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White Paper

Mapping Trade-offs in Communications Policy and Regulation

Global Agenda Council on the Future of Digital Communications

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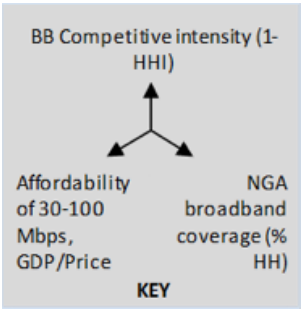
Introduction

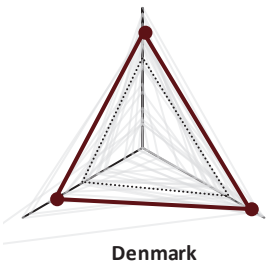
Communications policy and regulatory objectives are wide ranging and complex. Countries seek affordable, diverse, widely available and widely used services of a high quality. Furthermore, virtually all regulatory decisions involve some degree of trade-offs between these objectives. A given decision may support one policy objective, but perhaps impede another, or come at a cash cost to be borne by the treasury.

Given the importance of the communications industry to international competitiveness, there is an ongoing interest in international comparisons of communications markets. To date, such comparisons have taken one of two broad approaches – data sets and league tables.

This report offers a new perspective – what can be termed as a "spirit level" approach – which emphasizes the balance struck between different objectives. For this paper, we have developed a dynamic tool,[1] which assembles relevant metrics from a wide variety of sources, enables a user to choose a country set and the metrics relevant to their requirement, and automatically generates the report. It charts the relative results for three selected metrics for a given country set. An example for a single country is shown below.

[1] Published together with this paper, and available at http://widgets.weforum.org/regulatory-tradeoffs/





These outputs are designed to enable the user to take a view on the different balances struck by different countries. For instance, a given country may have a stronger performance in affordability than others, but a weaker one in coverage. Based on this, the country may wish to "rebalance", favouring trade-offs that are positive for coverage. Alternatively, such a skew may be in line with the country's policy objectives – coverage may have been deliberately sacrificed in pursuit of affordability.

This report shows how spirit levels can illuminate areas where sets of metrics appear to be in tension with each other and provide perspective on the aggregate impact of decisions made to date, putting a given market in the context of its peers. This, combined with a decision-making framework also provided in the report, allows a focus on the key decisions which to support the rebalancing of a market, or, alternatively, to support the pursuit of international competitive advantage on a particular dimension.

International Comparisons

Communications are key enabling technologies. Well-functioning, affordable networks are vital both socially and economically. Increasingly they are seen as an essential ingredient of international competitiveness.

Consequently, there is ongoing interest in international comparisons of communications markets. Such comparisons can help regulators and policy-makers in a country understand its relative performance and highlight areas for improvement. Thus, they can act as an international competitive spur for nations.

International comparisons can also help global and regional communications companies identify markets with growth potential, and help multi-national companies select markets with adequate infrastructure to support their operations. To date, such comparisons have fallen into two broad categories – data sets and league tables.

Data sets are primarily focused on the raw numbers of international comparisons, with relatively little synthesis (aside from pricing baskets). Regulators and supranational bodies are important providers of such data sets. For example, the US Federal Communications Commission (FCC) publishes an International Broadband Data Report,[2] the UK's Office of Communications (Ofcom) has an annual International Communications Market Report,[3] the Organisation for Economic Co-operation and Development (OECD) publishes statistics through its Broadband Portal[4] and its Digital Economy Outlook,[5] the European Commission has a Digital Agenda Data Tool[6] and the International Telecommunication Union (ITU) offers a World Telecommunication/ICT Indicators database.[7]

In addition, a number of private bodies such as the GSMA, Point Topic and Akamai publish metrics for their particular areas of interest.

League tables are often based on these data sets, but generally seek to synthesize a number of metrics into a single score, which can then be used to rank countries. One example is the EC's Digital Economy and Society Index (DESI).[8] This combines raw metrics into scores for connectivity, human capital, internet use, integration of digital technology and digital public services. These scores are in turn combined into a single DESI score, used to rank the EU28.

Another example is the World Economic Forum's Networked Readiness Index, which combines 53 individual metrics into a single score, used to rank the 143 countries covered.[9] The metrics include telecoms measures, but also measures related to the general business and regulatory environment, education levels and so on. There are also more narrowly focused rankings, such as the FTTH Council's reports on fibre deployment.[10]

Such league tables undoubtedly have impact. Rankings are easy to understand and are particularly powerful as a stimulus to competition between countries, for example. However, the distillation of a complex set of metrics into a single score also carries some disadvantages, particularly as a guide to a policy and regulatory decision-making. These disadvantages include:

Rankings often substantially driven by wealth. The quality of communications networks clearly depends on what a country can afford. Country X may have a higher score than country Y, but this may primarily be driven by country X's higher GDP per capita.

More is not necessarily better. As with other industries, overinvestment in communications networks is possible, and thus it is feasible that in some circumstances top rankings may represent less economically optimal outcomes than slightly lower rankings.

Decision-making involves trade-offs. League tables can be read to imply that countries should make progress on all fronts, driving to improve all incorporated metrics. However, very often the practical decisions facing regulators and policy-makers involve trade-offs between such metrics. For instance, greater superfast coverage may reduce affordability. A single aggregate score may obscure rather than illuminate such critical trade-offs. (The issue of trade-offs is discussed in more detail below).

[2] FCC, *Fourth International Broadband Data Report*, 4 February 2015.
[3] Ofcom, *International Communications Market Report 2015*, 10 December 2015.
[4] OECD, *OECD Broadband Portal* [accessed 29 December 2015].
[5] OECD, *OECD Digital Economy Outlook 2015*, 15 July 2015.
[6] EC, *Digital Agenda Data Tool*, [accessed 29 December 2015].
[7] ITU, *World Telecommunication/ICT Indicators database 2015 (19th Edition/December 2015)*, 22 December 2015.
[8] EC, *The Digital Economy and Society Index (DESI)*, [accessed 29 December 2015].

[9] World Economic Forum, INSEAD & Cornell, *The Global Information Technology Report 2015*, 15 April 2015.
[10] See for example FTTH Council MENA, *FTTH MENA Panorama 2015*, September 2015.

These disadvantages do not invalidate league tables, but they do suggest that alternate perspectives on international comparisons can also be valuable.

This report offers one such perspective – what is termed as a "spirit level" approach, which emphasizes the balance struck between different objectives, rather than a single weighted average score. The approach is also intended to make allowance for differences in wealth, enabling more meaningful comparisons to be made between richer and poorer countries.

However, the spirit level approach is not at odds with league table approaches, some of which (such as the Forum's Network Readiness Index) do provide mappings of countries' performance across individual metrics as well as aggregate scores. Moreover, the spirit level approach draws on similar underlying data sets to some of the league tables. Rather, the spirit level approach has a different conceptual framework and emphasis, and thus provides an additional perspective on policy and regulatory issues; it can be helpful for understanding trade-offs, a central component of regulatory and policy decision-making.

In addition to the top-down analysis of communications outcomes presented in the sprit level, this report also considers the regulatory inputs – the decisions facing regulators and the outcomes they are likely to affect. "Decision matrices" are used to explore trade-offs from a bottom-up perspective.

Policy and Regulatory Trade-offs

Communications policy and regulatory[11] objectives are wide ranging and complex. Countries seek affordable, diverse, widely available and widely used services of a high quality. However, virtually all regulatory decisions involve some degree of trade-offs between these objectives. A given decision may support one policy objective, but perhaps impede another, or come at a cash cost to be borne by the treasury. For example, choosing to allocate spectrum via auctions may support the goal of it being assigned to the most efficient users (and bring in revenue for the government), but conversely it places a cost burden on operators which may be passed through to consumers in higher prices.[12]

Decisions involving trade-offs are not necessarily delicately balanced. For instance, the imposition of emergency call obligations on telecommunications companies does bring costs that ultimately need to be absorbed by consumers. Regulators, however, have been confident that these costs are far outweighed by the benefits. In practice, it is the more balanced decisions that consume most regulatory attention – they inspire the most debate, require the most analysis and call for the most judgement.

Types of trade-offs

There are several types of possible trade-offs, which can be categorized as follows:

Direct
These are trade-offs between elements of communications, where there is a direct link between those elements. For example, a universal service obligation funded by an industry levy may improve coverage but conversely increase prices.

Long term
Long-term trade-offs are those which may have immediate benefits, but which will likely carry costs (currently uncertain) in the longer term. For instance, a decision to impose stringent retail price controls will immediately enhance affordability of communications. However, by creating a hostile investment environment, it will likely deter future funding for the network. This could reduce coverage and quality, or indeed increase prices in the long term. Another example would be strict net neutrality. This may protect current over-the-top (OTT)[13] providers, but perhaps at the expense of future OTT offers that might otherwise have been enabled by specialized services.

Short-term pain for long-term gain is also possible – for instance, choosing FTTH (fibre to the home) rather than FTTC (fibre to the curb) delays the availability of faster broadband (since it is slower to deploy), but in the long term supports higher speeds.

External
External trade-offs are those involving consequences outside communications, and in particular those involving government funds. For instance, state subsidies for FTTH require a trade-off between the benefits of enhanced broadband versus other ways in which the government could spend its money. Data privacy laws are another example. The benefits (though real) are intangible. However, such laws potentially diminish the range of OTT services available. External trade-offs are particularly relevant in the context of international comparisons, since state funding and other external support can flatter communications metrics of a country by comparison to other countries which have not drawn on the public purse for telcos.

The above categorization of types of trade-offs is loose. Moreover, any particular decision can involve multiple types of trade-off. For instance, a government decision to subsidize wholesale next generation access (NGA)[14] involves both a direct trade-off (wholesale vs retail only) and an external trade off (will the subsidy bring worthwhile benefits, and in particular will the incremental subsidy for a wholesale mandate bring worthwhile incremental benefits).

The trade-offs for any one decision also sit within the wider context of other decisions a regulator is making. For example, a regulator may choose to forego a fixed broadband universal service obligation (USO) since it knows a high coverage obligation for mobile broadband will be imposed in a pending spectrum auction. Moreover, the impact of a particular decision may depend on the wider regulatory context. For instance, mobile broadband coverage obligations imposed in spectrum auctions may be positive for broadband take up, but *only if* other regulatory interventions are in place (such as affordable fibre backhaul to base stations).

[11] There are obviously important differences between policy-making and regulation; however, these differences are not relevant to the issues discussed in this paper. Therefore, for the sake of brevity, from this point onwards we will use "regulation" to cover both regulation and policy issues.
[12] The merits and consequences of spectrum auctions are a richly debated field, and we certainly do not claim to have a definitive view. The pros and cons offered here (and for other examples of trade-offs) are purely illustrative.
[13] OTT services rely on internet connectivity provided by others. This covers a wide range, including everything from Skype to Netflix.
[14] Next generation access (NGA) typically brings fibre closer to the end-user to enable higher broadband speeds.

Differences in trade-off decisions

Regulators around the world face similar trade-offs, and there has been much common ground in their response. For instance, the drive for greater competition in communications has been a global theme over the last 25 years (albeit somewhat reversed in the pursuit of NGA in recent years). However, there is also much diversity, with national authorities making very different choices. While on occasion this may simply be bad policy-making, there are substantial legitimate reasons for such different choices, including:

Different views of the future
In making such trade-offs, regulators face a fundamentally hard challenge – comparing two uncertain forecasts of the future. Even for simple yes/no choices, a regulator must, in theory, reach a view as to the likely outcome of "yes", the likely outcome of "no", and the delta between them. However, the uncertainty on the delta of two numbers which themselves are uncertain is significant.

This uncertainty means reasonable people can legitimately reach different views as to the right option. One example of the impact of uncertainty is future bandwidth demand. Some countries have taken the view that applications with high economic or social value that require very high bandwidth are imminent, and therefore have chosen to invest heavily in FTTH and FTTB (fibre to the building). Other countries, taking a different view of future bandwidth demand, have not.

Different communications industry starting points
The right direction of travel depends on the starting point. The current communications landscape is clearly a vital factor in regulatory decision-making. One example is the presence or lack of existing infrastructure competition. If the incumbent has the only fixed network in a country, then local loop unbundling (LLU) may be essential for widespread services competition. Conversely, if a country has widespread cable networks providing voice and broadband competition to the incumbent telco, then the incremental benefit of LLU may be much less. This suggests that LLU is not necessarily right or wrong, rather that it is an appropriate decision in certain circumstances. (It may simply be irrelevant in countries with very limited copper deployment). Similar logic applies to many other regulatory decisions.

Different geographic and economic starting points
Apart from their communications industry status quo, countries have vital differences in their wealth and geography. For instance, for many less developed countries, while a widespread fixed superfast broadband network might be desirable, it is simply unaffordable given the disposable income of consumers. Geography also matters. Australia, for example, has made an early intervention to support satellite broadband to support the significant number of its citizens living in remote locations. Such an intervention would clearly be inappropriate for Hong Kong.

Different weightings on objectives
Even if, hypothetically, two counties had identical starting points and matching views of the consequences of decisions, this would not necessarily mean they made the same trade-offs, since they might place different weights on the objectives. That is to say, they might have different priorities – universality of service might be most important for one country, whereas highest quality services for a smaller number might be most important for another.

Preferences of this type are deeply anchored in the attitudes of the society in question, and for the purposes of communications regulatory choices are a given. One example of how such attitudes differ between countries is the degree of attachment to free markets as a driver of efficient outcomes. Some countries see free markets as paramount; others prefer a more statist approach. More specific examples include Germany's focus on privacy, and France's focus on protection of the national culture. Such philosophical differences inevitably feed down into individual regulatory choices.

All these factors – different views of the future, different starting points and different priorities – mean that decisions regarding trade-offs will legitimately differ from country to country. These varying decisions combined with environmental factors result in very different outcomes across countries for coverage, pricing and so on. These output consequences are explored via the spirit level approach (see the Spirits Level section), but first it is necessary to explore the input regulatory decisions and the associated output trade-offs through "decision matrices".

Decision Matrices

While countries may make different regulatory decisions, the directional impacts of those decisions will generally be similar for different markets. For example, countries may or may not impose coverage obligations in spectrum auctions, but *if* they do, it will increase coverage but supress auction proceeds. Thus, while it may not be possible to take a "globally correct" view on regulatory decisions (since these depend on local factors), a global view can be taken on the factors being traded off for a given decision.

Existing research

There is academic literature investigating the impact of regulatory decisions (a selection of which is summarized in Appendix I). However, much of this is "unidimensional" – focused on only one element of the consequences of a given decision. For example, while it is useful to know that additional mobile operators keep prices lower, a regulator must consider the trade-off that those low prices and market fragmentation may lead to lower returns on capital. This in turn may weaken incentives to upgrade networks, thereby threatening quality.

It is also a feature of much of the literature that investment is taken as inherently good – it serves as the measure of success in many of the econometric studies. Clearly, some investment is essential, but it is also possible to have too much. For example, the period 1998-2002 saw a wasteful overinvestment in international capacity.

Mapping regulatory decisions and outcomes

Given the different focus of existing literature, "decision matrices" have been created for this report to explore trade-offs. For a range of decisions – such as "increase spectrum availability" or "apply NGA wholesale active access" – these matrices offer a view of the dimensions affected by that decision. For NGA active access, for example, the affected dimensions include NGA investment, competition, affordability, coverage and uptake.

For each of these dimensions, a tentative view is offered as to whether the impact is positive or negative. For instance, NGA active access might have a positive impact on NGA competition, but a negative impact on NGA investment. In some cases the view is "+/-". This is used to indicate situations where the direction of the impact may heavily depend on the specifics of local circumstances, or it may be different for different players so that the direction of the overall outcome is more uncertain.

For example, higher telecoms taxes may be positive for the treasury directly, but will have offsetting negative effects if weaker telecommunications (due to the specific tax) weaken the economy and thereby suppress general taxes. The degree of this offset will depend on how effectively an economy gathers these general taxes. To take another example, strong net neutrality may limit service innovation by telcos, but protect innovation by application providers.[15]

For the purposes of this paper, the direction of impacts is not critical. Rather, the linkage between decisions and affected dimensions are mapped to build a picture of the trade-offs associated with individual decisions, and the multiplicity of decisions with may be relevant to a particular desired outcome.

The paper also focuses on decisions that are current and material, drawing on the Forum's recent work investigating regulatory priorities,[16] supplemented by expert knowledge.

The decisions have been split between those primarily relevant to each of fixed and mobile. While convergence continues, as a practical matter, most regulatory decisions sit in one area or the other, and the affected dimensions are different. As a result, there are both a fixed and a mobile decision matrix. Those impacts that are outside the communications sector entirely, or cross-impacts from decisions, which primarily relate to mobile but also affect fixed (or vice versa), are treated as "external".

[15] Though some argue that the absence of higher cost, higher quality IP products may foreclose innovation by application providers that would require such products.
[16] World Economic Forum, *Future of Digital Communications – Regulatory Heat-map*, February 2016.

Fixed decision matrix

Decision	Intermediary dimensions: Competition: Copper	Intermediary dimensions: Competition: NGA	Intermediary dimensions: Investment: NGA	Output dimensions: Affordability: Copper	Output dimensions: Affordability: NGA	Output dimensions: Affordability: Voice	Output dimensions: Coverage NGA	Output dimensions: Uptake/ usage	Output dimensions: Service innovation	Output dimensions: QoS	Output dimensions: Content	External dimensions
Increase copper access prices	-	+	+?	-	+?							
Apply NGA whosale active access		+	-?		+?		-	+				
Apply passive infrastructure access		+	+		+							
Structural separation	+	+	-?						-?			
NGA supply-side subsidies			+				+					- subsidy
NGA demand-side subsidies			+?		+			+				- subsidy
Increased BB USO (gov't funded)			+				+					- subsidy -mobile investment
Increased BB USO (industry funded)			+	-	-		+	-				- mobile investment
Strong net neutrality			-?	-?	-?	+?			+/-	-?	+	
Merger blocks	+	+	-	+?	+?					-?		
FTTH co-investment		-?	+		+		+		-?			
Enterprise wholesale products	+	+	-		+?							
Telecoms specific taxes and fees			-	-	-	-	-?	-?				+/- tax revenues

+ Decision has positive impact on this dimension (+? indicates a limited or less certain positive impact)

- Decision has negative impact on this dimension (-? Indicates a limited or less certain negative impact)

Dimension affected by greatest number of decisions

Dimension affected by many decisions

Note: For definitions of the decisions, see Appendix III.

Mobile decision matrix

Decision	Intermediary dimensions: Competition	Intermediary dimensions: Investment	Output dimensions: Affordability: Data	Output dimensions: Affordability: Voice	Output dimensions: Coverage	Output dimensions: Penetration	Output dimensions: Usage volume	Output dimensions: Service innovation	Output dimensions: QoS	Output dimensions: Content	External dimensions
Spectrum set-aside for entrants	+		-?	-?							- proceeds
Increased spectrum availability	+		+	+	+?	+?	+		+		- expense to release
Spectrum coverage mandates		+	-?	-?	+						- proceeds
Extended spectrum licence term		+			+?						- proceeds
Merger blocks	+	-	+?	+?	-?						
Strong net neutrality		-?	-?	+?			+?	+/-	-?	+	
Passive infrastructure sharing		-?	+?	+?	+?						
Backhaul price control		+	+?	+?	+?				+		- fixed lost revs
Mobile used for universal service					+						- fixed lost revs
"Mobile first" regulations		+					+	+			- fixed lost revs
National mobile plans		+			+?			+			-? subsidy
Telecoms specific taxes and fees		-	-	-	-?	-?	-?				+/- tax revenues

+ Decision has positive impact on this dimension (+? indicates a limited or less certain positive impact)

- Decision has negative impact on this dimension (-? Indicates a limited or less certain negative impact)

Dimension affected by greatest number of decisions

Dimension affected by many decisions

Note: For definitions of the decisions, see Appendix III.

Dimension types

The matrices cover a range of affected dimensions (though certainly these are not exhaustive) and group them in three categories – intermediary, output and external.

Intermediary dimensions are those that are not in of themselves valuable, but are widely agreed to be important to a healthy market and good overall outcomes. Competition[17] and investment are the two main examples; both are means to ends. Their value is not inherent, but rather in that they lead to lower prices, more innovation and so on. Put another way, there would be no reason to pursue ever-greater competition if it did not lead to incremental innovation and price reductions. Moreover, it is possible to have an excess of either competition or investment – more is not always better.

Output dimensions are those aspects of the communications markets that are directly valuable to end-users. These include affordability, coverage, uptake, quality of service and so on. External dimensions are those that are outside the communications market. As discussed above, a number of regulatory trade-offs have impact beyond the telecoms markets, through subsidies, industry levies, auction proceeds, cost of spectrum release by other users and so on.

"Focus" dimensions

The matrices highlight the dimensions, which are affected by the greatest number of live regulatory decisions. For instance, on the fixed network matrix "NGA investment" is shaded dark pink, since a majority of decisions are likely to have an impact on this investment. In a sense, this is unsurprising. NGA investment is a priority for many countries (at least in the developed world), and this is driving the regulatory agenda. Interventions that might increase investment are very much to the fore. This analysis of "focus" dimensions supports the choice of dimensions to track through the spirit level analysis. A spirit level that includes metrics for these priority areas is likely to be more relevant than one in which omits them.

Using the matrices to identify "levers to pull"

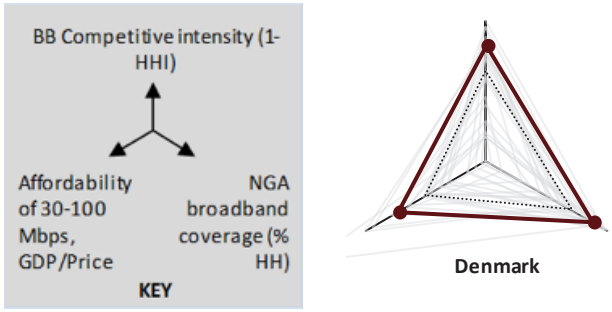
The matrices have been built starting from decisions and considering the outputs affected. However, they can also be used in the opposite direction. By considering all the decisions that are linked to a given output, one can readily see the regulatory levers that are likely to be most relevant. To take a simple example, if a regulator had a particular concern about the level of competition in its mobile market, the matrix highlights spectrum set-aside and availability, and merger blocks as choices, which might improve matters on that particular dimension. (Though, as the matrix notes, these choices might have other adverse consequences).

[17] Which we mean to use "competitive intensity", rather than simply the number of players in the market.

Spirit Levels

Now let's turn to a mapping of outcomes – that is, the relative performance on different communications dimensions resulting from a country's regulatory decisions to date (combined with environmental factors).

The basis for this is a "spirit level' report, which charts the relative results for three selected metrics for a given country set. An example for single country is shown below.



For this paper, a dynamic tool (published alongside this report)[18] has been developed. The tool assembles relevant metrics from a wide variety of sources, enables a user to choose a country set and the metrics relevant to their requirement, and automatically generates the report.

These reports are designed to enable the user to take a view on the different balances struck by different countries. For instance, a given country may have a stronger performance in affordability than its peers, but a weaker one in NGA coverage. Based on this, the country may wish to "rebalance", favouring trade-offs which are positive for coverage. Alternatively, such a skew may be in line with the country's policy objectives – coverage may have been deliberately sacrificed in pursuit of affordability.

Available data

The spirit level tool draws on an array of data sources, shown in Figure 1. These sources provide raw data for topics such as pricing, coverage, speeds, usage, adoption, industry financials, demographics and economic data. The tool draws on these to create a set of output metrics. Some are pulled directly from the relevant underlying data; others involve minor recalibration. For example, underlying price figures are converted to affordability by dividing into GDP per capita. This ensures that for all metrics a higher figure is better.

Figure 1: Data sources for the spirit level

Akamai	Google	OECD
Bank of America	GSMA	Ofcom
EC	IMF	StatCounter
Eurostat	ITU	World Bank
FTTH Council		

Data availability varies significantly; the range of metrics available for developed countries is much higher than that for developing countries. A number of sources – such as Akamai, Bank of America, the EC, FTTH Council, OECD and Ofcom – are largely or entirely focused on higher income countries.[19] Even sources such as the ITU, which aspire to global coverage, often have significant gaps for some metrics .

While in part this may be a result of the sophistication or resourcing of the authorities gathering the raw data in different countries, it may also be driven by relevance. For instance, data on FTTH has been of much less interest in many developing markets where given the trajectory of development there has been limited investment in fibre services but rather a focus on developing mobile networks first.

Country sets

A country set is a group of counties, such as Africa, the OECD or "high income". The spirit level tool allows the user to select which group comparisons should be applied to. This affects both the countries to be included and the benchmark for best performance within the country set. While it is possible to run a spirit level for all counties, in practice it is generally more useful to focus on an individual group, since:

- The set of metrics available varies for different country types.
- The relevant metrics are different – fixed broadband is much more important in developed markets, for example.
- The regulatory issues are different – encouraging NGA deployment is a key concern in developed markets, much less so elsewhere.
- The "envelope of the possible" is very different; richer countries can afford high levels on multiple metrics, whereas poorer countries may face sharper trade-offs. (That Bahrain scores higher than Bangladesh across a set of metrics is not very illuminating; how Bangladesh compares to its peers is more helpful).

[18] Available at http://widgets.weforum.org/regulatory-tradeoffs/

[19] For details, see Appendix IV.

Metrics

Each spirit level is based on a set of three metrics, for example "NGA coverage", "Affordability of 30-100 Mbps broadband" and "Broadband competitive intensity".[20]

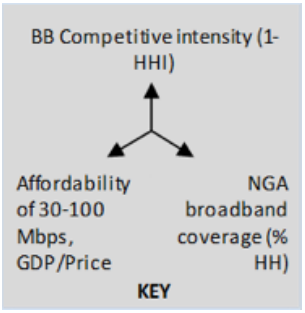
To facilitate an understanding of trade-offs, metrics such that "more is better" (standalone) is specified – i.e. all else being equal, a higher score is preferable. For this reason, affordability rather than price, for example, is used.

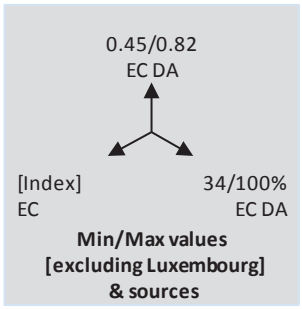
Each metric in a spirit level is rebased relative to the best and worst performers for that metric from the country set. For example, in the EU28, Malta has the highest NGA coverage – 100% per the EC – and is given a score of 1.0 on this metric. Spain, with 73% NGA coverage, is given a score of 0.59, since its coverage is a little better than halfway between Malta and that of the worst performer, Greece, at 34%.[21] (Greece receives a score of 0).

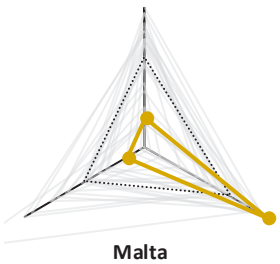
Note however that if the country set was the EU5, Spain would receive a score of 0.71 instead of 0.59, since its relative performance within that group is stronger.
For each spirit level metric, the maximum and minimum values from the country set are provided, representing the outer and inner ends of each axis.

Country plots

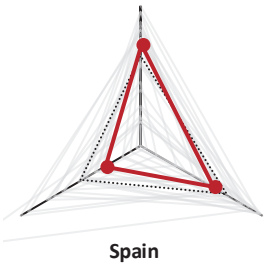
Shown below are the keys for a spirit level of fixed competition, NGA coverage and affordability for the EU28, and the country plots for Malta and Spain. On the NGA coverage dimension, Malta is at the outer end of the axis (1.0), since it has the highest coverage in this group, and Spain is at 0.59.







Malta



Spain

[20] Defined as 1-HHI for fixed broadband.
[21] 0.59 = (73%-43%)/(100%-43%).

Shown in the background is a dotted line. This represents the median performance for each metric. Thus, it can be concluded that the broadband competitive intensity in Spain is roughly at a median level for the EU28.

The area of Malta's triangle plot is smaller than that for Spain, and this can be taken as a very crude measure of overall performance across these metrics. (That said, this presumes the metrics are equally important, which may not be the case). As noted above, overall performance is clearly driven in part by GDP per capita, which enables a country to afford better outcomes. Malta has a GDP per capita a quarter lower than that of Spain, and this may be one factor in its poorer overall performance.

More importantly than the area of the plots, is the ability to compare their "skew". Malta has strong coverage, but rates less well on affordability and competition. This is described as "skewed toward" coverage, since this metric is much weaker than the other two. Conversely, Spain is "skewed away" from affordability, since this metric is weaker than the other two, which are roughly balanced.[22]

These dissimilar skews suggest that the differences between Malta and Spain are not simply a matter of wealth – if they were, one would expect that the two triangles have different sizes but similar shapes.

Such skews may be by accident or design, and are not inherently good or bad. For instance, they may stem from a deliberate targeting of certain goals to gain an international competitive advantage. (Qatar's FTTH national broadband network would be an example). They may also be driven by historical circumstances. For instance, Malta has long had good cable network coverage, which has supported a comprehensive NGA deployment. (Cable network coverage is an important environmental factor in a number of markets).

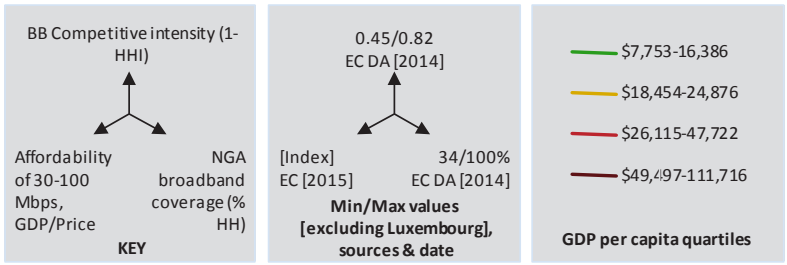
Ordering countries

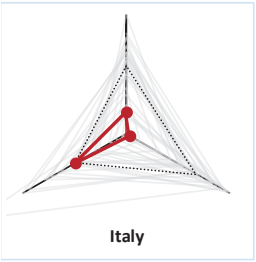
The final element of the spirit level is a grouping of countries based on their skew. The individual country plots are placed into order. First are those skewed toward metric one (ordered by the degree of skew), then those skewed towards metrics two and three.[23] Second are those skewed away from particular metrics. Third are those which are approximately balanced, and fourth are those countries with missing data, for which skew cannot be determined.

While automatically generated for each spirit level, the order does depend on some arbitrary assumptions, such as how much metrics can vary and still be deemed to be "balanced". There is also no inherent significance to this ordering – it is not better to be first, for example – but it does serve to group countries with a similar balance, facilitating pattern identification. Nor is it inherently better to be balanced – this simply means a country has performance with the same 'shape' as the median of its peers.

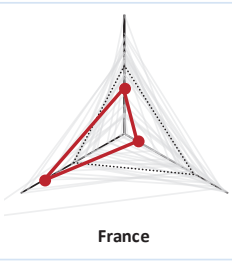
[22] Note that for the purposes of assessing skew, the strength or weakness of a metric is calculated relative to the median, not the maximum score for any given metric.
[23] The order of the metrics is arbitrary.

EU28: BB Competitive intensity (1-HHI) NGA broadband coverage (% HH) Affordability of 30-100 Mbps, GDP/Price




Italy


Luxembourg

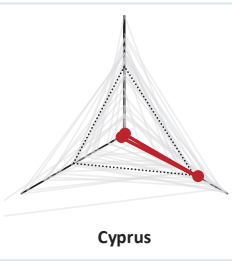

France

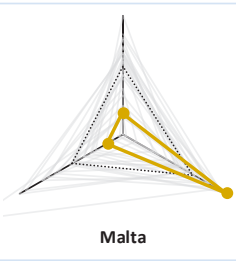

Ireland

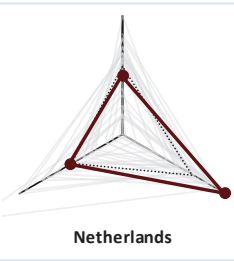

Finland


Sweden


Germany


Cyprus


Malta


Netherlands

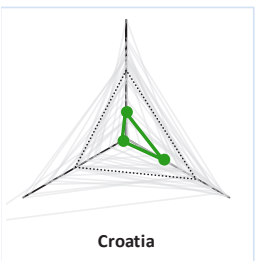

United Kingdom


Bulgaria


Czech Republic


Romania


Slovenia

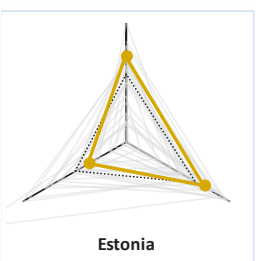

Croatia


Hungary


Portugal

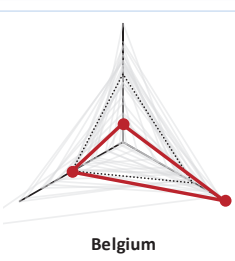

Latvia

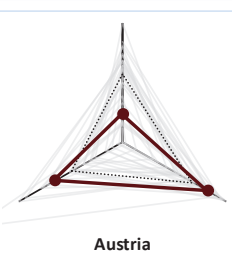

Spain

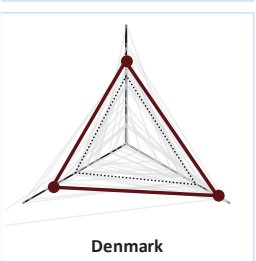

Estonia


Poland

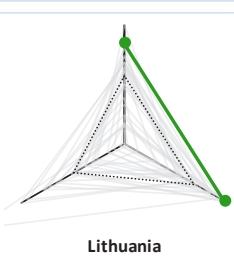

Slovak Republic


Belgium


Austria


Denmark


Greece


Lithuania

To provide further context for interpretation, the triangles are shown in different colours to indicate the GDP bracket of the country in question – green, yellow, light red and dark red for bottom through top quartile GDP per capita for the country set in question. Thus on a spirit level for low income countries, Zimbabwe is shown in dark red because it is in the top quartile within that group – obviously this does not mean that Zimbabwe is in absolute terms a wealthy country. (For countries such as North Korea where there is a lack of reliable GDP data, black is used).

Sample spirit levels

Below are the combined results for the EU28 for the three metrics discussed above (the first of three sample spirit levels in this report).[24]

Italy through Germany is skewed towards affordability. Cyprus through the UK is all skewed towards NGA coverage, and Bulgaria through Romania towards competition. Slovenia through Estonia is skewed away from affordability (a number of the lower income countries are in this group.). Poland and the Slovak Republic are skewed away from coverage, and Belgium and Austria away from competition. Denmark is roughly balanced (that is to say, have a shape similar to median performance). Greece and Lithuania are missing a data point (though Lithuania scores very well for coverage and competition, particularly given its relatively low wealth).

[24] For underlying data and sources, see Appendix IV.

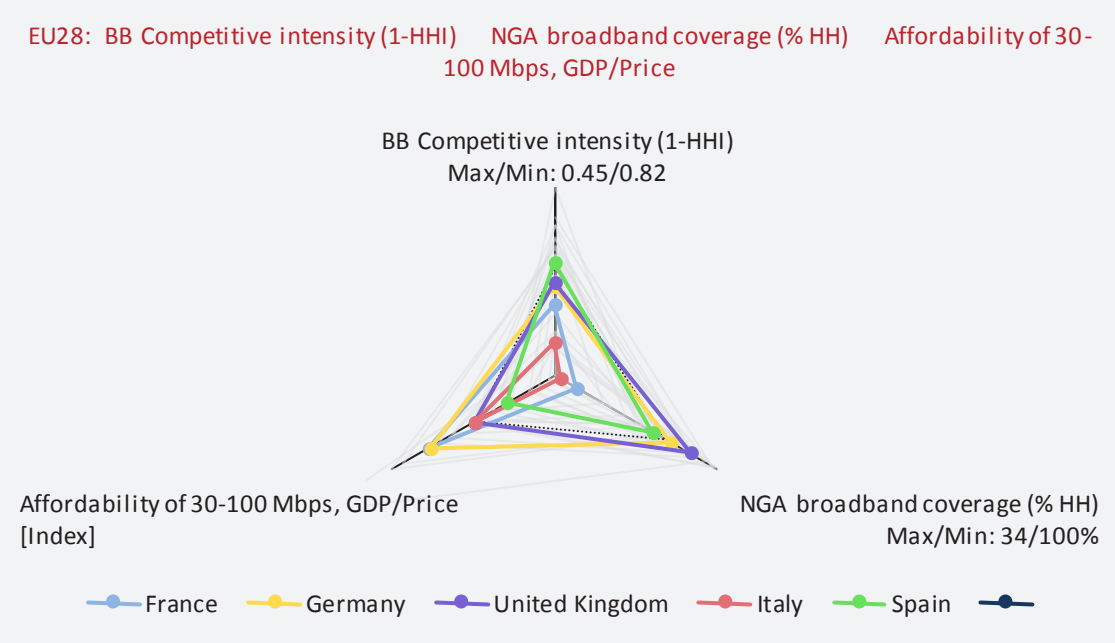
The largest triangles (representing multidimensional success) are associated with some of the more prosperous countries, such as Denmark, Finland, Sweden and Luxembourg. (Luxembourg's high GDP is such that it gains a very high score for affordability. This has been set aside as an outlier for the purpose of creating the charts).

However, wealth is no guarantee. For example, Ireland, despite being in the top GDP per capita quartile, scores lower. Conversely, Estonia scores relatively well despite being in the lower-middle GDP per capita quartile.
The charts suggest that there is a three-way trade off between these metrics – i.e. it is difficult to do well on all three dimensions simultaneously. A large number of triangles are skewed (underperforming on at least one dimension).

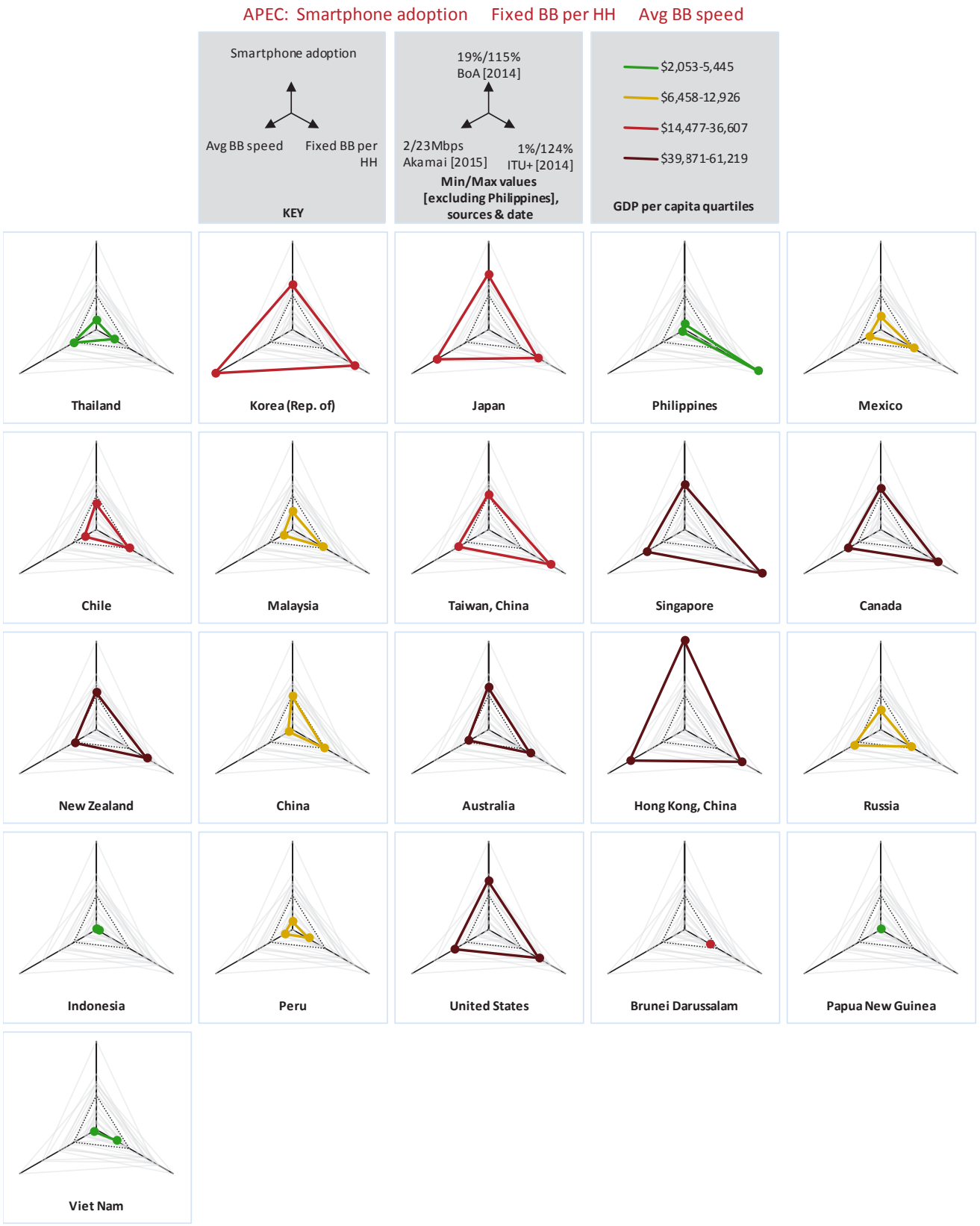
Only one country – Denmark – manages to exceed the median performance on all three metrics. Were there no trade-off between the three metrics, one might expect three countries to do so.[25] Such a trade-off is intuitive. Markets with fragmented customer bases and low retail prices are likely to find the business case for NGA deployment to more remote areas challenging.

For users interested in directly comparing given countries, the spirit level tool has a facility to plot up to six countries on the same chart. Here for example are the EU5 results from within this spirit level:

[25] A 1/2 chance of being in the top half for each of three metrics gives a 1/8 chance of being in the top half for all three. There is full data for 25 countries, implying an expectation of 25/8 = 3.125 countries beating the median on all three metrics, if there was no trade-off between them.



Another example of a spirit level considered is the diverse Asia Pacific Economic Cooperation (APEC) states. The metrics examined are fixed broadband speed and uptake and smartphone adoption (as a proxy for the sophistication of mobile networks).



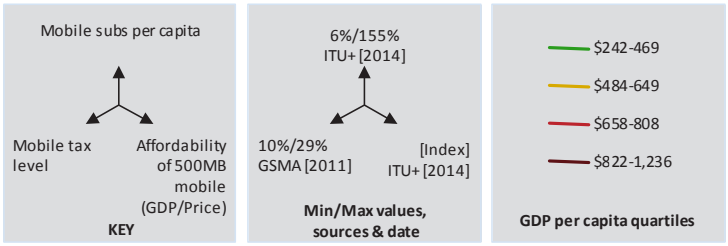
Thailand, Korea and Japan are skewed toward speed and the Philippines[26] through New Zealand are skewed to broadband adoption. Australia and China are skewed away from speed. Indonesia, Peru and the US are balanced.

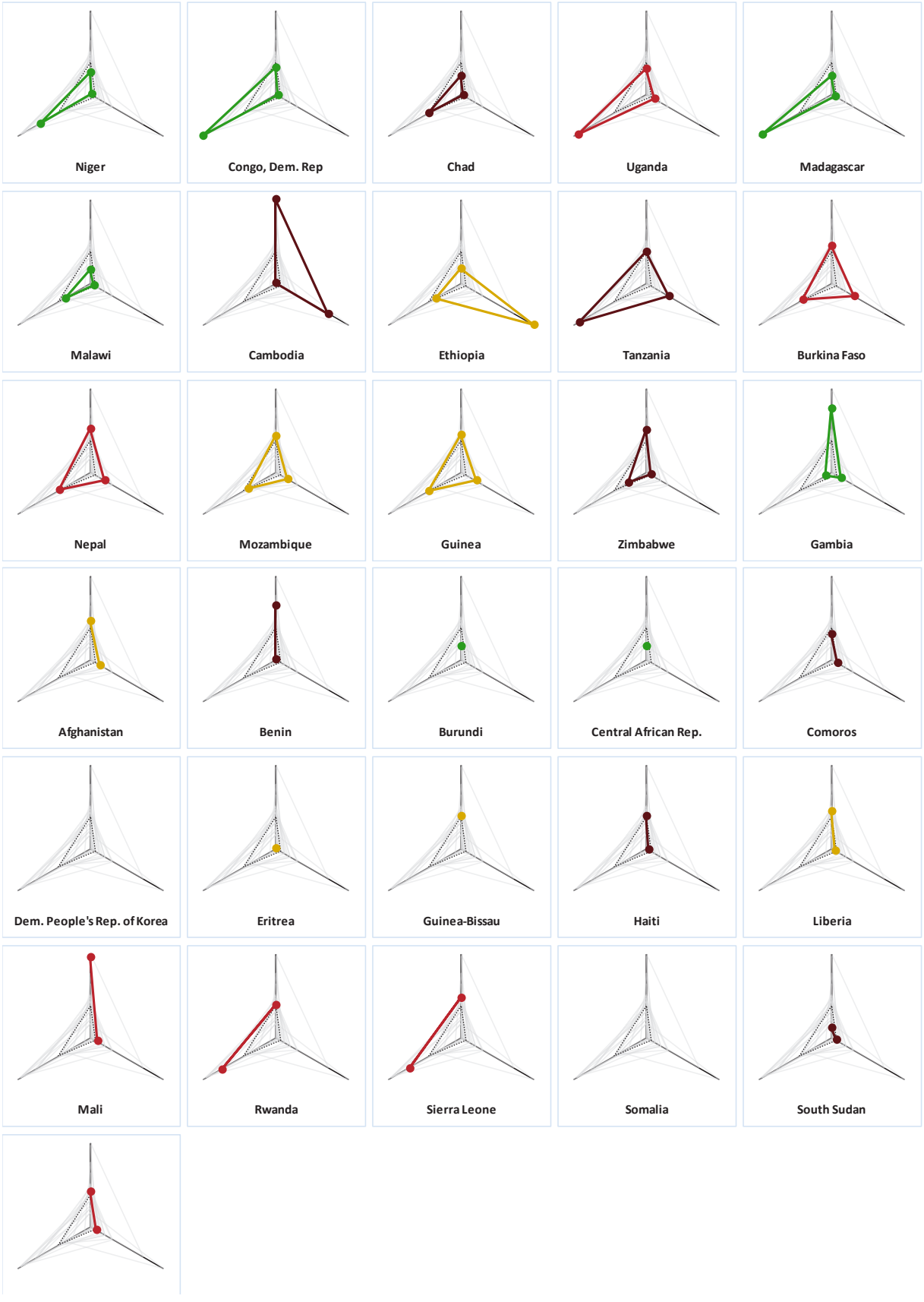
The APEC states have very different GDP per capita, and it unsurprising that, for example, Japan outperforms Thailand on all three metrics. However, other aspects are more intriguing:

- Japan and Korea's strong performance, despite only second quartile GDP per capita
- Hong Kong's strong performance across all dimensions, despite being the poorest of the top-quartile counties
- Korea's skew away from mobile
- China's underperformance on speed, relative to its success on other dimensions
- The underperformance of Latin America countries versus their various Asian economic peers

[26] The Philippines data may be anomalous.

Low income: Mobile subs per capita Affordability of 500MB mobile (GDP/Price) Mobile tax level





The third example spirit level is for the poorest-quartile countries, and the metrics considered are mobile adoption, mobile taxation levels and mobile affordability. A focus on mobile is appropriate for these poorer countries, in that fixed communications makes relatively a minor contribution to the retail market at this stage of development. For instance, of this group the country with the highest fixed broadband penetration is Zimbabwe, at just 5% of households. In the future, fibre connections, particularly to key government institutions, enterprises and for backhaul for mobile data services, are likely to become increasingly relevant.

Note that for this purpose higher tax levels are given a higher score. Standalone, they are positive, in that they bring money in to a country's treasury (an external dimension).[27] However, as discussed above, they may reduce overall tax take via a secondary impact on general taxation. Furthermore, even if the net effect on the treasury were to be positive, the critical issue is how this trades-off against other objectives, such as mobile adoption – precisely the issue addressed by the spirit level.

The tax figures used are for 2011 – the latest available. However, since the impact of changes in tax on other metrics is likely to be lagged, this is not necessarily problematic.

Niger through Malawi is all skewed towards taxation, having high rates but relatively poor performance on both mobile affordability and adoption. A number of the countries with the highest mobile taxation are also the poorest (green). In low-income economies, the tax base mobile represents is perhaps particularly tempting.

A sharp division in affordability is also evident. Cambodia and Ethiopia are significant outliers from the rest of the group. For example, while Chad and Cambodia have roughly similar GDP per capita, the cost of 500MB mobile service in Chad is 20x that in Cambodia.[28]

The spirit level is suggestive of trade-offs between these three metrics – only Guinea achieves better than median scores for all three, and by a narrow margin.

The significance of data gaps for these lower income countries should be noted. Even for these basic metrics, there is only full data for 15 out of the 31 countries.

[27] However, as discussed above, they may ultimately reduce overall tax take via a secondary impact on general taxation.
[28] Data from ITU.

Conclusions

The investigation of the above spirit levels and many others suggests that empirically measurable pair-wise trade-offs of output metrics are rare – that is, there is generally not a strong visible negative correlation between two metrics. This is not to say that, for example, greater affordability is not associated with lower broadband coverage. Rather, any such linkage is often lost in the noise of other factors that may independently influence these variables. Population density is obviously an important factor in the economics of coverage, for instance. Its impact may conceal any change linked to affordability. Equally important are other regulatory decisions. Government subsidies may allow a combination of high coverage and low prices for example.

However, spirit levels can illuminate areas where sets of metrics appear to be in tension with each other, as seen with broadband coverage, competition and affordability for the EU28.

Spirit levels also provide perspective on the aggregate impact of decisions made to date, putting a given market in the context of its peers. This, combined with the decision matrices, then allows a focus on the key decisions to support the rebalancing of a market or, alternatively, to support the pursuit of international competitive advantage on a particular dimension.

Naturally, the spirit level approach is constrained by the available data. As noted, a number of metrics have very incomplete data. Moreover, some metrics that would be extremely relevant to understanding trade-offs – such as industry return on investment by country – are barely tracked at all. This is a potential area for international bodies to consider.

Finally, the spirit levels make very clear that there is not a single path to communications development. The various countries are not improving networks and usage in a common way, separated only by time and wealth. Rather different countries have very different emphases, reflecting both their own priorities and the technologies available to them at various stages of their development.

Appendix I: Sample academic research regarding regulatory decisions

Paper	Primary Approach	Scope and/or Conclusion
Balto & Singer, "The FCC's Incentive Auction: Getting Spectrum Policy Right", Progressive Policy Institute, September 2013	Qualitative analysis	Spectrum allocation support for new MNO comes at the expense of the efficiency of the sector
Bohlin et al, "Mobile Wireless Performance in the EU and the US: Implications for Policy", Communications and Strategies, Q1 2014	Qualitative analysis	Discussion of static vs dynamic competition, making the case for consolidation to support the latter
Briglauer et al., "Facility- and service-based competition and investment in fixed broadband networks: Lessons from a decade of access regulations in the European Union member states", *ZEW Discussion Papers*, May 2015	Empirical analysis	Facilities based competition encourages investment
Dauvin & Grzybowski, "Estimating broadband diffusion in the EU using NUTS1 regional data", Telecommunications Policy, September 2013	Empirical analysis	Inter and intra-platform competition support fixed BB adoption (EU)
Flacher & Jennequin, "Access regulation and geographic deployment of a new generation infrastructure", *Telecommunications Policy*, March 2014	Abstract modelling	Ex-post access prices discourage investment but encourage uptake (static vs dynamic efficiency)
Garrone & Zaccagnino , "Seeking the links between competition and telecommunications investments" , *Telecommunications Policy*, April 2015	Empirical analysis	Unbundling + intense competition encourage incumbent investment
Götz, "Competition, regulation, and broadband access to the internet", Telecommunications Policy, September 2013	Abstract modelling	Analysis of FBB coverage/penetration trade-offs. Light handed regulation may be welfare maximising
Grønnevet et al, "Spectrum policy and competition in mobile data", May 2014	Abstract modelling	Spectrum sharing can result in strategic gaming and enhance producer surplus at expense of consumers
Hazlett et al, "What Really Matters in Spectrum Allocation Design", Northwestern Journal of Technology and Intellectual Property, October 2011	Various	Value of efficient allocation of spectrum is far greater than likely auction proceeds
Hrovatin & Švigelj "The interplay of regulation and other drivers of NGN deployment: A real-world perspective", *Telecommunications Policy*, July 2013	Slovenia case study	High copper access charges and no ex-ante mandate for fibre access encourage NGN investment
Krämer & Schnurr, "A unified framework for open access regulation of telecommunications infrastructure: Review of the economic literature and policy guidelines", *Telecommunications Policy*, September 2014	Literature review	Discussion of trade-offs from state involvement, open access, structural separation etc.
Lestage & Flacher, "Infrastructure investment and optimal access regulation in the different stages of telecommunications market liberalization", *Telecommunications Policy*, February 2014	Abstract modelling	Optimal access pricing depends on stage of liberalisation
Tsai & Bauer, "Effects of Public Policy on Fixed and Mobile Broadband Infrastructure Quality", TPRC Conference Paper, September 2014	Empirical analysis	Finds that competition is positive for broadband speed. Finds that impact of policies is context dependent

Appendix II: Data availability for metrics in the spirit level tool

		Country Income			
		Low	*Lower Mid*	*Upper Mid*	*High*
Price	FBB monthly subscription charge, in USD	94%	98%	96%	85%
	Fixed tariff basket / GNI (%)	65%	86%	85%	71%
	Affordability of fixed tariff basket (GNI/basket)	65%	86%	85%	71%
	Fixed tariff basket, US$	65%	86%	85%	71%
	Price of 50GB, 30 Mbps BB, US$	0%	0%	4%	40%
	Affordability of 50 GB, 30 Mbps BB, GDP/Price	0%	0%	4%	40%
	Med price, 12-30 Mbps BB+Tel, EUR PPP	0%	0%	6%	36%
	Affordability of 12-30 Mbps, GDP/Price	0%	0%	4%	31%
	Med price, 30-100 Mbps BB+Tel, EUR PPP	0%	0%	7%	40%
	Affordability of 30-100 Mbps, GDP/Price	0%	0%	4%	34%
	Med price, 100+ Mbps BB+Tel, EUR PPP	0%	0%	2%	29%
	Affordability of 100+ Mbps, GDP/Price	0%	0%	2%	25%
	Price, Mobile BB handset_500MB, postpaid ($)	77%	86%	81%	83%
	Affordability of 500MB mobile (GDP/Price)	74%	84%	81%	73%
	Mobile tariff basket / GNI (%)	65%	86%	85%	71%
	Affordability of mob tariff basket (GNI/basket)	65%	86%	85%	71%
	Mobile tariff basket, US$	65%	86%	85%	71%
Mob usage	Mobile subs per capita	100%	100%	96%	91%
	Take-up of mobile broadband (subs/100 ppl)	0%	0%	4%	33%
	Smartphone adoption	0%	16%	20%	35%
	Smartphone use	0%	14%	19%	49%
	Mobile data volumes per person (Mbyte)	0%	4%	4%	18%
Mob Cov	Pop'n covered by cellular (%)	42%	44%	57%	60%
	Pop'n covered by 3G (%)	29%	34%	41%	54%
	LTE coverage (as a % of HH)	0%	0%	4%	35%

		Country Income			
		Low	*Lower Mid*	*Upper Mid*	*High*
Fix use	Fixed BB per HH	87%	98%	93%	90%
	FTTH/B HH Penet	23%	32%	56%	61%
	FBB data vols per person (Gbyte/m)	0%	4%	4%	18%
Fixed cov/qual	Avg BB speed (Akamai)	0%	12%	26%	44%
	Median advertised FBB DL speed	0%	0%	4%	40%
	Connections > 30 Mbps	0%	0%	4%	40%
	FTTH/B share of all BB	0%	0%	4%	40%
	FTTP Coverage	0%	0%	4%	34%
	NGA broadband coverage (% HH)	0%	0%	4%	35%
Econ & Dem	Population	100%	100%	100%	98%
	Households	94%	98%	98%	91%
	GDP per Capita (EUR PPS)	0%	0%	4%	36%
	GDP per Capita (US$)	94%	98%	94%	75%
Competit'n	Mkt shr of leading op (% active SIMs)	0%	0%	4%	26%
	Mkt shr of non-leading ops (% act SIMs)	0%	0%	4%	26%
	New entrants' share in FBB subscriptions	0%	0%	4%	31%
	BB Competitive intensity (1-HHI)	0%	0%	4%	33%
Financials	Telecoms revs per capita (£/month)	0%	4%	4%	18%
	Telecoms revs / GDP	0%	4%	4%	18%
	Invest / Revenue	0%	0%	4%	39%
	Invest / capita	0%	0%	4%	39%
	Invest / GDP	0%	0%	4%	39%
	Mobile tax level	55%	64%	50%	44%
	Mobile EBITDA margin	0%	16%	20%	35%
	ARPU (US$)	0%	16%	20%	35%

Appendix III: Decision definitions

Fixed

Decision	Definition
Increase copper access prices	Increase the price for unbundled copper local loops
Apply NGA wholesale active access	Require incumbents to offer wholesale access to their FTTx access networks on an active basis, at a price attractive to other operators
Apply passive infra access	Require incumbents to make duct and pole access available to other operators at an attractive price
Structural separation	Break out the incumbent's fixed access network into a new company with independent ownership
NGA supply-side subsidies	Provide government funds to incent deployment of superfast broadband in areas where it would not otherwise be commercially viable
NGA demand-side subsidies	Provide government-funded vouchers to end-users, to be used to purchase superfast broadband
Increased BB USO (gov't funded)	Establish (or increase the tech specification of) a broadband universal service obligation, with incremental cost met by government
Increased BB USO (industry funded)	Establish (or increase the tech specification of) a broadband universal service obligation, with incremental cost met by industry
Strong net neutrality	Limitation of discrimination between IP traffic flows to basic traffic management
Merger blocks	Prevention of proposed mergers between fixed telecoms players
FTTH co-investment	Joint investment in FTTH deployment by telcos, with shared risk and return
Enterprise w/sale prods	Regulated leased lines and business grade bitstream / VULA.
Telecoms specific taxes & fees	Taxes (sales or otherwise) or government fees that apply to telecoms products but not to general goods and services

Mobile

Decision	Definition
Spectrum set-aside for entrants	Carving out of blocks of spectrum designated for the use of new mobile operators only
Increased spectrum availability	Increasing spectrum available to mobile operators, typically by refarming from other uses
Spectrum coverage mandates	Attaching requirements for a certain level of coverage (e.g. premise) as a requirement attached to a particular block of spectrum in a wider auction
Extended spectrum licence term	Increased length of spectrum licences, requiring less frequent renewal
Merger blocks	Prevention of proposed mergers between mobile operators
Strong net neutrality	Limitation of discrimination between IP traffic flows to basic traffic management
Passive infrastructure sharing	Sharing of mast sites and similar by mobile operators
Backhaul price control	Regulatory controls on the price charged by the incumbent to mobile operators for backhaul connectivity from masts to the core
Mobile used for universal service	Specification of universal service that allows the requirement to be met by mobile networks
'Mobile first' regs	A broad regulatory philosophy which defaults to mobile as the primary solution, focusing on fixed only when essential
National mobile plans	Government-level drive to enhance mobile connectivity (similar to various national fixed broadband plans)
Telecoms specific taxes & fees	Taxes (sales or otherwise) or government fees that apply to telecoms products but not to general goods and services

Appendix IV: Underlying data for spirit level reports

EU28 fixed broadband spirit level

	Countries	Metrics			
		BB Competitive intensity (1-HHI)	NGA broadband coverage (% HH)	Affordability of 30-100 Mbps, GDP/Price	GDP per Capita (US$)
1	Austria	0.54	88	656	51,307
2	Belgium	0.51	99	546	47,722
3	Bulgaria	**0.82**	69	392	7,753
4	Croatia	0.54	57	236	13,494
5	Cyprus	0.45	80	239	26,115
6	Czech Republic	0.72	67	540	19,563
7	Denmark	0.71	92	698	60,564
8	Estonia	0.72	83	466	19,671
9	Finland	0.71	75	846	49,497
10	France	0.59	43	743	44,538
11	Germany	0.63	81	730	47,590
12	Greece	0.50	34	..	21,653
13	Hungary	0.65	80	277	13,881
14	Ireland	0.57	71	636	53,462
15	Italy	0.52	36	551	35,823
16	Latvia	0.75	90	425	15,729
17	Lithuania	0.76	97	..	16,386
18	Luxembourg	0.50	94	**1,185**	111,716
19	Malta	0.51	**100**	313	24,876
20	Netherlands	0.63	98	561	51,373
21	Poland	0.68	53	469	14,379
22	Portugal	0.69	89	320	22,130
23	Romania	0.69	69	523	10,035
24	Slovak Republic	0.75	63	549	18,454
25	Slovenia	0.69	78	212	24,019
26	Spain	0.68	73	412	30,278
27	Sweden	0.70	76	890	58,491
28	United Kingdom	0.64	89	547	45,653
	Source	EC DA	EC DA	EC	World Bank
	Year	2014	2014	2015	2014

Note: Best performer for each metric shown in bold - Better than median performers shown in red

APEC fixed and mobile spirit level

Countries	Metrics			
	Smartphone adoption	Fixed BB per HH	Avg BB speed	GDP per Capita (US$)
1 Australia	64.6%	67.9%	8	61,219
2 Brunei Darussalam	..	40.9%	..	36,607
3 Canada	63.7%	92.0%	11	50,398
4 Chile	46.1%	53.4%	6	14,477
5 China	54.9%	51.3%	3	7,589
6 Hong Kong, China	**115.1%**	92.1%	17	39,871
7 Indonesia	19.0%	4.8%	2	3,534
8 Japan	78.9%	79.0%	16	36,332
9 Korea (Rep. of)	67.9%	99.8%	**23**	28,101
10 Malaysia	38.5%	48.3%	5	10,804
11 Mexico	33.2%	52.2%	6	10,715
12 New Zealand	58.8%	81.3%	8	43,837
13 Papua New Guinea	..	0.8%	..	2,133
14 Peru	27.3%	25.7%	5	6,458
15 Philippines	25.5%	116.8%	3	2,865
16 Russia	39.7%	48.0%	10	12,926
17 Singapore	67.5%	**124.2%**	13	56,319
18 Taiwan, China	55.9%	99.4%	11	22,598
19 Thailand	28.5%	28.3%	9	5,445
20 United States	70.9%	80.1%	12	54,597
21 Viet Nam	..	32.5%	3	2,053
Source	BoA	ITU+	Akamai	World Bank
Year	2014	2014	2015	2014

Lowest income mobile spirit level

Countries	Metrics			
	Mobile subs per capita	Affordability of 500MB mobile (GDP/Price)	Mobile tax level	GDP per Capita (US$)
1 Afghanistan	74.9%	107	..	649
2 Benin	101.7%	14	..	822
3 Burkina Faso	71.7%	236	17.8%	717
4 Burundi	30.5%	..	..	336
5 Cambodia	**155.1%**	540	10.3%	1,081
6 Central African Rep.	31.4%	..	..	380
7 Chad	39.8%	31	18.6%	1,236
8 Comoros	50.9%	68	..	923
9 Congo, Dem. Rep	53.5%	30	**29.1%**	437
10 Dem. People's Rep. of Korea	11.2%	..	..	..
11 Eritrea	6.4%	..	..	590
12 Ethiopia	31.6%	**748**	17.0%	575
13 Gambia	119.6%	102	11.8%	428
14 Guinea	72.1%	161	18.7%	573
15 Guinea-Bissau	63.5%	..	..	589
16 Haiti	64.7%	38	..	833
17 Liberia	73.4%	48	..	484
18 Madagascar	38.2%	43	28.3%	449
19 Malawi	30.5%	41	17.0%	242
20 Mali	149.0%	79	..	755
21 Mozambique	69.7%	133	17.6%	630
22 Nepal	82.5%	154	18.4%	699
23 Niger	44.4%	15	23.3%	469
24 Rwanda	64.0%	..	24.5%	722
25 Sierra Leone	76.7%	..	23.8%	808
26 Somalia	50.9%	..	..	..
27 South Sudan	24.5%	55	..	1,127
28 Tanzania	62.8%	238	27.8%	1,006
29 Togo	69.0%	65	..	658
30 Uganda	52.4%	94	28.2%	726
31 Zimbabwe	80.8%	54	15.0%	1,031
Source	ITU+	ITU+	GSMA	World Bank
Year	2014	2014	2011	2014

Appendix V: Glossary

APEC	Asia-Pacific Economic Cooperation Forum for Pacific Rim countries promoting free trade
BB	Broadband
EC	European Commission *The executive body of the European Union*
EC DA	European Commission Digital Agenda *EC initiative to strengthen ICT in Europe*
EU	European Union
EU28	The 28 member states of the European Union
FBB	Fixed broadband
FCC	Federal Communications Commission *US telecoms regulator*
FTTB	Fibre to the building
FTTC	Fibre to the cabinet
FTTH	Fibre to the home
GDP	Gross domestic product *A measure of economic performance*
GSMA	Groupe Speciale Mobile Association *International association of mobile operators*
ICT	Information and Communications Technology
ITU	International Telecoms Union *United Nations specialized agency for information & communication technologies*
LLU	Local loop unbundling *The provision of last-mile copper as a standalone wholesale product*
NGA	Next generation access *Higher speed broadband access, generally including fibre*
OECD	Organisation for Economic Co-operation and Development *Intergovernmental forum for developed and emerging economies*
OTT	Over the top *Services relying on connectivity provided by others (such as Skype or Netflix)*
USO	Universal Service Obligation *Requirement for a specified company to provide telecoms services at a specified price throughout a designated service area*

Acknowledgements & Disclaimer

The opinions offered herein are purely those of the author. They do not necessarily represent the views of the individuals who contributed.

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Robert Kenny is a media and telecommunications consultant, and a member of Communications Chambers. He has more than 20 year of senior experience in these industries, and is a globally recognized expert on a range of sector policy issues. His clients include government departments and agencies in the UK, Australia, Ireland and Nigeria; virtually all of the UK's leading fixed and mobile telcos; the UK's largest broadcasters and pay TV operators; some of the world's largest online businesses; and a wide range of trade associations.

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