚪	3.04	GSMA Q1_2017	📊

INFRASTRUCTURE ⓘ

	Country-level Indicator	Traffic Light	Comparison Average	Source	Graph
International bandwidth per user (kbps)	3.19	🔴⚪⚪⚪	32	ITU June 2016 (2015 data)	📊
% Population covered by 3G signal	53%	⚪🟠⚪⚪	66%	ITU June 2016 (2015 data)	📊
% Population covered by 4G signal	1.3%	🔴⚪⚪⚪	19.1%	ITU June 2016 (2015 data)	📊
Connections per Base stations	-	⚪⚪⚪	3,062	GSMA Q1_2017	📊
Country level investment per subscriber in USD	-	⚪⚪⚪	8.01	GSMA Q1_2017	📊

COMPETITION ⓘ

	Country-level Indicator	Traffic Light	Comparison Average	Source	Graph
Market concentration (HHI)	3,747	⚪🟠⚪	4,397	GSMA Q1_2017	📊
Number of Mobile Operators (excluding MVNO)	4	⚪🟠⚪	5.43	GSMA Q1_2017	📊
Market share of largest mobile operators	43.1%	⚪🟠⚪	53.5%	GSMA Q1_2017	📊
Highest MNO EBITDA Margin in country	32.4%	⚪⚪🟢	37.7%	GSMA Q1_2017	📊
Interconnection: Mobile Termination Rates (US ¢)	2.45	⚪🟠⚪	2.15	TMG 2015	📊
Mobile-specific taxes / TCMO	9.8%	🔴⚪⚪⚪	7.8%	GSMA 2016 (2014 data)	📊

Figure 3: Zambia benchmarked against Ghana, Kenya, Namibia, South Africa, Tanzania and Uganda

Example Zambia

The mAccess Diagnostic Tool was used to benchmark Zambia Zambia against Ghana, Kenya, Namibia, South Africa, Tanzania and Uganda (Figure 3). The countries were chosen because of either being neighbouring countries; countries that the ICT regulator or policymaker compares itself to, or because these countries feature some leading criteria in terms of ICT sector performance, such as low retail prices, wider coverage, largest 4G network or low wholesale prices for leased lines.

On every indicator that is part of the affordability component, Zambia is expensive. Comparing cheapest prices available in a country for voice and data baskets shows that Zambia's are twice the benchmark average. Comparing dominant operators Zambia is still a lot more expensive than the chosen peers. The low Value for Money Index (VMI) shows that top up bundles do not provide much value for Over The Top (OTT) users.

Access is low or average. Usage in terms of minutes of use and data per month is low which can be expected based on the high prices. International bandwidth per user is very poor, with the comparison average being more than 10 times higher. Part of the explanation is that Zambia is a landlocked country and therefore exposed to the risk of high cross connection charges to access undersea cables. Notably is also the very low 4G coverage. Zambia is in urgent need of substantial investment to upgrade its mobile telecommunication infrastructure.

Competition indicators in Zambia are similar to the comparison countries. Three mobile operators are usually sufficient for a competitive environment and market concentration is below the benchmark average. Although the market share of the largest operator is high at 43%, this is nevertheless lower than the comparison average. Mobile termination rates are adequate and the EBITDA margin of the most profitable mobile operator is reasonable at 37.7%.

The first analysis shows that prices are high and usage is low as a consequence. Mobile operators are not excessively profitable and the first intervention point would be seeking ways to make the mobile ecosystem more conducive. Reducing mobile specific taxes, which are high in comparison is a starting point. The steps to be taken are:

- Engage mobile operators on their high prices and low investment. What are price elasticities or who would usage change if prices came down? Why have they not yet rolled out 4G on a wide scale?
- Engage policy makers on lowering mobile specific taxes. With higher EBITDA margins MNOS are also more likely to invest.
- Engage to regulators whether there may be other investment obstacles from a regulatory perspective: spectrum , licensing, regulatory fees etc.

Conclusion

The problem with global indices is not the underlying individual indicators or data. Many of the indices, such as the GSMA, make use of interesting and innovative data sets. The problem is the compulsion to add all these indicators together, disguising the underlying indicators in a web of statistical transformation in order to produce a ranking that, in trying to capture the complexity of the evolving ICT ecosystem, is in fact misleading or is unable to produce useful recommendations to policy makers and regulators.

The alternative benchmarking approach, encapsulated in the mAccess tool with up to date and extensive price datasets that underpin

it, is able to provide an instant picture or baseline for the country relative to similar countries. While it does not give all the answers one needs for comprehensive sector review, it provides a baseline for deeper analysis. Possible remedies or interventions are then assessed in the context of the political economy of the country, the institutional endowments, the market structure of ICT sector, the capacity and adaptiveness of the various sector agencies and the levels of human development within the country that may determine the technological absorptive capacity of the country.This paper demonstrated that select indicators, rooted in an ecosystem framework that provides a clear chain of cause and effect, is a helpful guide to ICT policy makers and regulators, especially in comparison to aggregated composite indices. There are four key conclusions:

- The five indices reviewed here mostly track GDP per capita, something ICT policy makers and regulators can do little about. The same applies for any of the affordability indicators that divide price by GDP per capita. Price is a much more effective indicator to measure policy or regulatory interventions, since it is directly impacted by policy and regulatory decisions.
- None of the indices reviewed significantly explains price differences between countries.
- Carefully selected individual ICT indicators will always outperform any of the global ICT indices in terms of explanatory power of the ICT sector and any policy or regulatory interventions.
- The benchmark approach based on a minimal number of indicators to explain causal links within the sector is a better approach in order to understand obstacles to growth and what steps can be taken to improve sector performance.

Existing indices can be improved in several ways.

1. Global indices need to accommodate the shift towards data. To assess this in developing countries this means relying less on landline indicators and more on mobile broadband indicators.
2. Similarly, wired and mobile components should be split because the skills and resources that are required are fundamentally different for mobile and fixed broadband use and so is the regulatory and policy treatment.
3. Indices should allow users to pick countries to benchmark against in addition to displaying rankings.
4. Indicators that make up indices should be made available in non-normalised form to allow users to understand indices and sub-indices as well as to verify the index outcomes with country data.

Even when these issues are address however indices are unlikely to provide an adequate diagnostic tool to identify the factors that are determining the performance of a particular country. Benchmarking a specific country under review against similar countries and specific set of relevant indicators is more likely to identified the exact points of policy or regulatory intervention to improve its performance and realistic targets set or the appropriate remedies devised.