Global ICT Regulatory Outlook 2020

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Pointing the way forward to collaborative regulation

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Acknlowledgements

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Foreword

The Global ICT Regulatory Outlook 2020 benchmarks regulatory progress across no fewer than 193 countries worldwide. In three years, the report has established itself as the go-to reference for regulators and policy-makers seeking to shape meaningful, regulatory change that will benefit all.

There is much to navigate: the landscape is complex and fast moving. As mobile phones host ever more online services, regulators find themselves grappling with an ever-growing array of challenges including digital identity, data protection, blockchain and Artificial Intelligence (AI). There remains, too, the key challenge of achieving the Sustainable Development Goals (SDGs) by the deadline of 2030, now just a decade away. As always, ITU stands ready to support regulators and policy-makers around the world in meeting such challenges.

This year's report is especially exciting in that we have evolved our work on collaborative regulation to feature a new tool that sits alongside the ITU Regulatory Tracker – the Benchmark of Fifth Generation Collaborative Regulation. We regard this as the new gold standard for collaboration among regulators. It helps to fast-track collaborative, cross-sector regulation as the best and quickest means to leverage digital transformation for all. Rich in practicality, it offers metrics to assess gaps, proposes smart roadmaps through shifting regulatory landscapes, tracks progress, sets out new goals for regulatory excellence and proposes solutions where concrete progress towards SDGs has proved challenging.

I recommend this report as a rich, powerful and practical tool to all of us seeking to build a world of meaningful connectivity through regulation that is open, cross-sector, and above all, collaborative.

Doreen Bogdan-Martin
Director, Telecommunication Development Bureau

Introduction

Third edition of ITU's Global ICT Regulatory Outlook

The flood of digital change continues full spate – and digital transformation, while a reality for some, remains distant for many. A period of hope and aspiration buoyed by smartphones and increasingly accessible broadband has now darkened somewhat as misuse of profiling, data commercialization and harmful online behaviours have increasingly come to light, sparking considerable public debate. While markets are still driven by optimism about all that is digital, key players right across society are increasingly perceiving the role of regulation as central in restoring the full potential of ICT to deliver fully on its promise.

In the first edition of the Global ICT Regulatory Outlook in 2017, we explored the evolution of ICT regulatory trends over the preceding decade. We set out the ITU concept of *five 'generations' of ICT regulation* – now widely shared – analysing prime evidence and charting possible ways forward.

The second edition (2018) dived deep into the current trends defining regulation in the transition to the digital economy, and also focused on the strong correlation between ICT regulation and the take-up of ICT. It provided insight, inspiration and informed analysis designed to help address the challenges ahead – and paved the way for the first Benchmark for collaborative, fifth generation regulation presented in detail in Chapter 1 of this 2020 edition.

In this year's 2020 edition, we share unique, focused research and offer both evidence and practical advice to support regulators embarked on their journey to fifth generation collaborative regulation. The Benchmark of Fifth Generation Collaborative Regulation (G5 Benchmark), based on GSR19 Best Practice Guidelines together with the ICT Regulatory Tracker, serves as a compass for regulators on their journey of digital transformation, helping establish roadmaps towards regulatory excellence and a thriving digital economy.

Importantly, this year we revisit golden rules for inclusive digital markets based on a wealth of ITU data from 193 countries over more than a decade. Our research and analysis confirm that good regulation makes a difference – and provides the key to unlocking meaningful, inclusive connectivity across countries at different levels of development and national income. Working with those updated golden rules, we offer a regulatory recipe for accelerated take-up of fixed and mobile broadband markets.

Box 1: Together the G5 Benchmark and the Tracker tell the whole regulation story?

Complementary metrics across both tell the entire story – from telecom to ICT to digital regulation worldwide. Together they provide a clear, comprehensive and global snapshot of regulatory frameworks as they mature to enable the digital economy.

- The Benchmark of Fifth Generation Collaborative Regulation (G5 Benchmark) is new as of 2019. It sets out new goals for regulatory excellence and is the gold standard for collaboration amongst regulators, and for digital policy design that accelerates digital transformation. It is based on data from 84 mostly mature G4 countries and on GSR19 Best Practice Guidelines. This data is then organized across three regulatory tracks using 25 indicators. The Benchmark both complements and builds on the ICT Regulatory Tracker.
    - Note that the term 'G5' used in relation to the Benchmark should not be confused with '5G' which refers to wireless technology.
- The ICT Regulatory Tracker has identified major regulatory trends driving the ICT sector since 2007 and tracks countries' progress from G1 command and control regulation through to G5 collaborative regulation. Based on high-quality data from 193 countries, it uses 50 indicators organized across four pillars: regulatory authority, regulatory mandate, regulatory regime, competition framework. An in-depth external audit by the European Commission's renowned science and knowledge service (COIN) has found that the Tracker is a conceptually sound, statistically coherent and robust monitoring tool.

Chapter 1: The need for collaboration and metrics – and a new benchmark

"Digital connectivity can provide the canvas for achieving SDGs across the board and the transformative impact of digitalization will underpin progress on various development paths. The opportunities are within reach; however, they cannot be taken for granted."

GSR19 Best Practice Guidelines "Fast forward digital connectivity for all"

ICT regulators and policy-makers are under increasing pressure to connect with peers across all economic sectors to leverage digital transformation as an engine for sustainable development and achieving the SDGs. The mission at hand is challenging enough, and made more so as momentum and expectation surrounding that mission grow month on month.

Crucial in the transformation of industry and government institutions will be a laser focus on collaboration and metrics:

- **Why collaboration?** The digital journey brings together all players – from different backgrounds and sizes – into one living network. Collaboration gives all the opportunity to participate in decision-making, in contributing to the success of others and in forging inclusive momentum around the mission.
- **Why metrics?** Rules and decisions must find their logic in current, detailed evidence and in market data rather than in wishful thinking, opinion and theory.

Collaboration that lacks sound, metrics-backed decision-making will fail to achieve goals and impact in the real world. Conversely, a regulator deploying an evidence-based approach in a silo will fail to account for the multiple effects that regulatory decision triggers – and, in extreme cases, could undermine market development and benefits for consumers.

In contrast, a dual regulatory focus on collaboration and metrics, on process and tools, will succeed – and will drive investment, innovation and inclusiveness.

Collaborative regulation – key to unlocking digital transformation

As the pace of digital transformation accelerates, formulating an effective regulatory approach becomes a defining moment. While some still plead for unconditionally liberal markets, others call for caution, increased regulation and a rules-based digital order. Still others are supporting a third way – a new deal which advocates for shared perspectives and common responsibility and which strikes a robust balance between people's rights and the technology that impacts so much on our everyday lives. This new deal seeks to fast forward digital transformation for all – and that 'deal' is embodied in *collaborative regulation*. Such collaboration must engage a broad, diverse range of stakeholders in informed, evidence-based rule-making and decision-making, with both social and economic impact in mind – and, as noted in last year's edition, with priority granted to social impact.

Industry and regulators charting a common future

ITU forged 'collaborative regulation' in 2016 and have tested it annually at every Global Symposium for Regulators (GSR) since. While the concept continues to evolve, it can best be cast in 2020 as a framework to discuss the evolution of regulatory pattern and policy while charting the way ahead for industry and regulators as one constituency, towards digital transformation.

Box 2: Collaborative regulation: a forward-looking concept

Collaborative regulation or 5th generation regulation (G5) is a broad notion that ITU has defined based on the concept of generations of ICT regulation (see Figure 1). It marks a fundamental shift in the way regulation is executed, its holistic policy ground and the stakeholders that it brings together – from policy-makers, single-sector and cross-sector regulators to market players of any size. It also shifts regulatory focus on behaviours and impact on markets and development.

Collaborative regulation puts a new emphasis on consumer benefits and protection, and leverages the resources of government institutions and industry to deliver them, through organic consultation, collaboration and conciliation. Collaborative regulation is driven by leadership, incentive and evidence rather than by command and control schemes. The concept also refers to the set of new tools used by regulators to tackle the issues related to digital transformation and the data economy.

Source: ITU, building on 2018 Global ICT Regulatory Outlook

Why do we need collaborative regulation?

All roads now point to more collaboration, better channels and more bandwidth. But while the case for collaboration is irrefutable, progress has been stalled by power battles, lack of resources and misconceptions. Good progress towards inclusive, collaborative regulation is needed for the good of all users of digital services, now and into the future – a need borne out by four fundamentals:

- **Digital transformation is a game changer**

  ICTs have moved far beyond the realm of simple 'communications'. They have become the foundation for every economic sector and a sine qua non of business performance and national growth.

- **The new digital world needs a new take on regulation**

  ICTs can dramatically transform education, health care, environmental management, agriculture, trade and entrepreneurship, the provision of government services – and so much more. For this to happen, enabling frameworks of policy and regulation, and the right networks and services need to be put in place.

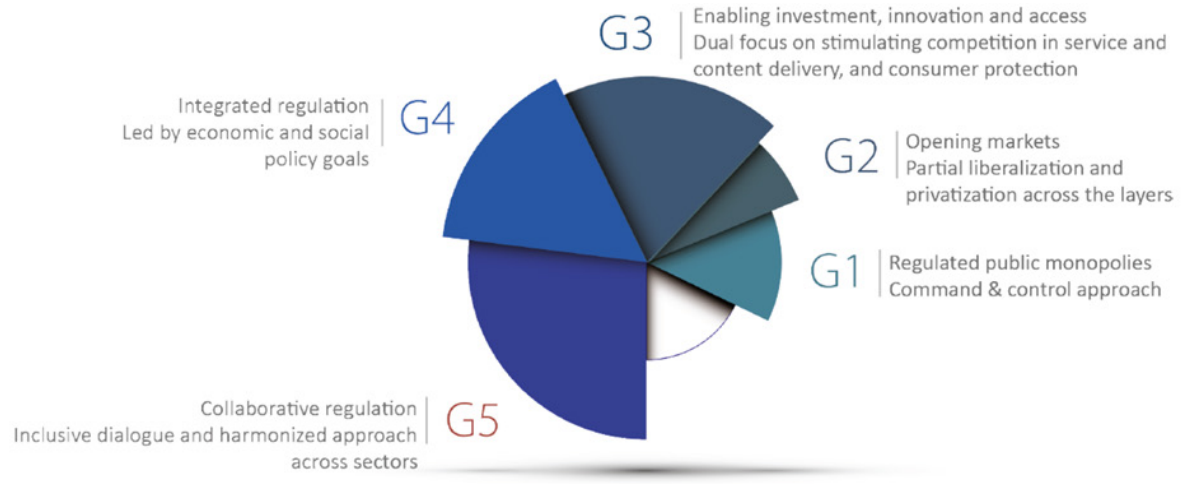
- **Holistic and harmonized approach can deliver greater impact**

  Silo-style ICT sector regulation isn't viable in the digital world. Collaborative regulation will mirror the interplay between digital infrastructure, services and content across industries and national borders. It will also harmonize rules and ensure consistent implementation of policy and regulatory frameworks that have evolved independently in many sectors over the years.

Box 3: G5 collaborative regulation – driver for development

The G5 open, collaborative regulatory approach will drive broader social and economic development for the greatest number of people throughout the world. G5 and the ICT regulator's leadership role in moving it forward, are crucial in navigating profound technology change and delivering on the rich promise of the transformative digital economy – to the benefit not only of consumers and businesses but importantly, to the 3.6 billion who remain unconnected.

Figure 1: Generations of ICT regulation – conceptual framework



Source: ITU

- **Development and inclusion have become a primary focus of regulation**

  Collaborative regulation is people-centred regulation – it looks at sustainability and long-term gains as opposed to industry profit maximization and exclusive economic growth. Collaborative regulation champions are also engaged in connecting marginalized individuals, persons with disabilities, low-income communities, communities challenged by educational impoverishment, and remote or isolated populations which may also lack basic infrastructure such as electricity – so we need to be much more innovative and collaborative in our approach to policy-making.

Generations of regulation: analysis tools and a roadmap for action

The concept of 'regulation generations' helps us analyse the maturity of modern regulatory frameworks. The ICT Regulatory Tracker pinpoints changes taking place in the regulatory environment and tracks the progress of all countries' regulatory oversight of telecommunication/ICT markets **through generations one to four** (see Figure 1).

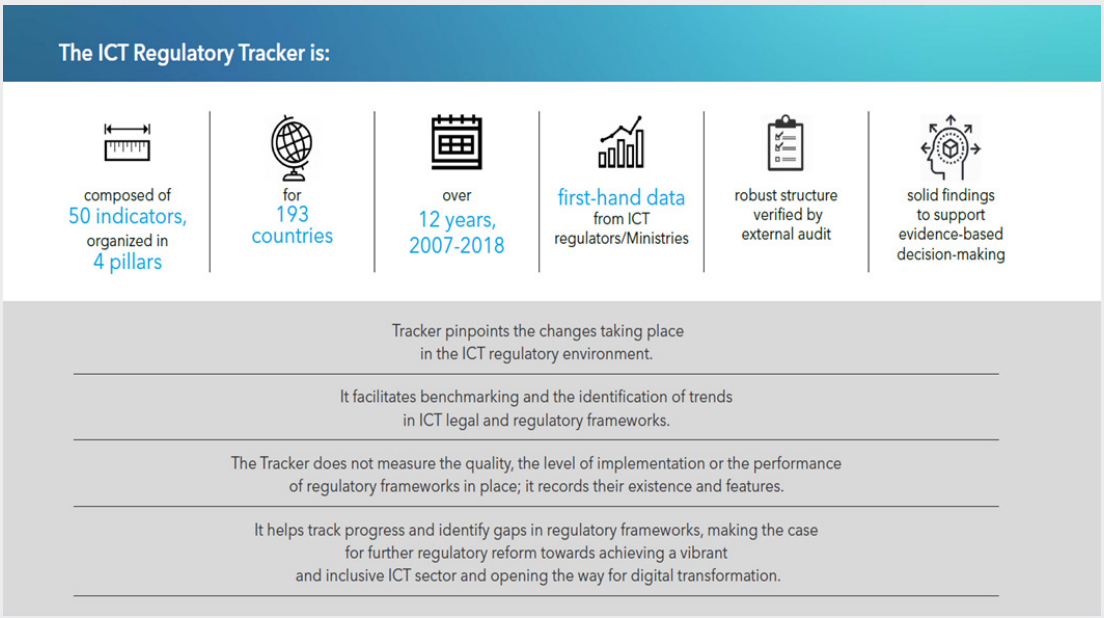
About the Benchmark of Fifth Generation Collaborative Regulation (G5 Benchmark)

The new Benchmark of Fifth Generation Collaborative Regulation (referred to as the 'G5 Benchmark' for short in this report) is a powerful, straightforward tool for policy-makers and regulators that captures the essence of fifth generation of regulation and sets new goals for regulatory excellence. It is the gold standard for collaboration amongst regulators, and for the design of digital policy and legal instruments seeking to maximize digital transformation across all sectors of the economy.

Based on data from more than 80 countries (mostly mature G4 countries) it extends and complements the work set out in the ICT Regulatory Tracker – and enables you to track how regulatory frameworks are broadening out beyond the narrow ICT sector to embrace and underpin all sectors of the digital economy. The G5 Benchmark dives deep into policy trends, enriches the global policy debate and points to how collaborative regulation can remedy policy and implementation shortcomings in pursuit of the Sustainable Development Goals (SDGs). The Benchmark was first presented at GSR19 and will be extended to more countries in the late 2020.

Both the Tracker and the Benchmark correspond closely to guiding principles outlined in the ITU Best Practice Guidelines of GSR adopted by ICT regulators globally for close to two decades. These Best Practice Guidelines are considered by the industry to be the very core of modern, future-facing ICT regulation. Table 1 below outlines the main characteristics and complementarities of the two metrics.

Box 4: What does the ICT Regulatory Tracker do?



The Tracker went through an in-depth external audit by the Competence Centre on Composite Indicators and Scoreboards (COIN) of the European Commission's science and knowledge service in 2019. The Joint Research Centre (JRC) COIN team is renowned for its expertise on statistical methodologies and technical guidelines on the development of sound composite indicators, which can be used in making informed policy decisions.

The audit report found that the Tracker is a conceptually sound, statistically coherent and robust monitoring tool. Simplicity and clarity stand out as two of the main strengths of the Tracker monitoring framework. The full audit report is available in Chapter 4.

For details, see the note on methodology of the ICT Regulatory Tracker in Appendix 1.
itu.int/go/tracker

The Tracker and the G5 Benchmark then are by design complementary metrics that together provide a reference framework that tracks the evolution from telecom to ICT to digital regulation. The metrics are aligned and balanced across both and provide a clear, comprehensive and global snapshot of regulatory framework maturity. Together, they highlight the complex transformation of regulatory frameworks as these evolve to enable the digital economy. They also reflect the qualitative change in focus, purpose and tools that define the new regulatory paradigm of G5 regulation.

Please see Chapter 3 for an overview of regional trends in digital policy and regulation emerging from the ICT Regulatory Tracker, and of regional trends for collaborative regulation emerging from the G5 Benchmark.

The Benchmark of Fifth Generation Collaborative Regulation (G5 Benchmark) – fast-track to collaborative regulation

Through complementary ITU regulatory metrics, the ICT Regulatory Tracker and the new G5 Benchmark, we have identified the broad tracks for regulatory reform and have pinpointed how countries can accelerate progress towards the next regulatory generation.

The G5 Benchmark is built around 25 indicators. *We expect its implementation to be pivotal in creating a digital market-place that is inclusive, sustainable and pro-development and a cornerstone of digital transformation.* These indicators are clustered into three tracks: collaboration, policy design principles and G5 toolbox.

Table 1: How they fit together: ICT Regulatory Tracker and the G5 Benchmark – a framework for tracking the evolution of regulatory frameworks from telecom to digital markets

	ICT Regulatory Tracker	Benchmark for collaborative regulation
Focus	Telecom/ICT regulation	Regulation for the digital economy
Defines generations of regulation	G1 through G4	G5
Based on	GSR Best Practice Guidelines	GSR Best Practice Guidelines & ITU research and analysis
Number of indicators	50 (including 11 composite indicators)	25 individual indicators
Maximum score	Goalpost = 100	Goalpost = 50 Score of 35: the G5 qualification threshold
Countries covered	193	84 (G4 countries & top G3 tier)
Structures	4 pillars: - regulatory authority - regulatory mandates - regulatory regime - competition framework	3 tracks: - collaboration among regulators - policy design principles - G5 toolbox
Data series	2007-2018	2018/2019
Data source	ITU World Telecommunication/ICT Regulatory Survey + ITU research	ITU World Telecommunication/ICT Regulatory Survey + ITU research
Data comparable over time	Yes	Yes
Can be integrated	1) Can be used as a stand-alone metric for the maturity of regulatory frameworks for telecom/ICT markets, or 2) be integrated with the Benchmark to view the full evolution path of regulation from telecom to digital	1) Can be used as a stand-alone metric for collaborative regulation, or 2) be integrated with the Tracker to view the full evolution of regulation from telecom to digital

Source: ITU

The Benchmark occupies high ground, and affords perspectives on the regulatory road already travelled as well as on the pathways into the future. It:

- Reflects how digital transformation is shifting regulatory perspective and patterns and the need for new tools;
- Reveals regulatory gaps, and helps with building custom roadmaps for navigating the digital transformation;
- Facilitates high-value debate on the future of markets and regulation, based on unbiased, non-judgmental evidence.

By integrating the ICT Regulatory Tracker and the Benchmark for collaborative regulation, we have been able for the first time to provide a comprehensive picture of the state of regulation in 2019,* also – importantly – taking into account the different technology and policy paths countries may choose to follow in their digital transformation journey.

* For the purposes of the analysis here, we have combined the 2018 Tracker scores (the latest available to date) with the first 2019 edition of the Benchmark. The final combined 2019 score for all countries will be released by the end of 2020.

The Benchmark is needed – especially now

The Benchmark arrives when regulators need it most. The following five elements explain why:

1. Regulation is changing as digital markets mature

   Evidence suggests that digital development trajectories are shifting: economies in the course of digital transformation in this decade will follow a different path from those that did so earlier. The Benchmark is there to guide regulators through uncertain times – not merely to rank a country or calculate a score.

2. Existing metrics do not tell the whole story

   The Benchmark builds a shared and global perspective across all economic sectors and lays out clear regulatory tracks which ensure that digital markets thrive while achieving development goals.

3. High-level policy design principles feature – for the first time

   The Benchmark combines high-level principles and specific instruments, recognizing that fifth generation regulation is contextual, modular and multi-dimensional. Different layers of regulation are integrated to highlight the complexity of regulatory action in the digital age.

4. Collaboration among sector/multi-sector regulators features – for the first time

   As set out in the Global ICT Regulatory Outlook 2018, collaboration among institutions is an essential ingredient for regulatory relevance, coherence and impact. The Benchmark takes into account the breadth and depth of collaboration between the ICT regulator and sector-specific or multi-sector regulators.

5. A benchmark is worth a thousand words

   The Benchmark is based directly on relevant indicators, enabling policy-makers to easily evaluate regulatory set-up and tools – comparing apples with apples. It facilitates the easy modelling of one country's digital development experience in setting out strategy and decision-making for development and regulation.

To borrow the emblem of ITU's work on policy and regulation over the past 20 years, the fifth generation of regulation – and the G5 Benchmark – effectively resemble a lighthouse illuminating the rough seas of digital technology phenomena and leading the way to a safe harbor for all.

The GSR19 Best Practice Guidelines "Fast forward digital connectivity for all" recommended to regulators to adopt "…benchmarks measuring regulatory maturity and levels of collaborative regulation [as] regulatory benchmarks pinpoint the status of advancement of policy and regulatory frameworks for digital markets. They help track progress and identify trends and gaps in regulatory frameworks, making the case for further regulatory reform towards achieving vibrant and inclusive digital industries."

Box 5: Why is the G5 Benchmark especially important now?

Its time is now. It takes a bold, new approach that is fit-for-purpose, and closely modelled on elements that profoundly characterize today's fast-changing regulatory landscape. The G5 Benchmark offers a big-picture, higher-level view enabling regulators not only to see the landscape clearly laid out below them, but also their routes across it to G5 regulation.

Looking 'under the bonnet' of the Benchmark

We have identified three regulatory tracks which correspond to processes and practices facilitating digital transformation. For each track, metrics define the profile of digital regulation in G4 countries and in the upper G3 tier and will help them progress to fifth generation regulation. The three tracks are as follows:

1. **Collaboration** is the dominant element – the very watermark of fifth generation regulation. It measures the breadth and depth of cross-sector collaboration between the ICT regulator and her/his peers. This track factors in institutional set-up (agencies and their mandate) as well as practices around regulatory collaboration, formal and informal (see Table 2).

   Digital regulation now occurs across a network of centres of expertise and enforcement. Shared focus and accountability among government agencies and stakeholders is replacing the ICT silo model, and the Benchmark reflects this trend.

Track 1: Collaboration	»	**Focus**: • Established sector or multi-sector government regulatory agencies for competition, consumer protection, finance, energy, broadcasting, spectrum management and Internet issues. • Degree of regulatory collaboration between the ICT regulator and other regulatory agencies.
	»	**Best-case scenario:** • Combines the greatest number of agencies collaborating with the highest official status of collaboration.

2. **High-level principles**: as regulation shifts from rules to principles, the design of frameworks and what keeps them together have acquired especial importance. While rules will not disappear soon, principles are better suited for finding balanced, sound solutions, especially in complex areas. Today's effective regulators will rely on sound policy principles, tried-and-tested institutional wisdom and a vanguard spirit – from infrastructure investment to consumer protection to data privacy, and any area where there are no good or bad responses.

Track 2: Policy design principles	» **Focus**: Policy design principles lay the foundation of collaborative regulation and define a new approach to market regulation, taking into account the broad economic and policy context.
	» **Best-case scenario:** The goalpost here is to have all nine high-level policy design principles enshrined in laws and regulatory decision through concrete tools that are: • Forward-looking • Holistic • SDG-oriented • Evidence-based • Market-proof • Incentive-based • Innovation-based • Inclusive • Technology-neutral The Benchmark builds on the policy design principles laid in the GSR Best Practice Guidelines "Fast forward digital connectivity for all" adopted by the global community of regulators in July 2019. The principles help regulators develop an understanding of new technology paradigms and guide them towards appropriate regulation.

3. **G5 regulatory toolbox**: to switch on the digital economy, regulators need new tools over and above the established instruments of modern regulation. Adapting old tools for use in digital markets which are leaping ahead is not sufficient. New consumer needs, business models and market dynamics call for retooling regulatory inventory and the development of coherent, outcome-oriented policy instruments.

The baskets of indicators corresponding to each of the three tracks are set out in Table 2.

The Benchmark encapsulates a vision where countries build their digital development path around their local and national priorities, and one where policy instrument configurations lead to the same goals. The Benchmark structure reflects the interplay of the three tracks – policy principles, tools and collaboration – with each track building on the others (see Figure 2 and Table 2). The Benchmark extends and enhances the Tracker to address those regulatory pre-conditions needed for the digital economy to thrive, overriding the established requirements for a vibrant – but

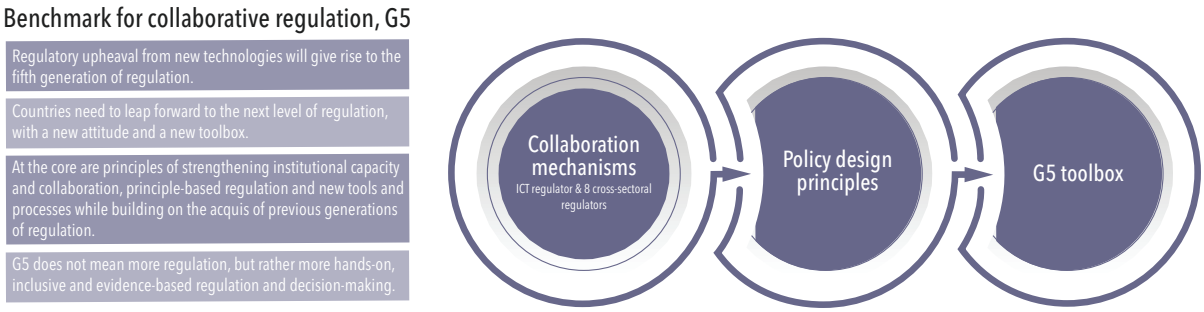
Track 3: G5 toolbox	» **Focus**: New market realities and the challenges they bring about require a new perspective and new tools. Policies that used to be 'nice to have' and formerly associated with developed countries have become a stepping-stone in leading the digital transformation.
	» **Best-case scenario:** The more these tools have been adopted and become functional, the greater the chances to create a safe place for digital experimentation and a safe experience for consumers.

Table 2: Canvas for assessing countries' readiness to leapfrog to the fifth generation of regulation

Track 1		**Degree of collaboration between the ICT regulator and:**
	1	Competition authority
	2	Consumer protection commission
	3	Data protection commission
	4	Spectrum agency
	5	Broadcasting regulator
	6	Financial regulator
	7	Energy regulator
	8	Internet agency
		8 indicators/ max. score = 16 points
Track 2		**Policy design principles**
	9	Forward-looking * Digital strategy exists
	10	Holistic * Digital strategy spreads over multiple sectors
	11	SDG-oriented (or development in general) * Digital strategy SDG-oriented
	12	Evidence-based * Regulatory Impact Assessment (RIA)
	13	Market-proof * Regulatory space for digital experimentation such as sandboxes, pilots, new focus of regulation (AI, IoT, fintech)
	14	Incentive-based * Incentives for network operators
	15	Innovation-based * ICT Innovation policy
	16	Inclusive * Stakeholder input & engagement
	17	Technology-neutral * Spectrum licensing
		9 indicators/ max. score = 18 points
Track 3		**G5 toolbox: policies & regulations**
	18	Competition
	19	Data protection
	20	Cybersecurity
	21	e-Commerce/e-Transactions
	22	Digital financial services
	23	Accessibility
	24	Taxation of Internet services
	25	Infrastructure mapping
		8 indicators/ max. score = 16 points
Total		***25 indicators/ max. score = 50 points***

Note: The full methodological framework for the Benchmark including indicator definitions is featured in Appendix 2.

Figure 2: G5 Benchmark design



Source: ITU

inward-looking – national ICT market. Hence, it facilitates analysis of each country's progress towards the digital economy.

Benchmark for collaborative regulation – spotlighting the shifts in regulatory frameworks

Three features ensure the Benchmark has a laser focus on how regulatory frameworks are evolving: scope, clarity and objectivity.

- Its scope: it covers 80 economies from all regions and uses 2018-2019 data. These countries are on the glide path towards collaborative regulation. The Benchmark's uniquely wide scope and the ease with which it 'plugs in' to the ICT Regulatory Tracker make it a powerful tool to assess cross-sector regulatory frameworks and for conducting regulatory gap analysis.
- The Benchmark has a clear, straightforward methodology (see Appendix 2). The 25 indicators at its heart are easily measurable, enabling policy-makers to check and update their country data and to run 'what-if' projections that measure policy impact. This ease-of-use also enables regulators to compare their level of maturity with peers, at similar and different levels of ICT development.
- The Benchmark is built on objective criteria and factual evidence, not on opinion, pundit commentary or other subjective data.

A snapshot of G5 Benchmark features is provided in Box 2.

The Benchmark sifts through huge volumes of data to deliver an executive understanding of the digital

Box 6: The 'big picture story' of 2019 – as disclosed by the G5 Benchmark

The Benchmark sets out a full picture of the current level of maturity of regulatory frameworks for the ICT sector and beyond:

- A lead group of 8 per cent of countries now has holistic, forward-looking regulatory frameworks enabling digital transformation across the economy.
- One-third have achieved G4, integrated ICT regulation led by social and economic goals –These countries have thriving markets for ICT services and the lowest proportion of unconnected population.
- One-quarter are only half way through their journey, making steady progress in strengthening policy and regulatory frameworks.
- More than half of world's population is concentrated in G2 and G3 countries, poised to leapfrog to near universal digital inclusion and lead vibrant ICT markets.

40 per cent remain in G1 or G2, missing development opportunities and remaining disconnected from the transformation of their economies.

regulatory landscape – and facilitates measured navigation through a landscape of fast-changing complexity. In particular, it enables you to:

- Monitor the evolution of regulation as digital markets mature

  Monitoring policy and implementation ensures that countries promote a take-up of digital technologies that is broad-based and meaningful. Country profiles, together with regional and global trends, provide insight into how ready regulation is for the challenges of digital transformation – while gaps in policy and implementation are clearly visible. Building custom country roadmaps for collaborative regulation becomes easier.
- Compare countries and analyse their paths towards regulatory maturity

  The Benchmark is unique in featuring high-level policy design and regulatory collaboration very much in a holistic, cross-sector context – essential for regulatory effectiveness. It becomes a valuable tool for benchmarking regulatory performance within and across countries. Together the three tracks enable you to look in-depth into a single track as well as looking at linkages across all tracks. You can also deconstruct each track to assess countries' strengths and areas for improvement, providing useful evidence on areas of priority for regulatory reform.
- Construct complex models that explore the interplay between market take-up, regulation and development

  The Benchmark's holistic approach, its three digital regulation tracks and its modular structure can be combined with other metrics to quantify the interplay between digitization and regulation, or the impact of regulatory decisions on market development. Such studies provide rich evidence to further inform policy-making in the digital age.

Box 7: What's in a metric? A 360° overview of the Benchmark for collaborative regulation

Structure and scores

The Benchmark for collaborative regulation and the ICT Regulatory Tracker are designed as complementary metrics to capture the transformation of regulatory frameworks.

The Benchmark therefore mirrors the scoring rationale of the Tracker and uses scores of 0 (absence), 1 (partial occurrence) and 2 points (presence of desired characteristic) for each indicator. The table below provides the scoring structure of the Benchmark.

Benchmark for collaborative regulation: structure and scores

Track	Number of indicators	Maximum score (in points)
1. Collaboration	8	16
2. Policy design principles	9	18
3. G5 toolbox	8	16
Benchmark	25	50

Countries and year

The dataset covers 84 countries (G4 and higher G3 tier), for 2018 (Track 1) and 2019 (Tracks 2 and 3).

Data sources

The indicators come from two main sources:

- ITU World Telecommunication/ICT Regulatory Survey
- Desktop research based on official sources

How to read the scores?

The Benchmark can be seen as a roadmap towards collaborative regulation.

- Countries obtaining scores of 35 and higher (corresponding to 70 per cent of the reference frame goalpost) qualify as G5 regulatory champions.
- Countries obtaining scores of 25 to 35 points are the rising stars and are expected to join G5 next.
- Countries with scores lower than 25 need to continue enhancing and refining their regulatory frameworks, while turning to new tools and collaborative regulatory mechanisms.

Going forward

The Benchmark will be updated every two years to allow for tracking changes over time, both changes in absolute scores and changes in rankings relative to other economies. The future data series will provide a useful tool for measuring progress in narrowing the gaps in collaborative regulation between countries.

The full dataset as well as in-depth analysis on the findings of the first G5 Benchmark will be published in 2020.

Note: The full list of indicators and the detailed scoring rationale per indicator are available in Appendix 2. The list of countries covered is provided in Appendix 4.

Source: ITU

G5 countries – movers, shakers… and some surprises

This first edition of the Benchmark examines how mature ICT frameworks leverage cross-sector, collaborative regulation. While many ICT regulators have been watching how communication services have been reshaped by digital technologies and new business models, few have adapted to capture the benefits of digital flows in adjacent sectors – for example by expanding collaboration with other regulators, harmonizing rules or applying new policy design principles and tools.

Nevertheless, we have identified 16 G5 regulators forging ahead, demonstrating thought leadership and a holistic yet practical perspective (see Table 3) – and importantly, charting the route ahead for the many G4 and G3 regulators navigating towards collaborative regulation.

Table 3: Fifth generation of regulation champions, 2019*

	Country	Region	ICT Regulatory Tracker Score	G5 Benchmark	Combined Score	GEN
1	Norway	Europe	95.5	39	134.5	G5
2	United Kingdom	Europe	95	37	132	G5
3	Singapore	Asia-Pacific	91.5	39	130.5	G5
4	Croatia	Europe	94	36	130	G5
5	Germany	Europe	93.5	36	129.5	G5
6	Romania	Europe	92	36	128	G5
7	Netherlands	Europe	93	35	128	G5
8	Kenya	Africa	87.5	37	124.5	G5
9	Estonia	Europe	87	37	124	G5
10	Sweden	Europe	89	35	124	G5
11	Brazil	Americas	88.5	35	123.5	G5
12	Morocco	Arab States	88.5	35	123.5	G5
13	Canada	Americas	85.5	37	122.5	G5
14	Spain	Europe	86	36	122	G5
15	Albania	Europe	83	35	118	G5
16	Japan	Asia-Pacific	72.5	37	109.5	G5

Source: ITU

Box 8: Understanding G5, a non-linear evolution of the regulatory approach from ICTs to digital

- Fifth generation builds upon the solid foundation of G3 and G4 regulation; G5, however, isn't merely an upgrade of the G4 status.

  Since the Tracker and Benchmark scores are combined to calculate the global score, G3 countries, along with G4, can leapfrog to G5. A score of 35 out of 50 points is considered the entry point into G5 regulation.

- Fifth generation regulation is defined by more complex and diverse patterns. Tools and processes set G5 apart from previous generations, not the nature of its regulation.

  In G1-G4, we assess the maturity of countries' competition frameworks for the ICT sector; in G5, the focus expands to competition in all sectors where digital underpins service delivery.

- G5 is therefore seen as complementary to the previous generations – as a different paradigm – and G3 and G4 countries can join G5 for their outlook on digital markets.

  G5 countries thus still belong under the G3 or G4 'brand' based on the maturity of their regulatory frameworks for the ICT sector, more narrowly.

Some emerging insights are intuitive while others reveal more surprising trends across geographies, income groups and across countries at different levels of development (Table 3):

- Norway and Singapore lead the way to collaborative regulation. Innovation and pro-active multi-stakeholder initiatives have paved their way to the top world spot.
- Europe performs strongly featuring 10 of 16 G5 countries globally – not surprising as the region boasts the greatest number of G4 regulators. Europe is arguably the region with the highest level of regulatory harmonization across economies while a structured, coordinated traditional approach to policy-making is successful in shaping digital economies.
- Whilst G5 level countries mostly feature those transitioning from the G4 category, two previously G3 countries made it directly into G5. Japan achieves the second highest world score in the Benchmark despite its 106th rank in the ICT Regulatory Tracker. Albania comes 4th in the Benchmark while ranking 69 on the Tracker. Both countries demonstrated innovation in boosting digital markets while retaining a traditional approach to ICT regulation.
- Of the world's top 10 most mature ICT regulatory frameworks, only Norway and UK are G5. They have consistently built synergies between ICT regulation on the one hand, and digital services, on the other.
- While few of the most mature ICT regulatory countries have shifted to collaborative regulation, countries like Estonia and Kenya have been skillful in prioritizing regulatory reforms which benefit the broader digital economy, not the ICT sector alone.
- Six countries from outside Europe join the G5 group distinguishing themselves through regulatory initiatives enabling digital markets to deliver better services and higher value to consumers: Brazil, Canada, Japan, Kenya, Morocco and Singapore.

Breaking it down track by track – more surprising insights

The insights set out below help identify current trends and emerging patterns as regulation evolves, providing valuable evidence of best practice. These G5 Benchmark insights help build a canvas for evidence-based decision-making and for developing fit-for-purpose regulation for digital markets.

Different paths to collaborative regulation (Table 4) emerge as the Benchmark examines the top-scoring countries track by track:

Collaboration

- The countries ranked as top three in this track represent three different regions – Africa, Asia-Pacific and Europe – underlining the universal value of collaboration in regulating digital markets.
- Many countries lack mechanisms that connect the ICT regulator with financial or data protection regulators (55 and 52 countries).
- The great majority of countries have collaboration mechanisms in place for spectrum management and broadcasting regulation (78 and 71 countries), followed by competition issues (60 countries).
- Formal collaboration occurs most often in broadcasting and spectrum management while informal collaboration more often occurs in relation to competition and consumer protection authorities.

Table 4: G5 Benchmark top countries, by track, 2019

Rank	Collaboration	Score
1	Singapore	13
1	Botswana	13
3	Norway	12
3	United Kingdom	12
		Max score: 16

Rank	High-level principles	Score
1	Kenya	17
2	Japan	17
3	Bulgaria	16
		Max score: 18

Rank	G5 toolbox	Score
1	Canada	16
1	Spain	16
1	Romania	16
1	Germany	16
1	Greece	16
1	Ireland	16
1	Sweden	16
		Max score: 16

Source: ITU

Policy design principles and their implementation:

- 90 per cent of countries surveyed (73 countries) have adopted a digital strategy. 51 countries' strategies are holistic in scope and address interplay across digital markets. Only 16 countries have clear references to the SDGs and link development goals with global priority areas. While many strategies pre-date SDG adoption, incoherence across national and global frameworks will pose a challenge in harmonizing cross-border digital markets.
- Almost half of countries (41) have a space for digital experimentation, providing a testbed for new technologies and services before fully launching them commercially. In this group, we count regulatory sandboxes and pilot initiatives, as well as regulation of new and emerging phenomena such as fintech, Artificial Intelligence and the Internet of Things.
- Around 30 countries are using targeted regulatory incentives for regulators; however only in half of these have such incentives been translated into concrete, targeted measures.

G5 tools for holistic regulatory oversight:

- Between 80 and 90 per cent of surveyed countries have adopted holistic policies for competition, mobile financial services and cybersecurity. This underlines the critical role these elements play in digital transformation.
- Most countries have introduced forward-looking competition policies and data protection laws, safeguarding both providers and consumers.
- Over recent years, many countries have adopted regulatory frameworks for ICT accessibility for persons with disabilities, a foundation for digital inclusion across the board. This is the case for three-quarters of surveyed countries.
- Despite a consensus on the importance of digital services, 45 countries still have taxes on Internet services, raising additional barriers to service provision and adoption. Taxation remains an area for scrutiny and regulatory action in many developing countries.

The Benchmark allowed us to cover the full array from G1 through G5. The current snapshot of

regulation maturity of regulation for ICT and beyond is highlighted in Chapter 2.

Opportunity awaits regulators who embrace collaboration

Increasing numbers of countries are embracing the new approach to collaborative regulation.

While opportunities associated with digital transformation are undeniable, most countries still face quite a journey in getting there. Such opportunities await those government regulators who sit down with peers from different economic sectors and embrace collaborative regulation, meeting the challenges ahead openly and holistically.

Box 9: The collaboration dividend

G5 regulation fosters vibrant markets – G5 open, collaborative regulation will best ensure that fast-evolving markets, innovative technologies, products and services deliver the greatest social and economic value to the world's population.

G5 regulation key to finding market solutions – the spectacular growth of cloud computing, social media and mobile technology has helped create new technologies, business models and players that significantly impact how societies function and fundamentally challenge existing regulatory paradigms. Only open, collaborative, incentive-based G5 regulation will encourage market growth and innovation while building wide consensus and affording consumers protection.

G5 regulation: ICT regulator plays leadership role – the ICT regulator has an expanding, leadership role in facilitating a cross-sectoral, open and highly collaborative regulatory approach best suited to engender markets that are vibrant, innovative and inclusive while affording adequate protection to consumers.

Feedback loop and living Benchmark

The Benchmark for collaborative regulation is based on data provided by ITU Member State Administrations through annual ITU surveys. Additional research was carried out to complement the dataset.

The Benchmark was first presented at the Heads of Regulators' Executive Round Table at the 2019 Global Symposium for Regulators (GSR). We will continue the conversation and count on all interested stakeholders to provide contributions to enhance the tool.

Please contact us at treg@itu.int to share your comments, views, suggestions or questions on the Benchmark methodology and data.

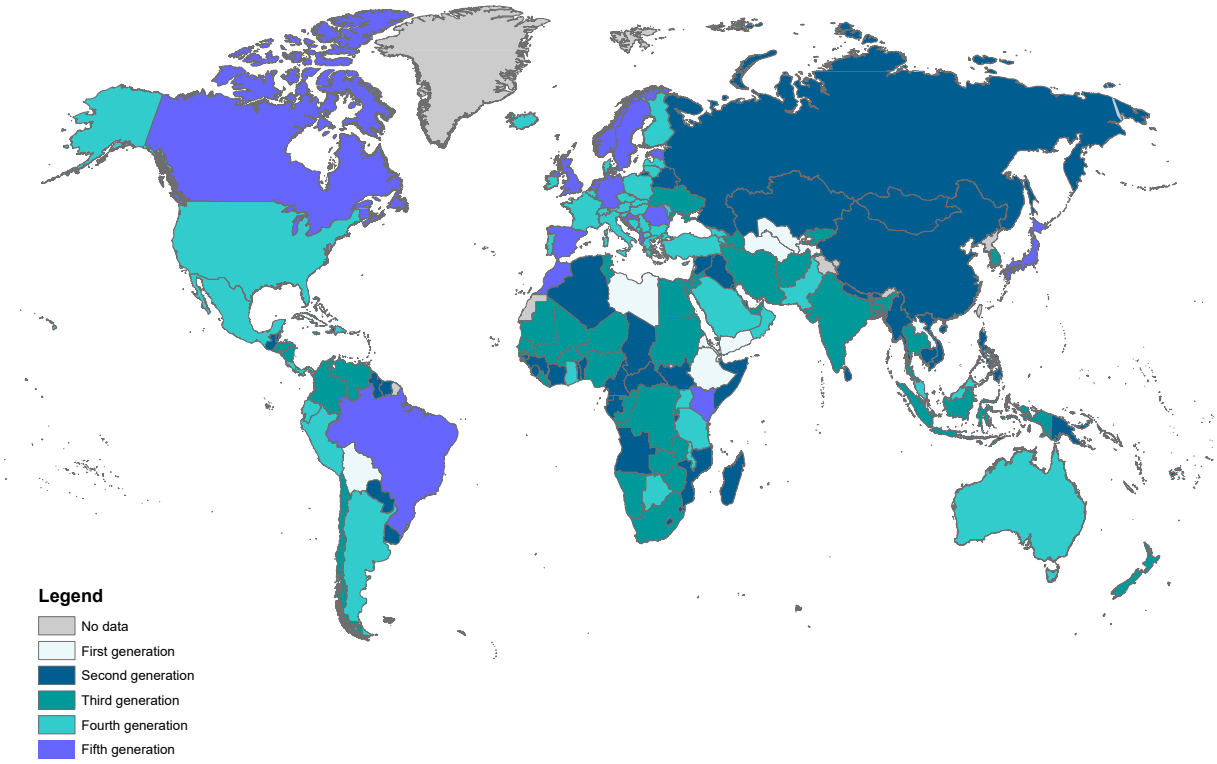
Chapter 2: Collaborative regulation: unstoppable, not yet universal

Global trends: G4 is now the industry standard but vanguard countries moving onto G5

ITU regulatory metrics sets out clearly the levels of maturity of regulatory frameworks for the ICT sector and for the digital economy itself. Our analysis shows that while digital has been gaining ground and shaping regulatory response, too few countries have to date achieved the maturity needed to trigger its multiplier effect on development and digital transformation – with nine of every 10 countries still regulating ICTs as a separate economic sector. However, a vanguard of 8 per cent of countries now has holistic, forward-looking regulatory frameworks in place enabling digital transformation across their economies. The global headlines emerging from this year's report are:

- Europe ranks first of the regions, with 10 countries of the 16 global G5 champions, including the two world-leading scores coming from Norway and the UK.
- The highest-ranking non-European countries in collaborative regulation are Kenya and Singapore, ranking third and eighth respectively. The list of leading non-European G5 regulators also includes Brazil, Morocco and Japan.
- More than 50 additional countries have achieved G4 (integrated ICT regulation led by social and economic goals). These are the countries with the lowest proportion of unconnected population and have thriving markets for ICT services. In just 10 years, G4

Figure 3: Generations of regulation – where do we stand in 2019*?



Note: The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of ITU concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Source: ITU

has become the established standard for every ICT regulator.

- Although the race at the top is tight, the gap between the top ranking and the lowest ranking countries is more than 100 points.
- More than half of world's population is concentrated in G2 and G3 countries, poised to leapfrog to near universal digital inclusion and lead vibrant ICT markets.
- A quarter of countries is only half way through the journey, still in the G3 category: making steady progress in strengthening policy and regulatory frameworks but unable to unlock the full potential of ICT markets.
- As many as 40 per cent of countries languish in G1 or G2, missing development opportunities and running the risk of remaining disconnected from global digitization and how this can transform their economies.
- Italy, although current global leader in the G4 category, has dropped out of top rankings and has now been overtaken by regulators with a more evolved, collaborative approach to digital regulation.
- Albania and Japan, while in the G3 category with regard to inward ICT sector regulation, both leap forward to G5, benefitting from their preparedness to move forward with digital transformation.

Figure 4: Digital regulation worldwide at a glance, 2019*

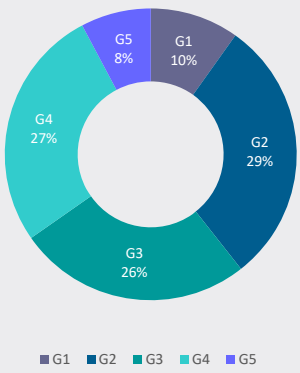
Generations of regulation	
Number of countries having graduated to G4 and G5:	67 out of 193 (or 35 per cent)
First country to reach G4:	Belgium, 2007
Gap between the highest and lowest scores:	Highest: Norway, 134,5 Lowest: Djibouti, Libya, 4,5
Regional averages per area:	ICT Regulatory Tracker Regulatory authority: 15/20 Regulatory mandates: 17/22 Regulatory regime: 19/30 Competition framework: 20/28
World average:	**73,7**

Note: Scores are based on the ICT Regulatory Tracker (Generations 1 to 4) and the Benchmark for collaborative regulation (Generation 5)

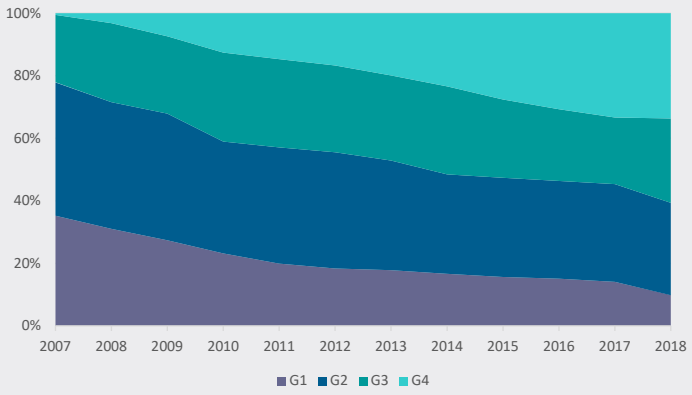
Lead countries in the fifth generation of regulation

	Country	Region	ICT Regulatory Tracker Score	G5 Benchmark Score	Combined Score	GEN
1	Norway	Europe	95.5	39	134.5	G5
2	United Kingdom	Europe	95	37	132	G5
3	Singapore	Asia-Pacific	91.5	39	130.5	G5
4	Croatia	Europe	94	36	130	G5
5	Germany	Europe	93.5	36	129.5	G5
6	Romania	Europe	92	36	128	G5
7	Netherlands	Europe	93	35	128	G5
8	Kenya	Africa	87.5	37	124.5	G5
9	Estonia	Europe	87	37	124	G5
10	Sweden	Europe	89	35	124	G5
11	Brazil	Americas	88.5	35	123.5	G5
12	Morocco	Arab States	88.5	35	123.5	G5
13	Canada	Americas	85.5	37	122.5	G5
14	Spain	Europe	86	36	122	G5
15	Albania	Europe	83	35	118	G5
16	Japan	Asia-Pacific	72.5	37	109.5	G5

World, 2019*



Evolution of the generations of ICT regulation worldwide, 2007-2018



Source: ITU

The view from the regions: Africa

- Kenya is the only African country in the lead group of 5G regulators, entering the global top 10 at eighth position. Ghana ranks as the second African country overall (far behind Kenya) at 48th position in the world.
- For the first time*, Africa now boasts a top five of countries across G4 and G5 categories.
- Africa is the region where regulatory frameworks have evolved most over the past 10 years. G3 countries have increased steadily in number from five per cent to 52 per cent of African countries in slightly over a decade. In 2007, more than 40 per cent of African countries were of G1 category – in 2018, only two LDCs remained in this lowest tier.
- The evolution of Africa's scores tracks world averages, and tracks *above the averages* of the Arab States, Asia-Pacific and CIS.
- Much remains to be done to advance G1 and G2 countries to the higher tier: considerable support will be required to ensure these countries move ahead on their journey towards meaningful regulatory reform.

Box 10: Voices from the region: Kenya on the journey towards collaborative regulation

'Voices from the region' is a qualitative feedback-based project involving ICT regulatory regimes at various levels of development. As part of the overview of regional trends in ICT regulation, we feature the experience of leading countries in the race towards collaborative regulation.

- *Single most difficult challenge in moving towards collaborative regulation*

  Lack of awareness of existing regulatory framework by key actors and sector regulators

- *Key counterparts/interlocutors*

  Government ministries, legislature, the judiciary and law enforcement agencies, cross-sector regulators, Central Bank

- *Top three most important actions a regulator can undertake*

  1. Analyse regulatory gaps
  2. Identify areas for collaboration
  3. Elaborate a strategic plan for collaboration, with concrete outcomes

- Single most important lesson learned moving forward with a collaborative regulatory approach

  Overcoming jurisdictional issues is the first step towards true collaboration

- *Piece of advice to regulators engaging on a journey towards digital regulation*

  Maintain transparency and disclosure in corporate governance affairs

Source: Communications Authority of Kenya

Figure 5: Digital regulation compass, Africa, 2019*

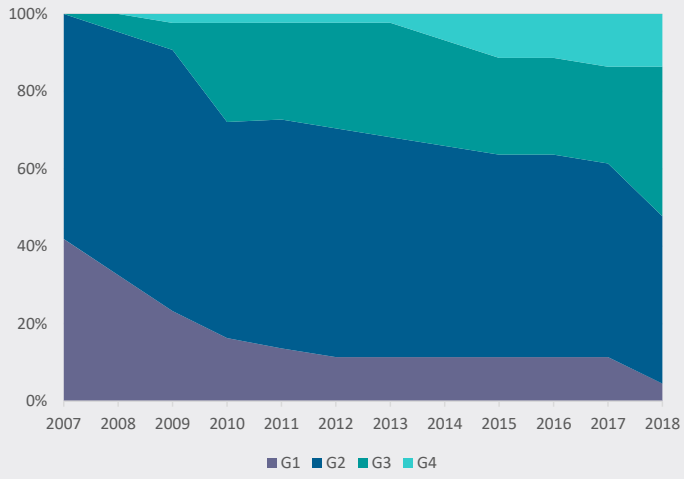
Generations of regulation in Africa in 2019	
Number of countries having graduated to G4 and G5:	6 out of 44 (or 14%)
First country to reach G4:	Uganda, 2009
Gap between the highest and lowest scores:	Highest: Kenya, 124,5 Lowest: Eritrea, 25
Regional averages per area:	ICT Regulatory Tracker Regulatory authority: 16/20 Regulatory mandates: 18/22 Regulatory regime: 17/30 Competition framework: 18/28
World average:	**Africa: 69,8** **World: 73,7**

Note: Scores are based on the ICT Regulatory Tracker (Generations 1 to 4) and the Benchmark for collaborative regulation (Generation 5)

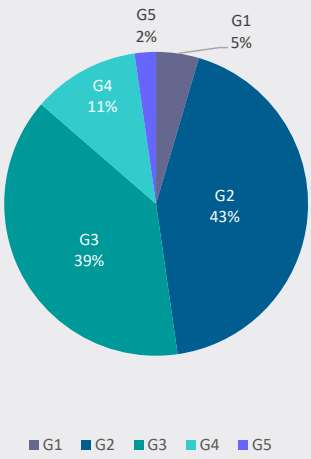
Top 5 Africa, 2019

	Country	Score	GEN	World rank
1	Kenya	124.5	G5	8
2	Ghana	88	G4	48
3	Malawi	87	G4	52
4	Uganda	86	G4	56
5	Botswana	85	G4	64
5	Tanzania	85	G4	64

Evolution of the generations of ICT regulation, Africa



Africa, 2019*



Source: ITU

The view from the regions: Americas

- Both Latin America and North America have their champions in G5 collaborative regulation, in 2019. Brazil is the highest-ranked country from the region ranking 11th in the world, with Canada immediately behind with a single point difference in scores.
- Over a third of countries in the region have graduated to the highest generations of regulation, G4 and G5. No Americas country was part of the worldwide top 20 in 2007 and none was of G4 status.
- In 2019*, the Americas and Europe are the only regions where the average scores on the ITU regulatory metrics are above world average.
- Thirteen countries have attained G4 status. Between 2007 and 2018, the Americas has increased its average score more than other regions – and that growth has been more homogeneous than in other regions such as Africa and Asia Pacific.
- Bolivia and Cuba are the only two countries still of G1 status and in need of fresh reforms to upgrade their regulatory frameworks for the digital economy.

Box 11: Voices from the region: Mexico on the journey towards collaborative regulation

- *Single most difficult challenge in moving towards collaborative regulation*

  Elaborate and build consensus around a broad digital policy vision driven by citizen participation and built on transparency, accountability and collaboration, at the forefront in institutional innovation

- *Key counterparts/interlocutors*

  Government ministries, departments and agencies, cross-sector regulators, law enforcement agencies, Attorney General's Office

- *Top three most important actions a regulator can undertake*

  1. Establish mechanisms for inclusive and effective public consultation
  2. Enable spaces for participation and debate, and establish framework agreements with collaborating agencies
  3. Simplify administrative procedures

- Single most important lesson learned moving forward with a collaborative regulatory approach

  Strengthening institutional capacity is essential in gearing up towards collaborative regulation. This includes both internal governance (i.e. organizational structures, behaviour, accountability, business processes, reports and performance management) and external (i.e. functions, relationships and distribution of powers and responsibilities with other stakeholders, governmental and non-governmental).

- *Piece of advice to regulators engaging on a journey towards digital regulation*

  Create space for collaboration and debate involving as large a number of stakeholders as possible in order to integrate different perspectives into new regulations

Source: IFT Mexico

Figure 6: Digital regulation compass, Americas, 2019*

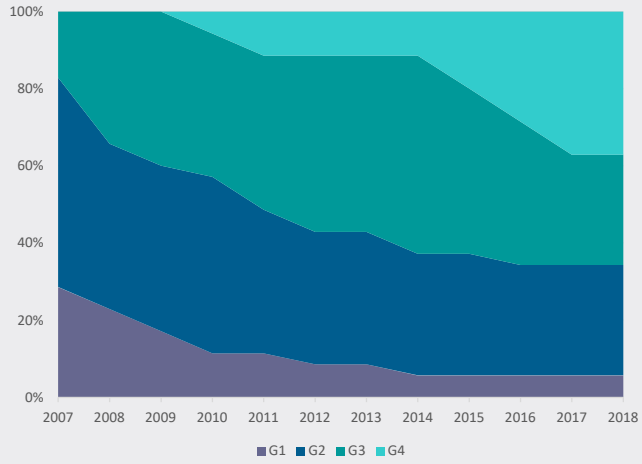
Generations of regulation	
Number of countries having graduated to G4 and G5:	13 out of 35 (or 37%)
First country to reach G4:	Brazil, United States, 2010
Gap between the highest and lowest scores:	Highest: Dominican Rep., 94.5 Lowest: Cuba, 33
Regional averages per pillar:	ICT Regulatory Tracker Regulatory authority: 16/20 Regulatory mandates: 17/22 Regulatory regime: 19/30 Competition framework: 20/28
Average score region compared to world average:	**Americas: 75,2** **World: 73,7**

Note: Scores are based on the ICT Regulatory Tracker (Generations 1 to 4) and the Benchmark for collaborative regulation (Generation 5)

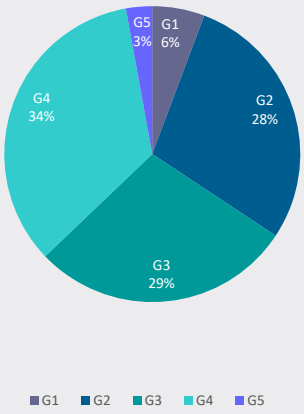
Top 5 Americas, 2019

	Country	Score	GEN	World rank
1	Brazil	123.5	G5	11
2	Canada	122.5	G5	13
3	Dominican Rep.	94.5	G4	22
4	Mexico	90	G4	40
5	Bahamas	88.8	G4	43

Evolution of the generations of ICT regulation



Americas, 2019*



Source: ITU

The view from the regions: Arab States

- Morocco is the only Arab country in the newly identified group of G5 collaborative regulation champions, entering the world top 10 for the first time.
- Saudi Arabia, Oman and Bahrain follow as Arab leaders in G4 regulation and on their way to G5. Four more countries are within four points of attaining G4 status.
- Progress up the 'generation ladder' has been slower than in most other regions, although the pace is likely to accelerate over the next two years with major reforms in the pipeline in a number of Arab States, including Kuwait and UAE.
- Most movement in the region has resulted from G2 countries progressing to G3 and, to a lesser extent, G3 countries moving up to G4.
- One fifth of all Arab States remain at G1 status.

Figure 7: Digital regulation compass, Arab States, 2019*

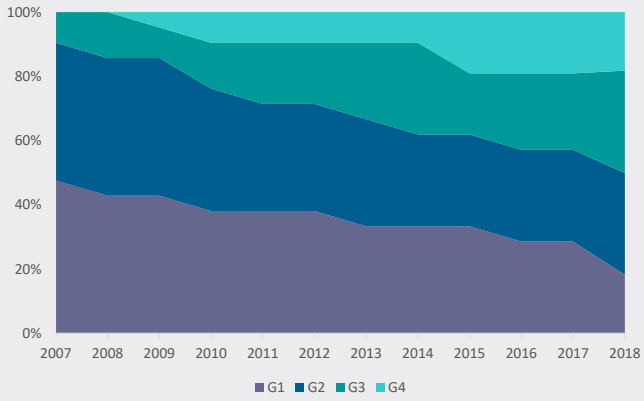
Generations of regulation in Arab States	
Number of countries having graduated to G4 and G5:	4 out of 22 (or 18%)
First country to reach G4:	Morocco, 2009
Gap between the highest and lowest scores:	Highest: Morocco, 123,5 Lowest: Djibouti, Libya, 4,5
Regional averages per pillar:	ICT Regulatory Tracker Regulatory authority: 14/20 Regulatory mandates: 16/22 Regulatory regime: 17/30 Competition framework: 15/28
Average score region compared to world average:	**Arab States: 64,1** **World: 73,7**

Note: Scores are based on the ICT Regulatory Tracker (Generations 1 to 4) and the Benchmark for collaborative regulation (Generation 5)

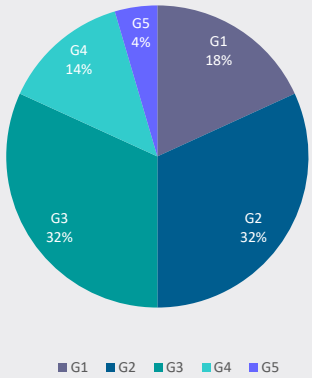
Top 5 Arab States, 2019

	Country	Score	GEN	World rank
1	Morocco	123.5	G5	11
2	Saudi Arabia	92	G4	23
3	Oman	90.3	G4	39
4	Bahrain	87.3	G4	51
5	Jordan	84.5	G3	68

Evolution of the generations of ICT regulation, Arab States



Arab States, 2019*



Source: ITU

The view from the regions: Asia-Pacific

- Singapore places third in the world ranking and tops the Asia-Pacific ranking.
- Japan – with newly upgraded 5G status – ranks second in the region and 16th worldwide.
- Only four countries – one in 10 – have attained G4 status, a performance comparable to the figures for Africa. No new countries have succeeded in attaining G4 status since 2012.
- With the exception of Africa, Asia-Pacific presents the most diverse range of countries in terms of regulatory maturity.
- Sub-regions diverge in their levels of maturity. While in East Asia and the Pacific a third of the countries are of G1 status, South Asia has none and over half of the countries are of G2 status. A third of South Asian countries are G3 status – this compares to close to 40 per cent in the rest of the region.

Box 12: Voices from the region: Pakistan on the journey towards collaborative regulation

- *Single most difficult challenge in moving towards collaborative regulation*

  Compliance with Government procedures while maintaining a balance between operator incentives and consumer rights

- *Key counterparts/interlocutors*

  Government ministries and agencies active in the ICT sector, telecom operators and consumers

- Top three most important actions a regulator can undertake
  1. Working with policy-makers on policy guidelines enabling innovation and technology adoption
  2. Start collaboration with a wide network of stakeholders, including regulators and operators
  3. Build intuitional capacity and skill up regulatory professionals
- *Single most important lesson learned moving forward with a collaborative regulatory approach*

  Progress towards integrated and collaborative regulatory regime is heavily dependent upon effective stakeholder coordination

- *Piece of advice to regulators engaging on a journey towards digital regulation*

  Use the bottom-up approach, build consensus among the stakeholders and learn from regional and international best practices

Source: PTA Pakistan

Figure 8: Digital regulation compass, Asia-Pacific, 2019*

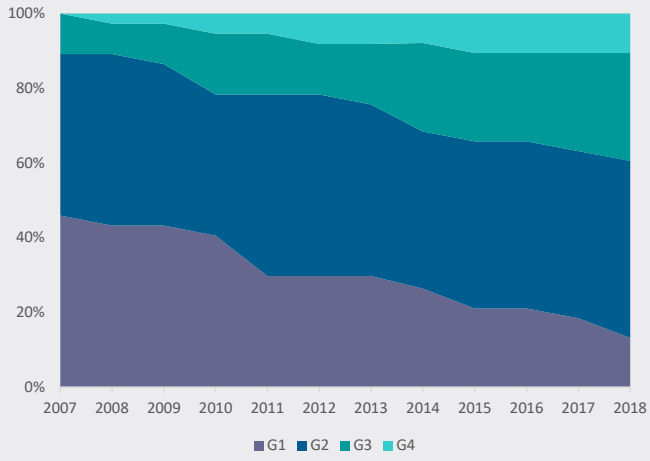
Generations of regulation in Asia-Pacific	
Number of countries having graduated to G4 and G5:	4 out of 38
First country to reach G4:	Australia, 2008
Gap between the highest and lowest scores:	Highest: Singapore, 130,5 Lowest: Micronesia, 8
Regional averages per pillar:	ICT Regulatory Tracker Regulatory authority: 13/20 Regulatory mandates: 16/22 Regulatory regime: 16/30 Competition framework: 17/28
Average score region compared to world average:	**Asia-Pacific: 64,8** **World: 73,7**

Note: Scores are based on the ICT Regulatory Tracker (Generations 1 to 4) and the Benchmark for collaborative regulation (Generation 5)

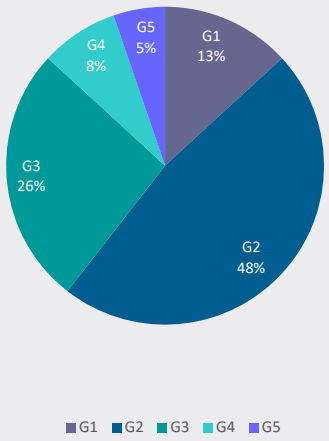
Top 5 Asia-Pacific, 2019

	Country	Score	GEN	World rank
1	Singapore	130.5	G5	3
2	Japan	109.5	G5	16
3	Australia	94.5	G4	22
4	Pakistan	88	G4	48
5	Malaysia	87	G4	52

Evolution of the generations of ICT regulation, Asia-Pacific



Asia-Pacific, 2019*



Source: ITU

The view from the regions: CIS

- Armenia is the lead CIS rankings and is the only G4 country. CIS is currently the only region *without* a collaborative regulation champion and still features G2 countries in its top 5 countries.
- Disparity of regulatory maturity is particularly marked – this despite the relatively small number of countries in the region. While the top CIS country places at 61st in the world ranking, the fifth CIS country ranks 170th in the world.
- The region has made steady progress since 2007 when 11 of 12 countries* were either of G1 or G2 status, and one country was categorized as G3. Eleven years later in 2018, three countries have progressed to G3 and G4 status.
- Overall, regulatory frameworks in CIS are moving at a slower pace, with average annual scores since 2007 consistently *below* the world average.
- Three countries remain in the G1 category, failing to adopt important reforms and move up the regulatory ladder. This situation is likely to persist.

* Georgia, Moldova and Ukraine (formerly part of CIS) joined the European region in 2018.

Figure 9: Digital regulation compass, CIS, 2019*

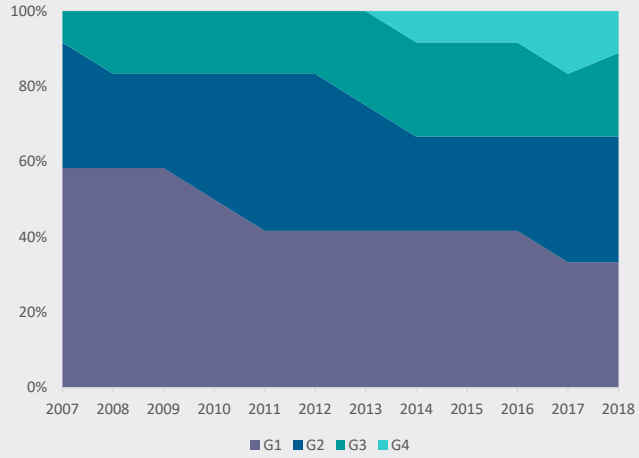
Generations of regulation in CIS	
Number of countries having graduated to G4 and G5:	1 out of 9 (or 11%)
First country to reach G4:	Armenia**, 2018
Gap between the highest and lowest scores:	Highest: Armenia, 85,5 Lowest: Turkmenistan, 7,7
Regional averages per pillar:	ICT Regulatory Tracker Regulatory authority: 8/20 Regulatory mandates: 11/22 Regulatory regime: 11/30 Competition framework: 16/28
Average score region compared to world average:	**CIS: 46,1** **World: 73,7**

Note: Scores are based on the ICT Regulatory Tracker (Generations 1 to 4) and the Benchmark for collaborative regulation (Generation 5)
** Georgia reached G4 in 2014, when it was still part of CIS region

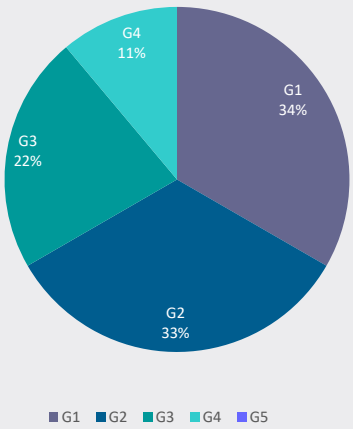
Top 5 CIS*, 2019

	Country	Score	GEN	World rank
1	Armenia	85.5	G4	61
2	Kyrgyzstan	74.5	G3	99
3	Azerbaijan	70.5	G3	117
4	Kazakhstan	54	G2	160
5	Belarus	44.5	G2	170

Evolution of the generations of ICT regulation, CIS



CIS, 2019*



Source: ITU

The view from the regions: Europe

- Europe leads other regions by far with 28 fourth generation and 10 fifth generation regulators.
- Norway tops both European and world rankings, followed by the United Kingdom.
- Europe was the first region to produce a G4 regulator, Belgium, the first (and only) country in the world to have attained this status in 2007.
- The annual average scores of Europe have consistently been the highest since 2007.
- Nevertheless, the gap between European annual average scores and world averages has halved from 45 per cent in 2007 to 21 per cent in 2018.
- Three European countries are in the G1 category – note that these are microstates with regulatory patterns likely to differ from mainstream best practice due to the lack of economies of scale and institutional incentives.

Box 13: Voices from the region: France on the journey towards collaborative regulation

- *Single most difficult challenge in moving towards collaborative regulation*

  Kick off a strategic review to identify new challenges and rethink regulatory priorities, with the aim of adapting regulation to new technological and market realities

- *Key counterparts/interlocutors*

  Specialized government agencies, cross-sector regulators, local authorities, operators, new digital players, manufacturers, consumers

- *Top three most important actions a regulator can undertake*

  1. Monitor and collect information on the entire digital ecosystem, beyond the regulated operators
  2. Promote innovation
  3. Promote data-driven regulation, empowering consumers and leveraging their experience to improve service provision

- *Single most important lesson learned moving forward with a collaborative regulatory approach*

  Enabling independent regulators to observe markets, and collect data on new topics will help the definition of future rational policies

- *Piece of advice to regulators engaging on a journey towards digital regulation*

  What matters most in moving towards a more open, collaborative and agile regulation is to bring external as well internal partners and various stakeholders on board

Source: ARCEP, France

Figure 10: Digital regulation compass, Europe, 2019*

Generations of regulation	
Number of countries having graduated to G4 and G5:	38 out of 45 (or 84%)
First country to reach G4:	Belgium, 2007
Gap between the highest and lowest scores:	Highest: Norway, 134,5 Lowest: San Marino, 22
Regional averages per pillar:	ICT Regulatory Tracker Regulatory authority: 17/20 Regulatory mandates: 18/22 Regulatory regime: 26/30 Competition framework: 25/28
Average score region compared to world average:	**Europe: 94,1** **World: 73,7**

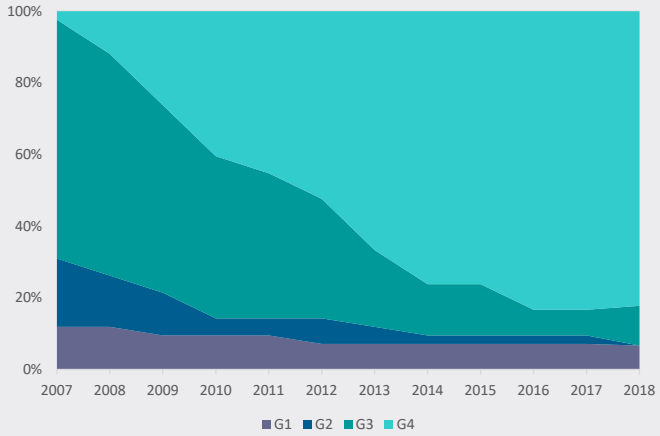
Note: Scores are based on the ICT Regulatory Tracker (Generations 1 to 4) and the Benchmark for collaborative regulation (Generation 5)

Top 5 Europe**, 2019

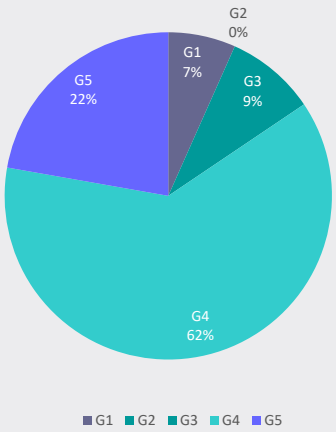
	Country	Score	GEN	World rank
1	Norway	134.5	G5	1
2	United Kingdom	132	G5	2
3	Croatia	130	G5	4
4	Germany	129.5	G5	5
5	Netherlands	128	G5	6
5	Romania	128	G5	6

** Georgia, Moldova and Ukraine (formerly part of CIS) joined the European region in 2018

Evolution of the generations of ICT regulation, Europe



Europe, 2019*



Source: ITU

Chapter 3: Good regulation broadens access and ignites markets

G5 and G4 regulation help advance digital services

Good regulation has impact – the first Global ICT Regulatory Outlook clearly demonstrated this in 2017 based on analysis from the ICT Regulatory Tracker. This finding is further underlined in this year's edition of the report. The work we have done in assembling the Benchmark of Fifth Generation Collaborative Regulation (G5 Benchmark) has clearly shown just how effectively higher generations of regulation (G5, G4) are helping mobile and fixed broadband penetrate further for digital services.

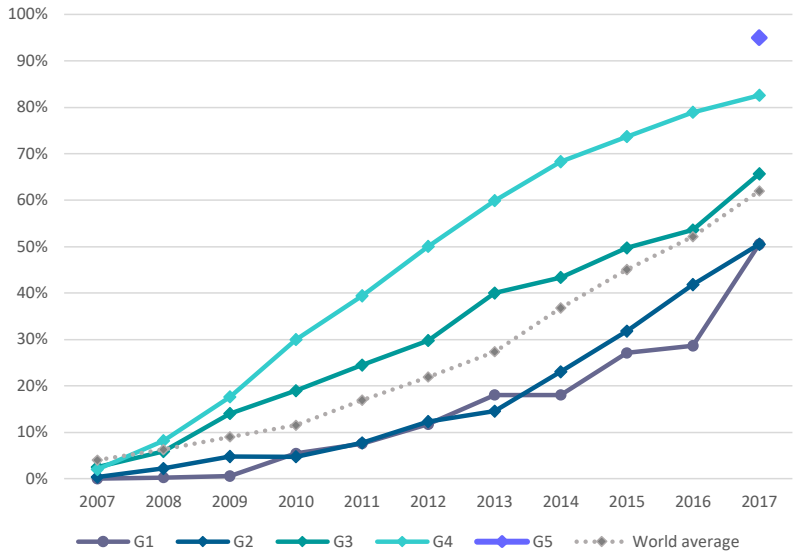
G4 and G5 – powerful engines for mobile broadband growth

The case of mobile broadband demonstrates the crucial role played by good regulatory frameworks. Our analysis plots mobile-broadband penetration of countries by G1, G2, G3 and G4 from years 2007 to 2017 (see Figure 11). We have also included the leader group of fifth generation regulators in 2017, for illustration.*

Our analysis shows that:

- In 2007: regulatory rules were not playing a major role. Mobile markets for 2G cellular services were well established across all regions – and with 3G largely leveraging the existing framework. The differences in penetration levels in countries with G1, G2, G3 and G4 regimes were insignificant.
- By 2010 however, regulatory maturity began having impact: suddenly G1 and G2 peers were distinctly below the world average penetration while G3 and G4 countries were clearly above. This trend lasted for half a decade.
- Around 2013, as smartphones and tablets went mainstream in developed markets, telling differences in countries' performance emerged. G1 and G2 peers were shown to be consistently underperforming, while G4 peers excelled, doubling the average world rate of penetration. Interestingly, the power of G3 regimes began to fade, with their penetration

Figure 11: Active mobile broadband subscriptions per 100, per generation of regulation, 2007-2017*



* As a proxy, the list of G5 countries was used to calculate the average mobile broadband penetration for 2017; the Benchmark for collaborative regulation defined the countries in the group for the first time in 2019.
Source: ITU

settling at world average level and staying there. Their mobile broadband penetration has remained close to that average since.

- Essentially, mobile broadband technologies have put additional pressure on regulatory frameworks in the ICT sector and have pushed the gold standard for regulation beyond and above past requirements. As a result, G3 regulation is maintaining world average penetration while G4 regulation is now the norm for vibrant mobile broadband markets.
- Average mobile broadband penetration in G4 peers is around 20 percentage points higher than countries in lower generations, attaining levels over 80 per cent compared to the world average of 62 per cent.
- The new-minted G5 group of countries, however, outperforms all others substantially: they boast a penetration level ten percentage points higher than fourth generation countries, on average, reaching a level of near universal penetration.
- Our analysis suggests – with strong supportive evidence – that the take-up of mobile broadband is testament to the power of regulation and how movement up the regulatory ladder leverages new technologies to meet market demand.

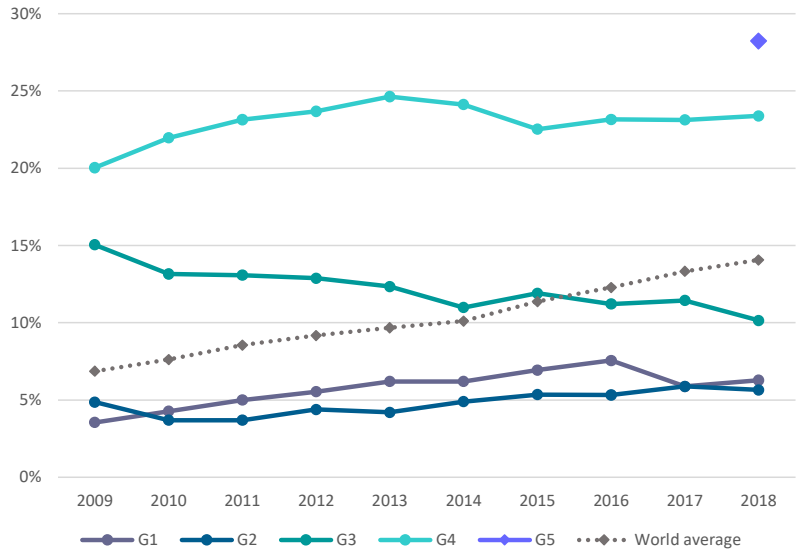
Fixed broadband – G4 countries losing momentum as G5 countries surge ahead

As with mobile broadband markets, the regulatory environment also powerfully determines how well fixed broadband markets develop. Our analysis below plots fixed-broadband penetration of countries by G1, G2, G3 and G4, and from years 2009 to 2018 (see Figure 12). We have also included the leader group of G5 regulators in 2018, for illustration.

The analysis shows that:

- Unlike mobile broadband, regulation for fixed broadband markets has been crucial since the outset (shown here since 2009). Penetration rates in G1 and G2 peers have been almost half the world average up to 2016 – while rates of penetration in these countries have dropped since. From today's vantage point, it emerges that there is no difference between the performance of G1 and G2 peers in fixed-broadband take-up.
- While G3 peers were comfortably above world average in terms of fixed broadband penetration in 2009, their performance has largely deteriorated – since 2015 they have performed below world average, approaching G1 and G2 levels. This is explained by the stepping up of many countries to G4 and the

Figure 12: Fixed broadband subscriptions per 100, per generation of regulation, 2009-2018*



* As a proxy, the list of G5 countries was used to calculate the average mobile broadband penetration for 2018; the G5 Benchmark defined the countries in the group for the first time in 2019.
Source: ITU

subsequent impact of invigorated regulatory frameworks. In dynamic digital markets, relying on established regulation is no longer effective – and less dynamic G3 countries are paying the price for their 'wait and see' approach.

- In contrast, move-ahead G4 countries have achieved fixed-broadband penetration ten percentage points higher than the world average.
- G4 country penetration rates have plateaued out since 2015, and are even indicating some decline.
- The group of rising G5 champions displays penetration rates twice as high as the world average and over 25 per cent higher than G4 peers in 2018, clearly charting a path forward for years ahead.

Golden rules that help unlock the power of broadband

The regulation generations – G1, G2, G3, G4 and G5 – are now well established as authoritative tools to understand how ICT regulation has evolved worldwide, how it is intimately enmeshed with market development and how it can be deployed to impact the growth and opening out of those markets to the digital economy.

As illustrated in our analysis of countries' market performance across five generations of regulation, incentives, targeted policies and enabling regulatory tools are essential for providing universal and meaningful access to technology.

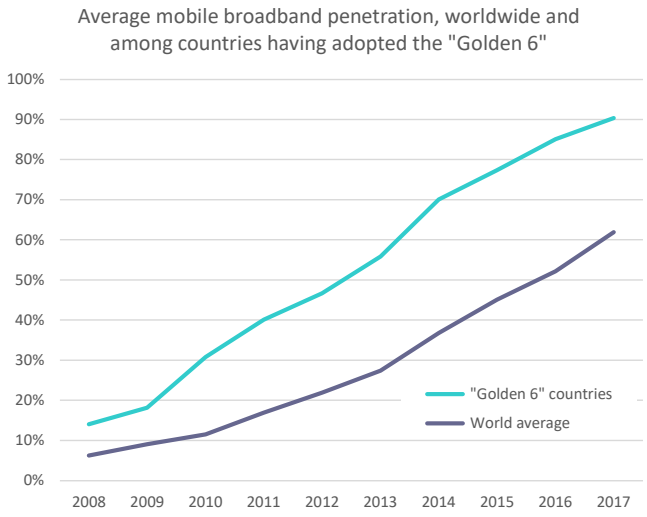
Our analysis shows that a handful of key regulations will unleash the potential of broadband markets and will serve as a launch pad for achieving connectivity and adoption goals. While there are many areas that require regulatory oversight, with different areas of focus across different countries, the evidence is clear: when key features of regulatory regimes for ICT markets are 'switched on', market take-up is faster and more access is delivered to more people more quickly.

Six golden rules that accelerate take-up of mobile broadband

Our analysis demonstrates that just six regulations, or 'golden rules', will accelerate the take-up of mobile broadband, removing roadblocks and incentivizing market players. The rules range include mandating the sharing of infrastructure, enabling number portability and gearing up markets for full competition (see Figure 13 for the full list of measures).

Our analysis plots mobile-broadband penetration of those countries operating the 'golden rules' from 2008 to 2017 against world average penetration (see Figure 13).

Figure 13: Average mobile broadband penetration, worldwide and among countries having adopted the '6 Golden rules for mobile broadband take-up'



The Golden Six:
A regulatory recipe for successful mobile broadband adoption

Winning formula for mobile broadband:

1. Co-location/site sharing mandated
2. Band migration allowed
3. Number portability available to consumers and required from mobile operators
4. Full competition in IMT (3G, 4G, etc.) services
5. Full competition in international gateways
6. No restrictions to foreign participation/ownership in spectrum-based operators

Source: ITU

The analysis shows that:

- The 'golden rules' helped no fewer than 63 countries achieve mobile-broadband penetration of 90 per cent on average or near-universal coverage in 2017.
- These 63 countries' markets have skyrocketed: penetration is one-and-a-half times higher than the world average in 2017 and is significantly outpacing most other countries. Although there are multiple factors at work, these countries have deployed high-performance regulation which is delivering outstanding results.
- While a decade ago the gap between those countries applying the 'golden rules' and the world average penetration was eight per cent, by 2017 it was close to 30 per cent. This evidence points to the power of targeted regulation in driving towards universal connectivity.
- Since the first formulation of the 'Golden 6' in our 2017 edition of the Global ICT Regulatory Outlook, we have tightened some criteria to align the 'golden rules' more closely to international best practice – for example prioritizing full competition above partial, and adding the requirement for the implementation of mobile number portability by operators as opposed to merely putting a legal framework in place. We found that higher penetration arises from more open and competitive markets.
- With 5G mobile broadband technology on the horizon, we expect new regulatory requirements to come into play – we will therefore be closely scrutinizing evidence and tracking those regulatory measures that will take markets to the next level.

Seven golden rules that accelerate take-up of fixed broadband

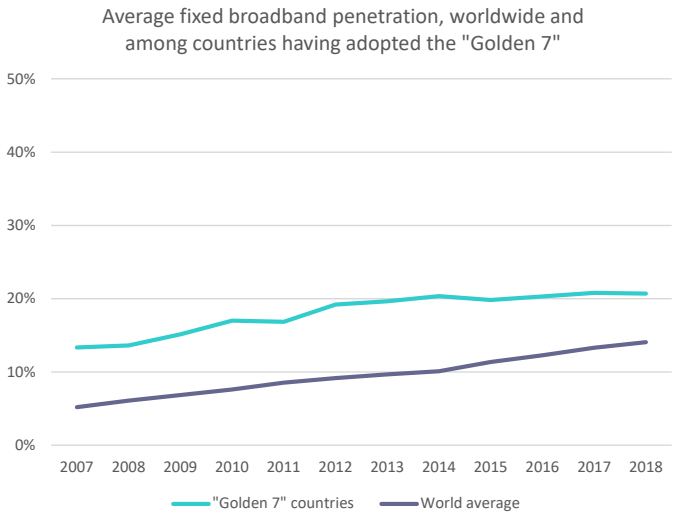
Similarly, our analysis of fixed broadband markets shows that a set of seven 'golden rules' can boost technology adoption. The rules include a unified licensing regime, a full competition framework and enforced quality of service monitoring (see Figure 14 for the full list of measures).

Our analysis plots fixed-broadband penetration of countries having adopted the seven 'golden rules' for the period from 2007 to 2018 (see Figure 14) against the world average penetration.

The analysis shows that:

- Forty-four countries running with the seven 'golden rules' score an average eight per cent higher for fixed-broadband service adoption, than world average for the period 2007-2018. Although causation is complex to establish statistically, the figures clearly imply that regulation facilitates market growth.
- The seven 'golden rules' include three measures that relate specifically to fixed broadband (for

Figure 14: Average fixed broadband penetration, worldwide and among countries having adopted the '7 Golden rules for fixed-broadband take-up'



The Golden Seven:
A regulatory recipe for successful fixed broadband adoption

Winning formula for fixed broadband:

1. General authorization regime
2. Infrastructure sharing mandated
3. Full competition in cable modem, DSL, fixed wireless broadband
4. Full competition in international gateways
5. Legal concept of dominance or SMP
6. Foreign participation/ownership in Internet Service Providers (ISPs)

Source: ITU

example full competition in the two main fixed-broadband segments) and four measures that relate to broader framework regulation (for example full competition at the international gateway and infrastructure sharing). This composition reflects the need for regulatory measures that vary in scope and profile when formulating a winning market formula.

- Our analysis suggests that fixed-broadband markets running the seven golden rules have reached saturation or the mature phase of the industry lifecycle. Over the past seven years, these countries achieved only a modest rise in penetration levels. Two implications arise from this. Firstly, policy and regulatory goals should be revised to encourage more service-based competition and subsequent crowding-in. Secondly, new regulatory measures may be needed to put fixed-broadband markets back onto a growth path.
- Our quantitative evidence suggests that best-practice regulation has real impact – and both the design and effective enforcement of regulatory frameworks are essential for broadband markets to thrive.

Chapter 4: Audit of ITU ICT Regulatory Tracker: conceptually sound, statistically coherent and robust

Abstract

The ICT Regulatory Tracker, developed by International Telecommunication Union, is an evidence-based tool that helps decision-makers and regulators monitor the rapid evolution of ICT regulation. It also helps identify the gaps in existing regulatory frameworks, making the case for further regulatory reform.

The statistical assessment of the ICT Regulatory Tracker presented herein delves into two main issues. First, we analyse the statistical coherence of the conceptual framework, and second, the impact of key modelling assumptions on the final country scores and ranks. In addition, we discuss briefly some outstanding trends in the scores of regions and countries over the period 2007-2018.

All in all, the results of the statistical assessment suggest that the Tracker is a conceptually sound, statistically coherent and robust monitoring tool. Notwithstanding, throughout the report we also present and discuss some alternative approaches for calculating the final scores and presenting the results. These suggestions might be taken on board by the developers of the Tracker in future releases of the tool.

Introduction

The ICT Regulatory Tracker is an evidence-based tool to help decision-makers and regulators make sense of the rapid evolution of ICT regulation. The Tracker is developed by the International Telecommunication Union (ITU), which is the United Nations specialized agency for information and communication technologies. Using both quantitative and qualitative data, the Tracker makes possible to pinpoint the changes taking place in the ICT regulatory environment, enabling benchmarking and the identification of trends in ICT legal and regulatory frameworks. It likewise helps identify the gaps in existing regulatory frameworks, making the case for further regulatory reform towards achieving a vibrant and inclusive ICT sector.

In May 2018, the developers of the Tracker invited the European Commission's Competence Centre on Composite Indicators and Scoreboards at the Joint Research Centre to undertake a statistical assessment of the tool and to make suggestions for improvement. Since then, the ITU team and the JRC have engaged in an iterative process to discuss potential refinements to the monitoring framework.

The third edition of the Tracker has been launched in 2019. The statistical assessment of the current edition of the ICT Regulatory Tracker presented herein is based on two main issues: the statistical soundness of its conceptual framework, and the impact of key modelling assumptions on the country results. In this report we also include a brief analysis of outstanding trends in regions and countries' scores over the period 2007-2018.

In the following sections, we will present the different stages of the statistical assessment carried out for the ICT Regulatory Tracker. All in all, the results of the analysis suggest that the Tracker is a conceptually sound, statistically coherent and robust monitoring tool. Notwithstanding, some potential alternatives to the current methodological choices have also been discussed in the framework and, as a result, some proposals for improvement have been laid out for the developers to consider in future editions of the Tracker.

Conceptual and statistical coherence

Index framework

The ICT Regulatory Tracker looks at the changes taking place in the ICT regulatory environment using both quantitative and qualitative data. The Tracker does not measure the quality, the level of implementation or the performance of regulatory frameworks in place, but records their existence

Table 6. ICT Regulatory Tracker pillars

Pillar	Name	Number of Indicators	Max Score
1	Regulatory Authority	10	20
2	Regulatory Mandates	11	22
3	Regulatory Regime	15	30
4	Competition Framework	14	28
	ICT Regulatory Tracker	**50**	**100**

Source: ITU, 2019

and features. The Tracker is based on self-reported information collected through two surveys[1], desktop research and direct outreach to national telecom/ICT regulatory authorities.

Overall, the Tracker is composed of 50 indicators grouped into four pillars: 1) the regulatory authority (focusing on the functioning of the separate regulator), 2) regulatory mandates (who regulates what), 2) the regulatory regime (what regulation exists in major areas), and 4) the level of competition in the ICT sector main market segments. The distribution of indicators and maximum scores by pillars is presented in Table 6.

The overall score is the sum of the four pillar scores. Hence, every pillar contributes to the score proportionally to the number of indicators it contains. The sum of the maximum pillar scores equals 100, which is the maximum theoretical score any country could achieve. The economies are classified in different generations of regulation (from G1 to G4), which showcase progress within the same country over time and for comparing different countries. Countries with a Tracker score below 40 are considered to belong to the first generation of regulation (G1), a score between 40 and 69 to the second (G2), a score between 70 and 84 to the third (G3) and finally, a score above 85 belong to the fourth (G4).

Data availability and missing values

Since the first edition of the Tracker, the developers have defined the thresholds for exclusion/inclusion of countries in view of including the highest number of countries possible. Inclusion is decided on the basis of the available data while providing a reasonable depiction of the situation in a given area (corresponding to the pillars). For the 2018 edition, those thresholds have been increased to cover at least 50 per cent of data for each pillar. The ITU team is confident that such a threshold provides for a robust metric for the regulatory maturity of ICT frameworks.

As explained by the ITU developers, both in the past and in the current edition they have used "reasonable extrapolation" to fill in gaps in some cases. This is the case, for example, when a country skips an annual survey. Therefore, if in year X they reported "Yes" on having a broadband plan, skipped the survey in year X+1, and then reported "Yes" to the same question in year+2, the ITU team extrapolates "Yes" for the middle year (X+1). So in that sense, extrapolated data is treated as real data, not as an estimate. The current 2019 edition is augmented with additional data research, and some of the parameters have been enhanced. Concretely, the data points that were missing in the 2018 Tracker but are now filled in the 2019 edition are hard data based on either desk research or direct outreach. They are not extrapolated but verified by research.

Missing values which cannot be filled using extrapolation have been left intentionally blank in the data set. However, it is worth noting that, when adding up the indicators to calculate the pillar scores, those cells with missing values will be implicitly treated as if a zero value had been imputed. On a related note, the developers agree that it is probably correct to assume that missing values are equal to zero, since for example some survey respondents may prefer leaving blanks rather than stating that their country does not comply with international best practices.

As shown in Table 7, among the included economies, most of the missing values in the data set are concentrated in indicators 43, 45, 46, 47, 48, 49 and 50.

Table 7. Quantity of missing data for every indicator of the ICT Regulatory Tracker

Pillar 1: Regulatory authority			Pillar 2: Regulatory mandate			Pillar 3: Regulatory regime			Pillar 4: Competition framework		
Ind	Nr missing	% missing	Ind	Nr missing	% missing	Ind	Nr missing	% missing	Ind	Nr missing	% missing
1	0	0%	11	0	0%	22	0	0%	37	0	0%
2	0	0%	12	0	0%	23	0	0%	38	1	1%
3	0	0%	13	0	0%	24	0	0%	39	0	0%
4	0	0%	14	0	0%	25	0	0%	40	2	1%
5	0	0%	15	0	0%	26	0	0%	41	3	2%
6	0	0%	16	1	1%	27	1	1%	42	0	0%
7	0	0%	17	0	0%	28	0	0%	43	5	3%
8	0	0%	18	0	0%	29	0	0%	44	0	0%
9	0	0%	19	1	1%	30	0	0%	45	7	4%
10	0	0%	20	1	1%	31	0	0%	46	5	3%
			21	1	1%	32	1	1%	47	10	5%
						33	0	0%	48	17	9%
						34	0	0%	49	19	10%
						35	0	0%	50	24	12%
						36	0	0%			

Normalisation

The ICT Regulatory Tracker has been conceived both as a scoring tool and an analysis tool. Each indicator provides a score, and scores are added up first at pillar level and then at the overall score level. Therefore, no normalisation has been deemed necessary at indicator or pillar level.

As an alternative to improve the readability of the results, pillar scores could be normalised. For example, a min-max normalisation formula could be applied to the pillar scores. Accordingly, the raw pillar score for any given country , can be scaled onto a normalised pillar score by subtracting from the raw pillar the theoretical minimum score for that pillar (zero) and dividing by the difference between the theoretical maximum and the theoretical minimum value for the pillar:

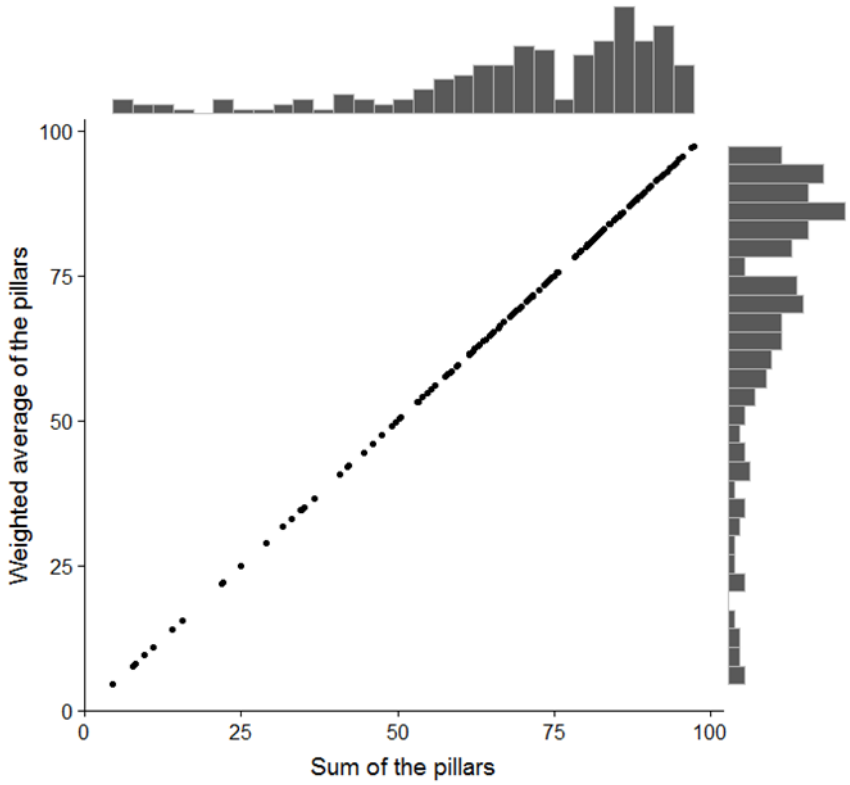
$$x_{i,c} = \frac{\tilde{x}_{i,c} - \min(\tilde{x}_i)}{\max(\tilde{x}_i) - \min(\tilde{x}_i)} \times 100$$

The result of this operation is that each of the four pillars in the Tracker would now have a minimum of zero, and a maximum of 100. The main advantage of this alternative approach to building pillar scores from the underlying indicators is that it would render those pillar scores directly comparable across pillars. As we will discuss in the following sections, including a normalisation stage would also allow us to introduce more flexibility when it comes to calculating the final index scores. For instance, we could envisage setting alternative weights for the pillars (e.g. equal weights) or even implementing not-fully compensatory aggregation formulas, such as geometric averaging. In particular, we will discuss how the same overall index can be obtained starting from the normalised pillars and assigning weights to each pillar based on their theoretical maximum scores.

Weighting and aggregation

As discussed in the previous section, we could normalize the pillar scores prior to aggregation, and then calculate the overall score as the weighted average of those normalised pillar scores. The weights to be used for this calculation would be given by the maximum theoretical scores achievable at pillar level. For example, since the maximum score for the first pillar (Regulatory authority) is 20, we would assign a weight of 20 per cent (maximum pillar score divided by maximum overall score in the Tracker) to the first pillar. Accordingly, the weights for the four pillars in the weighted average formula would be set equal to 0.20, 0.22, 0.30 and 0.28, respectively. As shown in Figure 15, the overall scores following this approach are identical to those initially calculated by the developers.[2]

Figure 15 - Comparison of the values of the default regulatory tracker with the weighted mean of the pillars



Statistical coherence

In this section we assess to what extent the conceptual framework is confirmed by statistical approaches. We use correlation analysis and Principal Component Analysis to evaluate whether the indicators fit statistically in their respective pillar and to what extent the pillars and the overall index are able to summarise the information contained in the underlying data [7].

As expected, results in Table 8 confirm that the grouping of indicators into pillars is statistically coherent, since individual indicators tend to be more correlated to their own pillar than to any other.[3] The four pillars are also strongly correlated to each other and to the overall index, which suggests that the index is well balanced in its four pillars [1]. The latter result is also confirmed by the PCA carried out at the overall index level. PCA reveals the presence of a single latent dimension (i.e. one component with eigenvalue greater than 1.0) which captures 72% of the variance in the four underlying pillars.

Table 8: Correlations between indicators, pillars and overall scores

	Pillar 1	Pillar 2	Pillar 3	Pillar 4	Overall
I1	0,50	0,46	0,33	0,27	0,42
I2	0,60	0,43	0,40	0,28	0,47
I3	0,58	0,33	0,31	0,21	0,37
I4	0,56	0,39	0,27	0,23	0,37
I5	0,42	0,20	0,30	0,25	0,32
I6	0,57	0,50	0,39	0,31	0,48
I7	0,55	0,42	0,35	0,31	0,45
I8	0,42	0,37	0,40	0,34	0,41
I9	0,40	0,33	0,34	0,30	0,37
I10	0,50	0,15	0,37	0,38	0,42
I11	0,5	0,6	0,4	0,3	0,4
I12	0,4	0,5	0,3	0,2	0,4
I13	0,5	0,5	0,4	0,3	0,5
I14	0,3	0,5	0,2	0,1	0,3
I15	0,4	0,6	0,3	0,2	0,4
I16	0,3	0,5	0,3	0,2	0,3
I17	0,4	0,5	0,4	0,3	0,4
I18	0,3	0,5	0,3	0,3	0,4
I19	0,2	0,5	0,1	0,1	0,2
I20	0,2	0,5	0,1	0,1	0,2
I21	0,2	0,4	0,2	0,1	0,2
I22	0,3	0,2	0,5	0,3	0,4
I23	0,2	0,1	0,4	0,3	0,4
I24	0,3	0,2	0,5	0,4	0,5
I25	0,3	0,2	0,5	0,3	0,4
I26	0,3	0,3	0,3	0,2	0,3
I27	0,4	0,3	0,4	0,3	0,4
I28	0,3	0,2	0,4	0,2	0,4
I29	0,3	0,2	0,5	0,3	0,4
I30	0,3	0,3	0,6	0,4	0,5
I31	0,3	0,2	0,6	0,4	0,5
I32	0,4	0,3	0,5	0,3	0,4
I33	0,4	0,2	0,6	0,5	0,6
I34	0,4	0,3	0,6	0,4	0,6
I35	0,2	0,2	0,4	0,3	0,4
I36	0,3	0,2	0,4	0,3	0,4
I37	0,3	0,2	0,5	0,7	0,6
I38	0,2	0,2	0,2	0,4	0,3
I39	0,3	0,2	0,4	0,6	0,5
I40	0,3	0,2	0,4	0,6	0,5
I41	0,3	0,2	0,4	0,6	0,5
I42	0,2	0,1	0,3	0,5	0,3
I43	0,4	0,3	0,5	0,4	0,5
I44	0,4	0,3	0,5	0,5	0,5
I45	0,2	0,2	0,3	0,6	0,4
I46	0,1	0,1	0,2	0,5	0,3
I47	0,3	0,2	0,5	0,7	0,6
I48	0,3	0,2	0,3	0,6	0,5
I49	0,3	0,3	0,3	0,6	0,4
I50	0,2	0,2	0,3	0,5	0,4
Pillar 1	1,0	0,8	0,7	0,6	0,9
Pillar 2	0,8	1,0	0,6	0,5	0,8
Pillar 3	0,7	0,6	1,0	0,7	0,9
Pillar 4	0,6	0,5	0,7	1,0	0,9
Overall	0,9	0,8	0,9	0,9	1,0

Note: Kendall's Tau is used to measure the correlation between the indicators and the pillars; Pearson's correlation coefficient is used to measure the correlation between the pillars.

Impact of modelling assumptions on the ICT Regulatory Tracker

In this section we perform an analysis of the impact of modelling choices on the final results of the ICT Regulatory Tracker results. In particular, we assess to what extent the final ranks would be affected by changes in the weights assigned to each pillar. We also assess the impact of using a partially compensatory formula (geometric aggregation formula) to calculate the overall scores, as an alternative to a fully compensatory formula such as the arithmetic average, being the latter an exact reproduction of the sum of items as introduced in Section 2.4. Note that the use of simple arithmetic averages allows countries with a comparative advantage in some pillars to compensate for comparative disadvantages in others. Conversely, geometric averages tend to reward more balanced profiles, and the formula used to calculate the average makes it more difficult to compensate low scores in one pillar with higher scores in another [4]. Table 9 shows the different sources of uncertainty taken into account for the analysis. The 2,000 simulated scenarios used in the analysis result from the combination of two alternative aggregation formulas and 1,000 sets of randomly generated weights [5]. This type of assessment aims to respond to any criticism that the country scores associated with aggregate measures are generally not calculated under conditions of certainty, even though they are frequently presented as such [6].

The main results of the uncertainty analysis are shown in Figure 16 with median ranks and 90% confidence intervals computed across the simulated scenarios.[4] All the ICT Regulatory Tracker ranks lie

Table 9. Sources of uncertainty – Uncertainty analysis

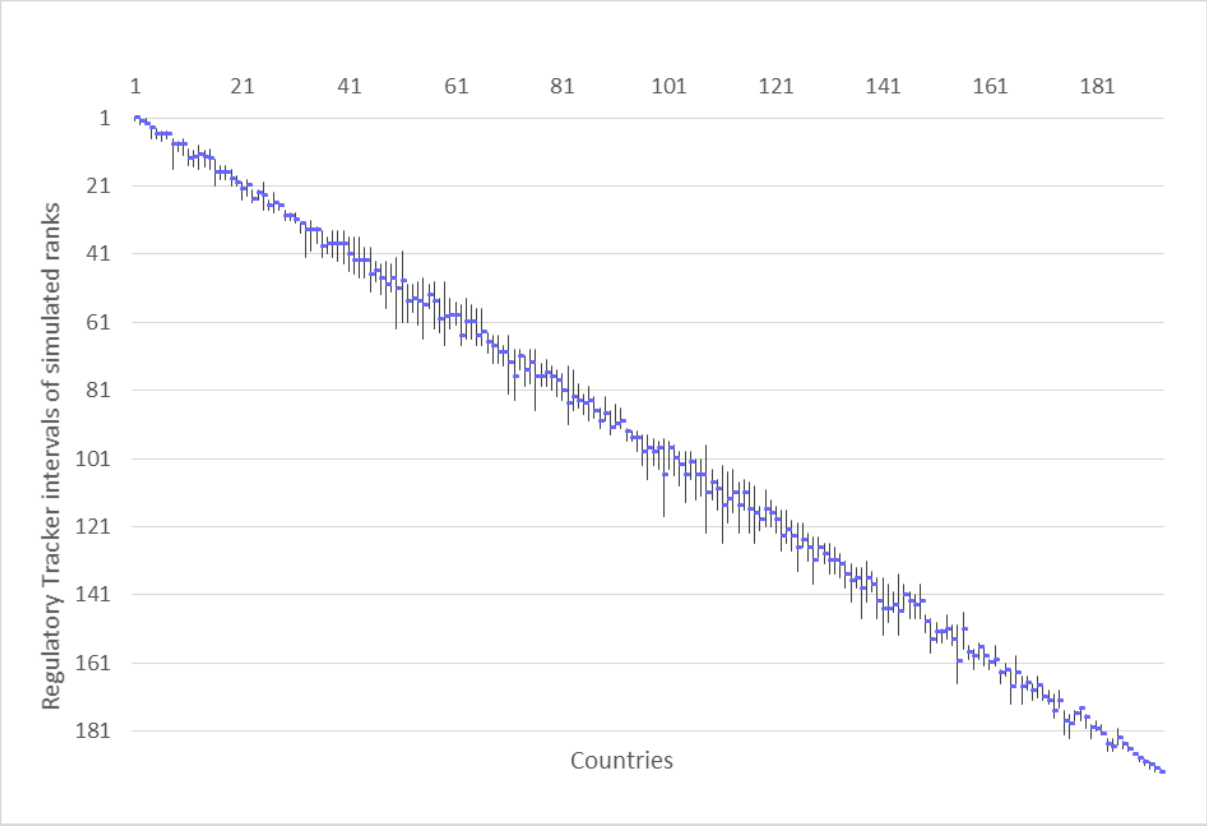
Assumptions	Reference	Alternative assumptions
I. Aggregation formula	Arithmetic Mean	Geometric Mean
II. Weights of the pillars	Reference values (based on number of indicators per pillar)	Range of variation (+/- 20% from reference values)
	Pillar 1: 0.20	U[0.160,0.240]
	Pillar 2: 0.22	U[0.176,0.264]
	Pillar 3: 0.30	U[0.240,0.360]
	Pillar 4: 0.28	U[0.224,0.336]

Source: European Commission, Joint Research Centre, 2019

within the simulated 90% confidence intervals. With very few exceptions, the width of the confidence intervals is narrow enough. Only 23.8% of the countries present confidence interval widths over 10 (7.2% over 15). Moreover, the original rank is less than 5 positions away from the simulated median for 97.4% of the countries. This analysis confirms the robustness of the Tracker, which is not influenced by the assumptions on importance of the pillars and by the aggregation procedure.

Complementary to the results from the uncertainty analysis, Figure 17 shows the impact of one-at-a-time changes in weights and in aggregation formulas. On the left-hand side of the figure, the default ranks are plotted against the ranks obtained assuming and equal weighting scheme across the four pillars. On the right-hand side, we plot the ranks result from the arithmetic aggregation of pillar scores (i.e. the default aggregation option) against the ranks resulting from applying a geometric aggregation formula.

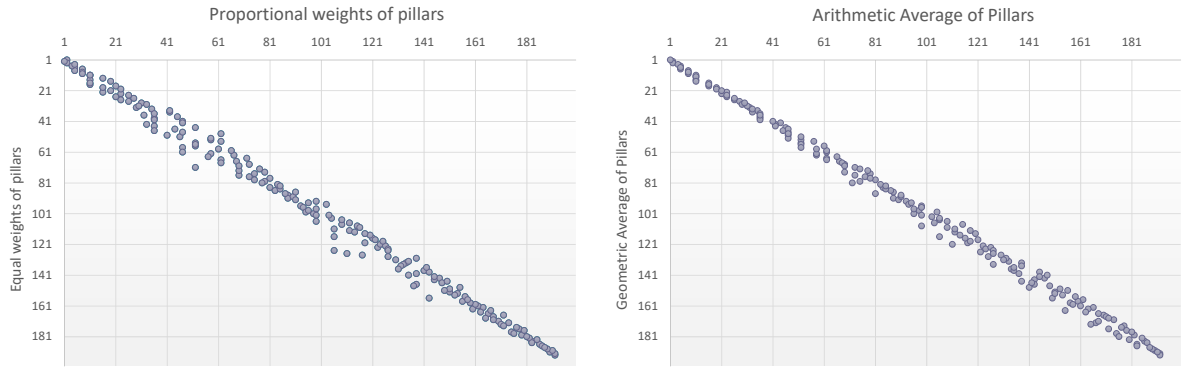
Figure 16. Results of the uncertainty analysis of the ICT Regulatory Tracker (nominal ranks in 2018 vs median rank, 90% confidence intervals)



Note: Countries are arranged along the horizontal axis in descending order of nominal rank; the dots represent the simulated median ranks; the vertical bars represent the simulated 90% confidence intervals.

Source: European Commission, Joint Research Centre, 2019

Figure 17. Sensitivity analysis on: a) levels of aggregation and b) level and formula of aggregation



Source: European Commission, Joint Research Centre, 2019

We have calculated the values of the Spearman correlation coefficients for each pair of ranks in each plot. The results suggest that the impact on the ranks of either using a geometric aggregation formula or assigning equal weights to all the pillars would be of a similar magnitude, with only a marginal difference between the Spearman correlation coefficients calculated for both options (0.996 for default versus equal weighting, and 0.998 for default versus geometric average).

Major shifts in the ICT Regulatory Tracker scores over the period 2007-2018

A number of countries monitored by the ICT Regulatory Tracker have experienced major shifts in their scores over the period 2007-2018. Those shifts provide rich analytical evidence and require special attention by the developers of the Tracker. In particular, strong and rapid improvements in the scores should be backed in every single case by significant evidence of major changes having taken place in the regulatory environment of those countries. If that was not the case, the evolution in the scores might be attributed to arbitrariness or subjectivity from those responsible for filling out the questionnaires that serve as the basis for the qualitative indicators on which the Tracker is based. In this section, we signal which countries have experienced rapid and significant improvements in their scores, and invite the developers to perform additional checks on those countries as an opportunity to learn lessons that could be shared with other countries and to gain deeper insights in the fundamentals of such an outstanding performance.

The ICT Regulatory Tracker is available from 2007 to 2018. There are 193 countries ranked in 2018 (190 in 2007). For nearly all of those 193 countries there is a score available for each of the 12 time points. The countries are divided into six regions based on the geographical groupings used by ITU. Table 10 gives information on the number of countries belonging to each region (for the last considered year). The Commonwealth of Independent States (CIS) is the region with the lowest number of countries (9 countries[5]) while the European region has the highest number of countries (45 countries).

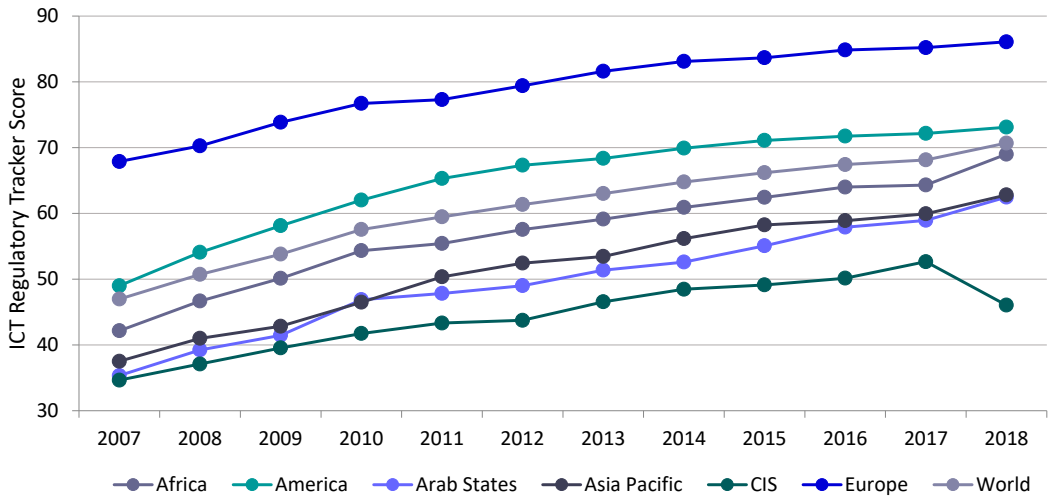
Table 10. Number of countries belonging to each region.

Nr	Region	Number of countries (2018)
1	Africa	44
2	America	35
3	Arab States	22
4	Asia-Pacific	38
5	CIS	9
6	Europe	45

Source: European Commission, Joint Research Centre, 2019

Figure 18 illustrates the progress in average scores by region during the period from 2007 to 2018. The trend is positive for all regions and there is a positive increase in average scores for all years apart from the last year for the CIS region, the decrease being due to the change of the number of countries in the region in 2018. The European averages remain the highest for all years, followed by the American region values. These two regions are the only ones with higher average scores than the World average. The CIS region averages

Figure 18. Progress in average scores, by region, 2007-2018



Note: CIS region counts 12 countries until 2017 and 9 countries in 2018.

Source: European Commission, Joint Research Centre, 2019

are the lowest for all years. The low values of Turkmenistan, Tajikistan and Uzbekistan are dragging down the average scores inside this region. The world average score has increased by 51%, from 47.0 in 2007 to 70.7 in 2018. The sharpest increase (77%) has been experienced by the Arab States region, with the scores shifting from 35.3 to 62.5.

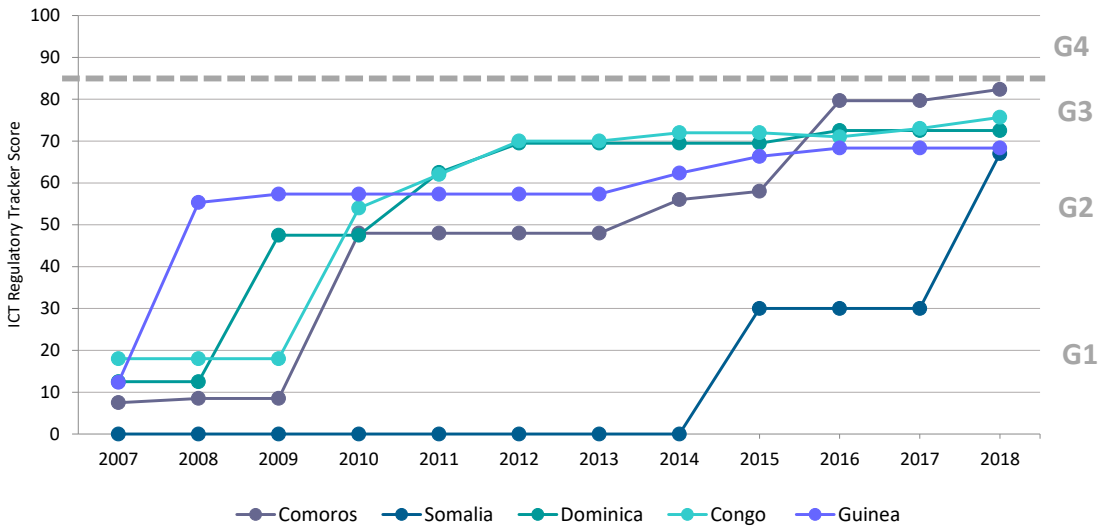
11 lists the ten countries with the largest increase in scores from 2007 to 2018. All the regions except for CIS are represented in that list. The island Comoros has the biggest increase in score values from (merely) 7.5 in 2007 (G1) to 82.3 in 2018 (G3 almost G4). Somalia has also made considerable effort, rising from 0.0 in 2014 to 67.0 in 2018. The increase in the scores of both countries is largely due to the establishment of national regulatory authorities (in 2010 in Comoros and in 2018 in Somalia) and the broad regulatory reforms they have engaged in since. Four of the ten countries in Table 11 are small-sized countries, with around or less than one million inhabitants[6]. Finally, Figure 19 shows in detail the time line of the five countries that experienced the largest increase in scores.

Table 11. Top 10 countries by increase in scores, 2007-2018

Order	Country	Region	Score 2007	Score 2018	Score increase 2007-2018
1	Comoros	Arab States	7.5	82.3	74.8
2	Somalia	Arab States	0.0	67.0	67.0
3	Dominica	America	12.5	72.5	60.0
4	Congo (Rep. of the)	Africa	18.0	75.7	57.7
5	Guinea	Africa	12.3	68.3	56.0
6	Myanmar	Asia-Pacific	8.8	63.7	54.8
7	Eswatini	Africa	5.5	59.3	53.8
8	Vanuatu	Asia-Pacific	17.3	71.2	53.8
9	Honduras	America	28.7	82.0	53.3
10	Italy	Europe	44.7	97.3	52.7

Source: European Commission, Joint Research Centre, 2019

Figure 19. Time line of the top five by increase in scores, 2007-2018



Source: European Commission, Joint Research Centre, 2019

Analysis of the distribution of regional ICT Regulatory Tracker scores in 2018

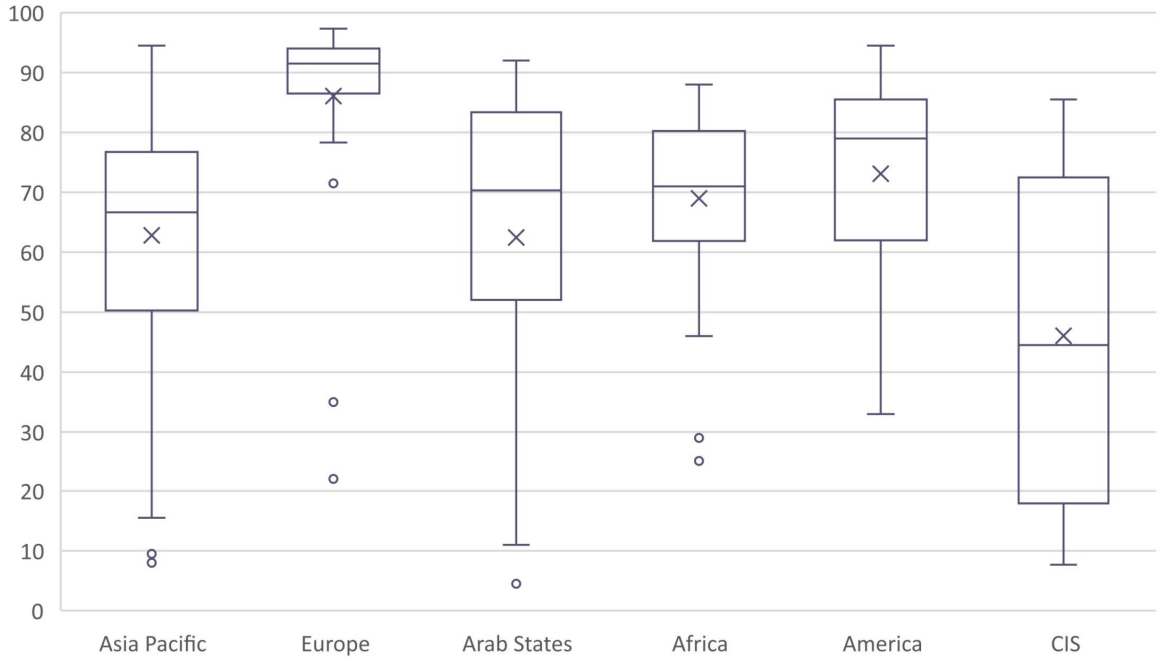
In this section we study the distribution of the regional scores for the latest available year (2018). As Table 12 and Figure 20 show, the scores in the European region are clearly above the other regions. 18 of the 20 countries with the highest scores are in fact coming from this region. Italy, Ireland and Hungary have the highest scores (97 or above). Small-sized countries with largely monopolistic markets like Andorra, San Marino and Monaco[7] lie at the other end of the spectrum and deviate from the rest of European region, with scores of 35 or below.[8]

Table 12. Summary statistics of regional ICT Regulatory Tracker scores in 2018

Region	Average Score	Median Score	Std Score	Nr of countries
Africa	69.0	71.0	14.1	44
America	73.1	79.0	16.4	35
Arab States	62.5	70.3	27.4	22
Asia-Pacific	62.8	66.7	21.2	38
CIS	46.1	44.5	27.7	9
Europe	86.1	91.5	17.0	45

Source: European Commission, Joint Research Centre, 2019

Figure 20. Box-plot of regional ICT Regulatory Tracker scores in 2018



Source: European Commission, Joint Research Centre, 2019

Note: A box-plot is a method for graphically displaying data. It includes a box indicating the central 50 percent of the data, i.e. the top and bottom of the box are the 25th and 75th percentiles. The horizontal band inside the box represents the median, and the size of the box is called the Interquartile Range (IQR). The lines extending vertically from the boxes (whiskers) indicate variability outside the upper and lower quartiles. The dots beyond the vertical lines represent potential outliers in the data.

The scores within the Africa and the Americas regions are similarly distributed (from 25 to 88 for Africa and from 33 to 95 for America). The scores for the Arab States and the Asia-Pacific countries are also comparable. There are three deviating countries in each of these two regions[9]. The nine CIS countries are divided into three distinct groups with similar scores[10].

For five regions (Africa, Americas, Arab States, Asia-Pacific and Europe) the median scores are (somewhat) greater than the average scores, so the distributions are slightly skewed to the left. The non-parametric[11] Kruskal Wallis rank sum test confirms that the six regions are significantly different. The pairwise comparisons using Wilcoxon rank sum test[12], show that Europe is significantly different from the other five regions [3], [8].

Conclusions

Simplicity and clarity stand out as two of the main strengths of the ICT Regulatory Tracker monitoring framework. In addition, the present statistical assessment also underscores the fact that the conceptual structure of the index is supported by the results of the analysis. The grouping of indicators into pillars is statistically coherent, and the overall index appears to be a good and balanced summary measure of its four underlying pillars. Moreover, the robustness of the index with respect to changes in the modelling assumptions is supported also by the results of the uncertainty and sensitivity analysis.

Throughout this document, we have pointed out to the developers some elements that merit further reflection. This is the case of the additive scoring approach used to arrive at the final index scores. The additive scoring approach could be easily substituted by an equivalent arithmetic aggregation formula, prior normalisation of the pillar scores. Normalisation would have the benefit of rendering the pillar scores directly comparable and easier to read and analyse. And as explained in the section dedicated to the uncertainty analysis, arithmetic averages are not the only options that could be considered for aggregating pillar scores. Applying a geometric average formula to aggregate the four pillars could be a possible alternative. As a matter of fact, the developers' preference has been to not penalise countries with uneven performance across pillars and reward those with similar high scores in all pillars. This choice of methodology reflects the overall vision where countries build their ICT regulatory reform path around their local and national priorities, and where varying policy instrument configurations lead to the same goals. All in all, the analyses conducted herein by the Joint Research Centre suggest that the ICT Regulatory Tracker framework is a conceptually sound, statistically coherent and robust monitoring tool.

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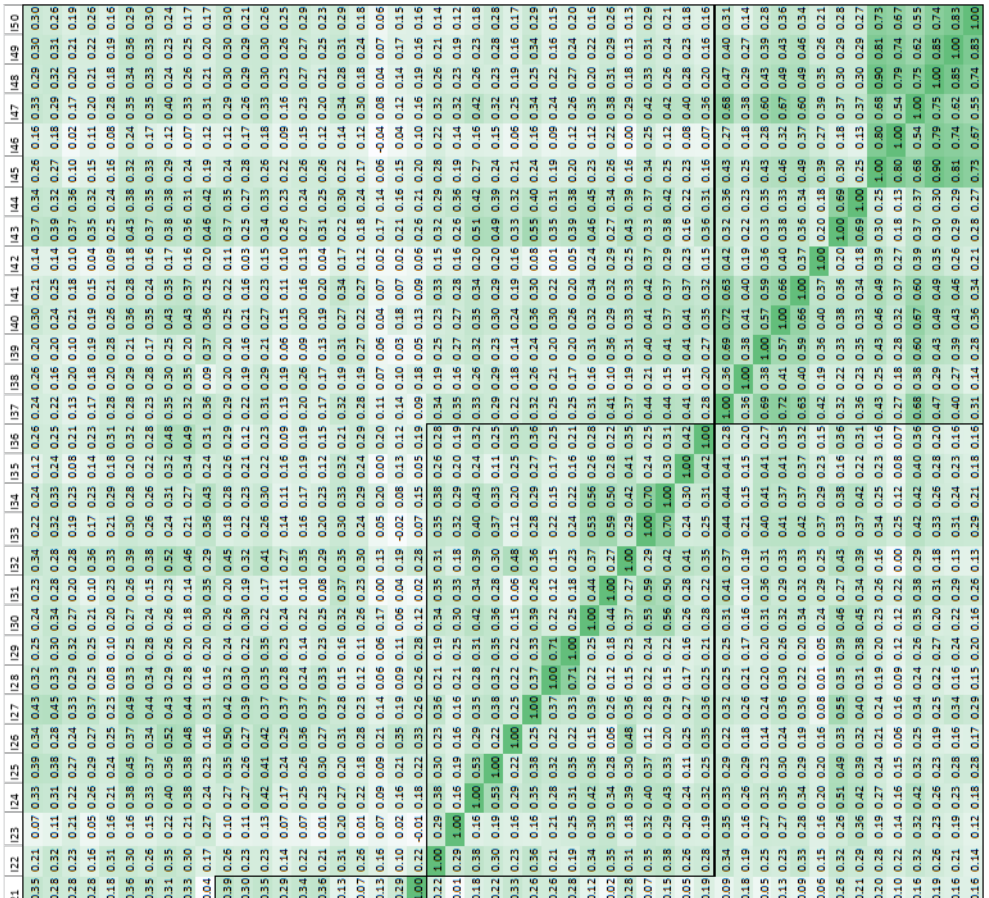
Annexes to Chapter 4

Annex I. Correlations between indicators



Note: Kendall's Tau is used to measure the correlation between the indicators
Source: European Commission, Joint Research Centre, 2019

Annex II. Nominal ranks with 90% confidence intervals

Table 1 out of 2. Countries with nominal ranks from 1 to 96

Countries	Rank	Interval	Countries	Rank	Interval	Countries	Rank	Interval
Italy	1	[1,2]	Czech Republic	33.5	[31.95,42]	Tanzania	63.5	[57,68]
Hungary	2.5	[1,3]	Sweden	33.5	[31,40]	Jordan	66	[57,68]
Ireland	2.5	[1,3]	Bahamas	35	[33,38]	Burkina Faso	67	[64,70]
Norway	4	[4,7]	Brazil	38	[34,42]	Hong Kong, China	68	[65,73]
Lithuania	6	[4,7]	Moldova	38	[36,41]	Albania	70	[65,73]
Malta	6	[5,8]	Morocco	38	[34,42]	Luxembourg	70	[68,74]
United Kingdom	6	[5,7]	Poland	38	[34,43]	United Arab Emirates	70	[65,82]
Australia	9	[7,16]	United States	38	[34,44]	Venezuela	72	[69,84]
Dominican Rep.	9	[8,11]	Slovakia	41	[36,46]	Comoros	73.5	[69,75]
Turkey	9	[7,12]	Ghana	42.5	[36,47]	Rwanda	73.5	[71,80]
Belgium	13	[10,15]	Pakistan	42.5	[36,48]	Honduras	75.5	[69,79]
Croatia	13	[10.5,15.5]	Denmark	44	[39,48]	Iran	75.5	[69,87]
France	13	[9,16]	Kenya	45	[39,52]	Korea (Rep. of)	77	[73,80]
Montenegro	13	[10.5,15.5]	Bahrain	46	[43,49]	Ukraine	78	[72,80]
Portugal	13	[10,16]	Estonia	49	[44,53]	Cabo Verde	79.5	[74,81.05]
Germany	17	[13,21]	Malawi	49	[43,57]	Thailand	79.5	[75,83]
Slovenia	17	[15,19]	Malaysia	49	[44,52]	Egypt	81.5	[76,84]
Switzerland	17	[15,19]	Peru	49	[42,63]	Mauritius	81.5	[74,91]
Bosnia and Herzegovina	19.5	[16,21]	FYR Macedonia	49	[40,61]	New Zealand	83	[75,87]
Netherlands	19.5	[18,21]	Argentina	54	[50,61]	Mali	84	[79,86]
Georgia	21.5	[20,25]	Iceland	54	[50,58]	S. Vincent and the Grenadines	85.5	[82,88]
Serbia	21.5	[19,24]	Panama	54	[49,62]	Senegal	85.5	[80,90]
Finland	24	[22,26]	Spain	54	[48,66]	Dem. Rep. of the Congo	87	[83,89]
Romania	24	[22,25]	Uganda	54	[50,57]	Chile	88.5	[86,92]
Saudi Arabia	24	[20,28]	Cyprus	57	[49,63]	Colombia	88.5	[83,90]
Bulgaria	26.5	[25,28]	Armenia	59	[54,64]	Jamaica	90	[87,94]
Singapore	26.5	[23,29]	Canada	59	[49,68]	Liechtenstein	91.5	[85,92]
Greece	28	[26,28]	Ecuador	59	[54,63]	Nigeria	91.5	[86,92]
Latvia	29	[28,31]	Trinidad and Tobago	61	[55,62]	Congo (Rep. of the)	93	[92,96]
Oman	30	[29,31]	Botswana	63.5	[56,68]	India	94	[93,96]
Mexico	31	[29,32]	Costa Rica	63.5	[54,66]	Sao Tome and Principe	95	[93,99]
Austria	32	[32,35]	Saint Lucia	63.5	[56,66]	Bangladesh	96	[94,103]

Source: European Commission, Joint Research Centre, 2019

Table 2 out of 2. Countries with nominal ranks from 97 to 193

Countries	Rank	Interval	Countries	Rank	Interval	Countries	Rank	Interval
Tunisia	97	[93.95,107]	Samoa	130	[126,132]	Guatemala	162	[156,162]
Kyrgyzstan	98	[95,103]	Viet Nam	131	[126,135]	Nauru	163	[163,167]
Grenada	100.5	[96,104]	Cambodia	132	[127,135]	Equatorial Guinea	164	[161,165]
Nicaragua	100.5	[95,118]	Benin	133	[129,136]	Tonga	165	[163,173]
Niger	100.5	[96,104]	Angola	134	[131,139]	China	166	[159,167]
Zimbabwe	100.5	[97,106]	Burundi	135.5	[132,143]	Kiribati	167	[165,173]
Gambia	103	[99,109]	Cameroon	135.5	[133,139]	Guinea-Bissau	168.5	[165,169]
El Salvador	104	[99,114]	Myanmar	137	[133,148]	Saint Kitts and Nevis	168.5	[167,172]
Afghanistan	105	[99,107]	Fiji	139	[131,143]	Belarus	170	[165,171]
Dominica	107	[101,113]	Gabon	139	[134,140]	Palestine	171	[168,172]
Indonesia	107	[101,112]	Kuwait	139	[136,148]	Russian Federation	172.5	[169,173]
Japan	107	[97,123]	Belize	141	[136,153]	Timor-Leste	172.5	[170,177]
Sudan	109.5	[104,113]	Sri Lanka	142	[138,149]	Antigua and Barbuda	174	[169,174]
Zambia	109.5	[107,116]	Guyana	143.5	[140,146]	Lao P.D.R.	175	[175,182]
Israel	111	[103,126]	Seychelles	143.5	[135,153]	Monaco	176	[176,183]
Liberia	112.5	[105,120]	Côte d'Ivoire	145.5	[138,146]	Solomon Islands	177	[175,178]
South Africa	112.5	[104,117]	Paraguay	145.5	[140,148]	Bolivia	178	[174,178]
Vanuatu	114	[108,123]	Algeria	147	[141,148]	Cuba	179	[176,180]
Mauritania	115	[107,116]	Brunei Darussalam	148	[138,148]	Lebanon	180	[179,183]
Namibia	116	[108,123]	Suriname	149	[147,152]	Ethiopia	181	[178,181]
Azerbaijan	117	[109,126]	Eswatini	150	[148,158]	Eritrea	182	[179,182]
Mongolia	118.5	[115,122]	Haiti	151.5	[149,155]	Andorra	183.5	[183,187]
Qatar	118.5	[110,121]	Papua New Guinea	151.5	[151,155]	San Marino	183.5	[183,187]
Madagascar	120	[113,121]	Chad	153	[147,154]	Uzbekistan	185	[180,185]
Bhutan	121	[115,123]	Central African Rep.	154	[150,156]	Marshall Islands	186	[184,186]
Togo	122	[116,128]	Iraq	155	[150,167]	Tajikistan	187	[185,187]
Barbados	123	[116,126]	Mozambique	156	[146,157]	Yemen	188	[188,188]
Guinea	124	[119,128]	Sierra Leone	157	[156,160]	Tuvalu	189	[189,190]
Nepal	125	[120,134]	Syrian Arab Republic	158	[157,163]	Micronesia	190	[189,191]
Lesotho	126	[120,127]	South Sudan	159	[155,160]	Turkmenistan	191	[190,192]
Philippines	128	[123,131]	Kazakhstan	160	[156,162]	Djibouti	192.5	[191,193]
Somalia	128	[124,138]	Maldives	161	[160,163]	Libya	192.5	[192,193]
Uruguay	128	[124,130]						

Source: European Commission, Joint Research Centre, 2019

Annex III. Values of the normalised pillars by country in 2018

	Sum of pillars (default)					Weighted mean of Pillars				
Country	P1	P2	P3	P4	Overall Score	P1	P2	P3	P4	Overall Score
Afghanistan	15	20	19	19.3	73.3	75	90.9	63.3	69	73.3
Albania	18	16	25	24	83	90	72.7	83.3	85.7	83
Algeria	18	16	16	11.5	61.5	90	72.7	53.3	41.1	61.5
Andorra	6	8	8	0	22	30	36.4	26.7	0	22
Angola	14	20	20	10.7	64.7	70	90.9	66.7	38.1	64.7
Antigua and Barbuda	8	11.5	8	13.3	40.8	40	52.3	26.7	47.6	40.8
Argentina	17	20	21	28	86	85	90.9	70	100	86
Armenia	19	19.5	20	27	85.5	95	88.6	66.7	96.4	85.5
Australia	19	21.5	26	28	94.5	95	97.7	86.7	100	94.5
Austria	18	16.5	28	27	89.5	90	75	93.3	96.4	89.5
Azerbaijan	8	13.5	24	25	70.5	40	61.4	80	89.3	70.5
Bahamas	19	18.5	26	25.3	88.8	95	84.1	86.7	90.5	88.8
Bahrain	17	18	26	26.3	87.3	85	81.8	86.7	94	87.3
Bangladesh	17	20	15	22.7	74.7	85	90.9	50	81	74.7
Barbados	17	12.5	18	21	68.5	85	56.8	60	75	68.5
Belarus	6	11.5	11	16	44.5	30	52.3	36.7	57.1	44.5
Belgium	18	19	30	27	94	90	86.4	100	96.4	94
Belize	17	18.5	20	7.3	62.8	85	84.1	66.7	26.2	62.8
Benin	16	16	21	12	65	80	72.7	70	42.9	65
Bhutan	15	20	16	18.3	69.3	75	90.9	53.3	65.5	69.3
Bolivia	9	9	8	8.5	34.5	45	40.9	26.7	30.4	34.5
Bosnia and Herzegovina	19	21	27	26	93	95	95.5	90	92.9	93
Botswana	18	22	19	26	85	90	100	63.3	92.9	85
Brazil	16	18.5	26	28	88.5	80	84.1	86.7	100	88.5
Brunei Darussalam	15	17	17	12.3	61.3	75	77.3	56.7	44	61.3
Bulgaria	19	16.5	28	28	91.5	95	75	93.3	100	91.5
Burkina Faso	19	19	20	26	84	95	86.4	66.7	92.9	84
Burundi	11	18	12	23	64	55	81.8	40	82.1	64
Cabo Verde	17	20	23	21.3	81.3	85	90.9	76.7	76.2	81.3
Cambodia	13	17	14	21.3	65.3	65	77.3	46.7	76.2	65.3
Cameroon	17	18	16	13	64	85	81.8	53.3	46.4	64
Canada	19	16.5	30	20	85.5	95	75	100	71.4	85.5
Central African Rep.	14	18	9	17	58	70	81.8	30	60.7	58
Chad	15	16	13	14.3	58.3	75	72.7	43.3	51.2	58.3
Chile	14	20	18	27	79	70	90.9	60	96.4	79
China	7	11	16	15	49	35	50	53.3	53.6	49
Colombia	15	15	22	27	79	75	68.2	73.3	96.4	79
Comoros	17	19	24	22.3	82.3	85	86.4	80	79.8	82.3
Congo (Rep. of the)	17	17	22	19.7	75.7	85	77.3	73.3	70.2	75.7
Costa Rica	19	16	26	24	85	95	72.7	86.7	85.7	85
Côte d'Ivoire	17	15.5	14	15.3	61.8	85	70.5	46.7	54.8	61.8
Croatia	19	19	28	28	94	95	86.4	93.3	100	94
Cuba	2	12	14	5	33	10	54.5	46.7	17.9	33
Cyprus	18	16	28	23.7	85.7	90	72.7	93.3	84.5	85.7
Czech Republic	17	17	30	25	89	85	77.3	100	89.3	89
Dem. Rep. of the Congo	14	20	20	25.3	79.3	70	90.9	66.7	90.5	79.3

(continued)

Country	Sum of pillars (default)					Weighted mean of Pillars				
	P1	P2	P3	P4	Overall Score	P1	P2	P3	P4	Overall Score
Denmark	18	18	28	23.7	87.7	90	81.8	93.3	84.5	87.7
Djibouti	0	2.5	2	0	4.5	0	11.4	6.7	0	4.5
Dominica	11	15.5	20	26	72.5	55	70.5	66.7	92.9	72.5
Dominican Rep.	19	19.5	28	28	94.5	95	88.6	93.3	100	94.5
Ecuador	20	18.5	21	26	85.5	100	84.1	70	92.9	85.5
Egypt	15	20.5	21	24.3	80.8	75	93.2	70	86.9	80.8
El Salvador	19	14.5	14	26	73.5	95	65.9	46.7	92.9	73.5
Equatorial Guinea	13	15	13	9.3	50.3	65	68.2	43.3	33.3	50.3
Eritrea	8	11	4	2	25	40	50	13.3	7.1	25
Estonia	14	20	26	27	87	70	90.9	86.7	96.4	87
Eswatini	19	19	14	7.3	59.3	95	86.4	46.7	26.2	59.3
Ethiopia	7	12	8	2	29	35	54.5	26.7	7.1	29
Fiji	13	14	19	17	63	65	63.6	63.3	60.7	63
Finland	18	17	30	27	92	90	77.3	100	96.4	92
France	18	20	30	26	94	90	90.9	100	92.9	94
Gabon	15	17	16	15	63	75	77.3	53.3	53.6	63
Gambia	20	19	16	18.7	73.7	100	86.4	53.3	66.7	73.7
Georgia	18	16.5	30	28	92.5	90	75	100	100	92.5
Germany	16	20.5	30	27	93.5	80	93.2	100	96.4	93.5
Ghana	18	21	22	27	88	90	95.5	73.3	96.4	88
Greece	20	17	28	26.3	91.3	100	77.3	93.3	94	91.3
Grenada	14	17	20	23	74	70	77.3	66.7	82.1	74
Guatemala	12	12.5	10	18.7	53.2	60	56.8	33.3	66.7	53.2
Guinea	16	18	22	12.3	68.3	80	81.8	73.3	44	68.3
Guinea-Bissau	10	10	8	18	46	50	45.5	26.7	64.3	46
Guyana	18	18	15	11	62	90	81.8	50	39.3	62
Haiti	14	19.5	10	15	58.5	70	88.6	33.3	53.6	58.5
Honduras	17	19	26	20	82	85	86.4	86.7	71.4	82
Hong Kong, China	18	18.5	20	27.3	83.8	90	84.1	66.7	97.6	83.8
Hungary	19	22	28	28	97	95	100	93.3	100	97
Iceland	18	18	22	28	86	90	81.8	73.3	100	86
India	18	14.5	20	23	75.5	90	65.9	66.7	82.1	75.5
Indonesia	16	13.5	18	25	72.5	80	61.4	60	89.3	72.5
Iran	19	19	28	16	82	95	86.4	93.3	57.1	82
Iraq	17	21.5	16	3.3	57.8	85	97.7	53.3	11.9	57.8
Ireland	20	19	30	28	97	100	86.4	100	100	97
Israel	8	11.5	28	24	71.5	40	52.3	93.3	85.7	71.5
Italy	18	22	30	27.3	97.3	90	100	100	97.6	97.3
Jamaica	19	12.5	19	28	78.5	95	56.8	63.3	100	78.5
Japan	8	11.5	26	27	72.5	40	52.3	86.7	96.4	72.5
Jordan	19	20	24	21.5	84.5	95	90.9	80	76.8	84.5
Kazakhstan	6	10	14	24	54	30	45.5	46.7	85.7	54
Kenya	18	21.5	21	27	87.5	90	97.7	70	96.4	87.5
Kiribati	13	18.5	4	12	47.5	65	84.1	13.3	42.9	47.5
Korea (Rep. of)	18	22	20	21.7	81.7	90	100	66.7	77.4	81.7
Kuwait	20	19	12	12	63	100	86.4	40	42.9	63
Kyrgyzstan	16	16.5	16	26	74.5	80	75	53.3	92.9	74.5

(continued)

Country	Sum of pillars (default)					Weighted mean of Pillars				
	P1	P2	P3	P4	Overall Score	P1	P2	P3	P4	Overall Score
Lao P.D.R.	0	12	17	7.7	36.7	0	54.5	56.7	27.4	36.7
Latvia	18	16.5	30	26	90.5	90	75	100	92.9	90.5
Lebanon	8	18	5	0.7	31.7	40	81.8	16.7	2.4	31.7
Lesotho	16	17.5	16	18.3	67.8	80	79.5	53.3	65.5	67.8
Liberia	17	20	22	12.3	71.3	85	90.9	73.3	44	71.3
Libya	2	2.5	0	0	4.5	10	11.4	0	0	4.5
Liechtenstein	14	14	24	26.3	78.3	70	63.6	80	94	78.3
Lithuania	19	21	28	27	95	95	95.5	93.3	96.4	95
Luxembourg	18	17	22	26	83	90	77.3	73.3	92.9	83
Madagascar	17	17.5	18	17	69.5	85	79.5	60	60.7	69.5
Malawi	18	22	20	27	87	90	100	66.7	96.4	87
Malaysia	18	22	24	23	87	90	100	80	82.1	87
Maldives	13	20	12	8.3	53.3	65	90.9	40	29.8	53.3
Mali	18	18	18	26.3	80.3	90	81.8	60	94	80.3
Malta	19	20	28	28	95	95	90.9	93.3	100	95
Marshall Islands	2	6.5	4	3	15.5	10	29.5	13.3	10.7	15.5
Mauritania	17	19	18	17	71	85	86.4	60	60.7	71
Mauritius	18	20.5	15	27.3	80.8	90	93.2	50	97.6	80.8
Mexico	19	17	26	28	90	95	77.3	86.7	100	90
Micronesia	0	4	4	0	8	0	18.2	13.3	0	8
Moldova	19	17.5	26	26	88.5	95	79.5	86.7	92.9	88.5
Monaco	0	15	8	12	35	0	68.2	26.7	42.9	35
Mongolia	18	19	18	14.7	69.7	90	86.4	60	52.4	69.7
Montenegro	19	19	28	28	94	95	86.4	93.3	100	94
Morocco	18	19.5	24	27	88.5	90	88.6	80	96.4	88.5
Mozambique	16	10.5	16	15.2	57.7	80	47.7	53.3	54.2	57.7
Myanmar	6	17	17	23.7	63.7	30	77.3	56.7	84.5	63.7
Namibia	19	17	22	12.7	70.7	95	77.3	73.3	45.2	70.7
Nauru	10	11.5	6	23	50.5	50	52.3	20	82.1	50.5
Nepal	18	17	11	22	68	90	77.3	36.7	78.6	68
Netherlands	19	18	28	28	93	95	81.8	93.3	100	93
New Zealand	17	13.5	22	28	80.5	85	61.4	73.3	100	80.5
Nicaragua	18	18	12	26	74	90	81.8	40	92.9	74
Niger	15	20	20	19	74	75	90.9	66.7	67.9	74
Nigeria	17	20	20	21.3	78.3	85	90.9	66.7	76.2	78.3
Norway	20	18.5	30	27	95.5	100	84.1	100	96.4	95.5
Oman	17	19	28	26.3	90.3	85	86.4	93.3	94	90.3
Pakistan	20	19	22	27	88	100	86.4	73.3	96.4	88
Palestine	4	11.5	13	13.7	42.2	20	52.3	43.3	48.8	42.2
Panama	19	21	20	26	86	95	95.5	66.7	92.9	86
Papua New Guinea	16	19.5	12	11	58.5	80	88.6	40	39.3	58.5
Paraguay	18	15.5	12	16.3	61.8	90	70.5	40	58.3	61.8
Peru	18	13	28	28	87	90	59.1	93.3	100	87
Philippines	16	12	17	22	67	80	54.5	56.7	78.6	67
Poland	16	17.5	28	27	88.5	80	79.5	93.3	96.4	88.5
Portugal	19	18	30	27	94	95	81.8	100	96.4	94
Qatar	14	18	21	16.7	69.7	70	81.8	70	59.5	69.7

(continued)

Country	Sum of pillars (default)					Weighted mean of Pillars				
	P1	P2	P3	P4	Overall Score	P1	P2	P3	P4	Overall Score
Romania	18	19	28	27	92	90	86.4	93.3	96.4	92
Russian Federation	4	11	13	14	42	20	50	43.3	50	42
Rwanda	20	20	18	24.3	82.3	100	90.9	60	86.9	82.3
Saint Kitts and Nevis	5	15	6	20	46	25	68.2	20	71.4	46
Saint Lucia	16	18	24	27	85	80	81.8	80	96.4	85
Saint Vincent and the Grenadines	17	18	18	27	80	85	81.8	60	96.4	80
Samoa	14	17	22	13.3	66.3	70	77.3	73.3	47.6	66.3
San Marino	0	4	2	16	22	0	18.2	6.7	57.1	22
Sao Tome and Principe	16	17	21	21	75	80	77.3	70	75	75
Saudi Arabia	19	22	29	22	92	95	100	96.7	78.6	92
Senegal	19	19	24	18	80	95	86.4	80	64.3	80
Serbia	20	19.5	26	27	92.5	100	88.6	86.7	96.4	92.5
Seychelles	6	12	16	28	62	30	54.5	53.3	100	62
Sierra Leone	16	19	14	7	56	80	86.4	46.7	25	56
Singapore	17	21.5	26	27	91.5	85	97.7	86.7	96.4	91.5
Slovakia	15	18.5	28	26.7	88.2	75	84.1	93.3	95.2	88.2
Slovenia	20	18.5	28	27	93.5	100	84.1	93.3	96.4	93.5
Solomon Islands	9	14	8	3.7	34.7	45	63.6	26.7	13.1	34.7
Somalia	14	19	10	24	67	70	86.4	33.3	85.7	67
South Africa	17	17	24	13.3	71.3	85	77.3	80	47.6	71.3
South Sudan	12	17	12	13.7	54.7	60	77.3	40	48.8	54.7
Spain	16	14	28	28	86	80	63.6	93.3	100	86
Sri Lanka	18	20	15	9.3	62.3	90	90.9	50	33.3	62.3
Sudan	15	20	18	18.7	71.7	75	90.9	60	66.7	71.7
Suriname	15	17	18	9.7	59.7	75	77.3	60	34.5	59.7
Sweden	19	20	24	26	89	95	90.9	80	92.9	89
Switzerland	18	18.5	30	27	93.5	90	84.1	100	96.4	93.5
Syrian Arab Republic	19	15	15	6.3	55.3	95	68.2	50	22.6	55.3
Tajikistan	2	6	2	4	14	10	27.3	6.7	14.3	14
Tanzania	20	21	19	25	85	100	95.5	63.3	89.3	85
Thailand	20	19.5	22	19.8	81.3	100	88.6	73.3	70.8	81.3
FYR Macedonia	18	20	30	19	87	90	90.9	100	67.9	87
Timor-Leste	13	21	3	5	42	65	95.5	10	17.9	42
Togo	15	22	20	12	69	75	100	66.7	42.9	69
Tonga	1	11	15	22.7	49.7	5	50	50	81	49.7
Trinidad and Tobago	18	19	22	26.3	85.3	90	86.4	73.3	94	85.3
Tunisia	19	16	25	14.7	74.7	95	72.7	83.3	52.4	74.7
Turkey	19	19.5	30	26	94.5	95	88.6	100	92.9	94.5
Turkmenistan	0	6	0	1.7	7.7	0	27.3	0	6	7.7
Tuvalu	0	4.5	0	5	9.5	0	20.5	0	17.9	9.5
Uganda	17	20	22	27	86	85	90.9	73.3	96.4	86
Ukraine	17	17.5	23	24	81.5	85	79.5	76.7	85.7	81.5
United Arab Emirates	19	21	27	16	83	95	95.5	90	57.1	83
United Kingdom	20	20	28	27	95	100	90.9	93.3	96.4	95
United States	19	17.5	28	24	88.5	95	79.5	93.3	85.7	88.5
Uruguay	17	17	20	13	67	85	77.3	66.7	46.4	67

(continued)

Country	Sum of pillars (default)					Weighted mean of Pillars				
	P1	P2	P3	P4	Overall Score	P1	P2	P3	P4	Overall Score
Uzbekistan	7	6.5	2	6.3	21.8	35	29.5	6.7	22.6	21.8
Vanuatu	17	14.5	14	25.7	71.2	85	65.9	46.7	91.7	71.2
Venezuela	20	21.5	16	25	82.5	100	97.7	53.3	89.3	82.5
Viet Nam	10	19	24	13	66	50	86.4	80	46.4	66
Yemen	0	3	4	4	11	0	13.6	13.3	14.3	11
Zambia	19	18	15	19.7	71.7	95	81.8	50	70.2	71.7
Zimbabwe	20	19	18	17	74	100	86.4	60	60.7	74

Source: European Commission, Joint Research Centre, 2019

Endnotes

1 ITU World Telecommunication Regulatory Survey and ITU Tariff Policies Survey.

2 Annex III presents a table with the default pillar scores and the normalised pillar scores for each country.

3 Annex I presents the full correlation matrix between individual indicators.

4 The complete table of results for the uncertainty analysis is presented in Annex II.

5 Three countries (Georgia, Moldova and Ukraine) moved from CIS to Europe region in 2018, according to ITU's internal regional classification.

6 The countries are Comoros, Dominica, Eswatini and Vanuatu. All are islands apart from Eswatini. The country with the smallest population, Dominica, officially the Commonwealth of Dominica, is an island country in the West Indies and had an estimated population of 71,625 (reference https://data.worldbank.org/country/dominica 2018 data).

7 The three countries are among the least populated in Europe with populations of less than 80 000 inhabitants, https://data.worldbank.org/country/.

8 Coincidentally, these three small-sized European countries are currently negotiating and Association Agreement with the EU (http://www.europarl.europa.eu/doceo/document/TA-8-2019-0188_EN.html).

9 Yemen, Djibouti and Libya in the Arab States and Marshall Islands, Tuvalu and Micronesia in Asia.

10 High CIS scores for Armenia, Kyrgyzstan and Azerbaijan, middle CIS scores for Kazakhstan, Belarus and Russian Federation and low CIS scores for Uzbekistan, Tajikistan and Turkmenistan.

11 Since the ANOVA assumptions of normality and homogeneity of variances are not met for the six regions, a non-parametric alternative may be used. The Kruskal-Wallis chi-squared test statistic with 5 df is large (66.5) and the p-value is very small (<0.01), so the null hypothesis is there for rejected.

12 We correct for multiple testing using the adjustment method of Benjamini & Yekutieli (2001)[2].

Appendix 1: Note on methodology, ICT Regulatory Tracker

What is the ICT Regulatory Tracker?
The ICT Regulatory Tracker is an evidence-based tool to help decision-makers and regulators make sense of the rapid evolution of ICT regulation. The Tracker enables various analytical features to pinpoint the changes taking place in the ICT regulatory environment. Using both quantitative and qualitative data, the Tracker makes possible benchmarking and the identification of trends in ICT legal and regulatory frameworks. It likewise helps identify the gaps in existing regulatory frameworks, making the case for further regulatory reform towards achieving a vibrant and inclusive ICT sector.

Scope
The ICT Regulatory Tracker is composed of a total of 50 indicators (11 composite, see full list in Table 7) grouped into four pillars (see also Table 13):

1) the regulatory authority (focusing on the functioning of the separate regulator),
2) regulatory mandates (who regulates what),
3) the regulatory regime (what regulation exists in major areas) and
4) the competition framework in the ICT sector (level of competition in the main market segments).

The Tracker is available for the period 2007-2019. It covers:

- 2007-2010: data for 190 countries and economies
- 2011-2013: 191 countries and economies
- 2014-2017 : 192 countries and economies
- 2018-19 : 193 countries and economies

The full list of countries is available in Appendix 3.

Data mechanics: coding & scores
After coding the originally qualitative information, all indicators are given a score between 0 and 2. The benchmark for the scoring is what is considered the best possible scenario based on the internationally recognized regulatory best practices that were adopted by the global community of regulators at the annual ITU Global Symposiums for Regulators.

Source of data
The Tracker is based on self-reported information gathered yearly via the ITU World Telecommunication Regulatory Survey and the ITU Tariff Policies Survey as well as desktop research and direct outreach to national telecom/ICT regulatory authorities. For years when questions were left blank or when the survey was not answered by a country, the latest available data for the indicator is retrieved or, whenever possible, data gaps are filled through desktop research based on official sources.

Indicators
The full set of indicators is shown in Table 14.

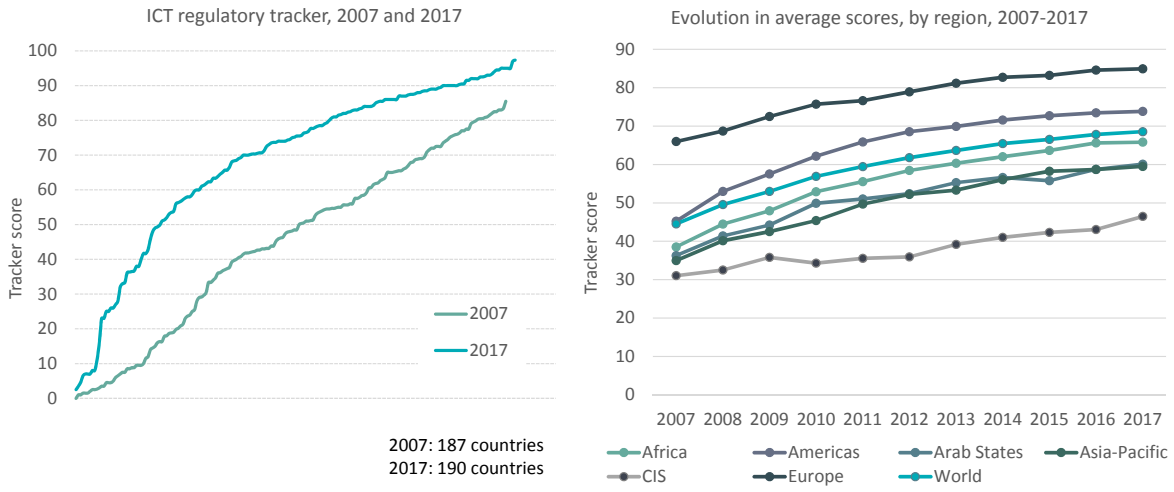
Detailed methodology
The matrix with the detailed methodology of the ICT Regulatory Tracker is available in Appendix 1 and can be downloaded online at itu.int/go/tracker, (About the Tracker). It provides detailed information on the choice, composition and scoring of each indicator.

Table 13: ICT Regulatory Tracker structure and scoring, 2007-2019

Pillar	Name	Number of indicators	Max score	Countries ranked if min indicators
1	Regulatory authority	10	20	3
2	Regulatory mandates	11	22	3
3	Regulatory regime	15	30	4
4	Competition framework	14	28	4
	ICT Regulatory Tracker	50	100	14

Source: ITU

Figure 21: Evolution dynamics of the ICT Regulatory Tracker, 2007 – 2019



Source: ITU

Table 14: ICT Regulatory Tracker indicators, per pillar

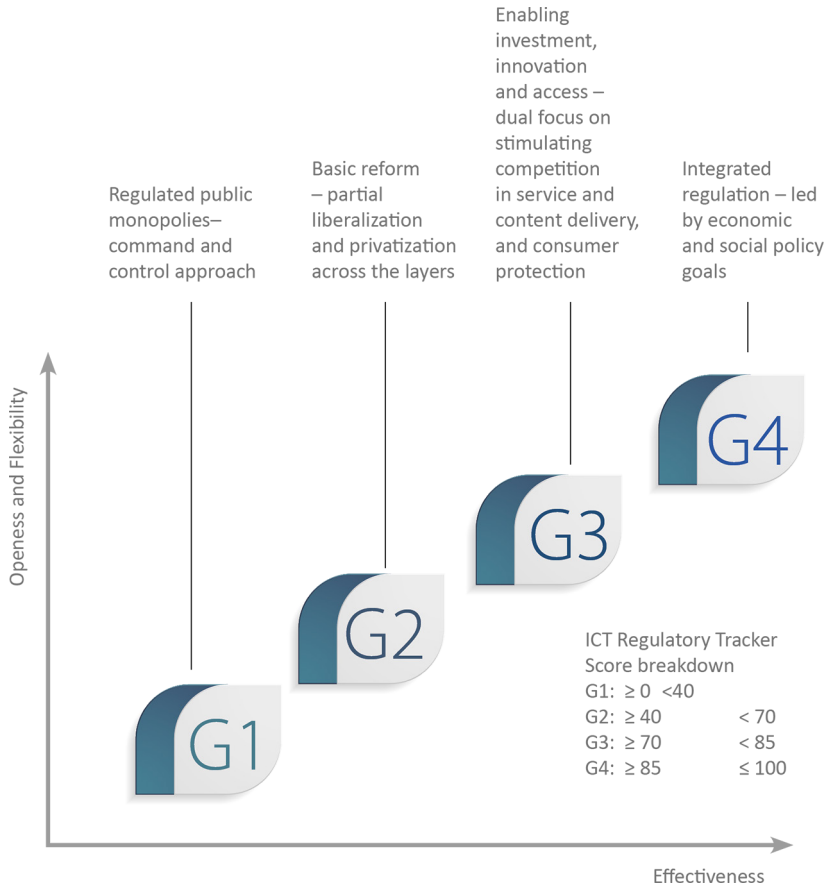
ICT REGULATORY TRACKER	
Pillar 1: Regulatory Authority	1. Separate telecom/ICT regulator
	2. Autonomy in decision-making
	3. Accountability
	4. Percentage of diversified funding
	5. Public consultations mandatory before decisions
	6. Enforcement power
	7. Sanctions or penalties imposed by regulator
	8. Dispute resolution mechanism
	9. Appeals to decisions
	10. Existence of Competition Authority
	Max score: 20
Pillar 2: Regulatory Mandate	*Who is in charge of regulating the following?*
	11. Quality of Service obligations measures and service quality monitoring
	12. Licensing
	13. Interconnection rates and price regulation
	14. Radio frequency allocation and assignment
	15. Spectrum monitoring and enforcement
	16. Universal service/access
	17. Broadcasting (radio and TV transmission)
	18. Broadcasting content
	19. Internet content
	20. IT
	21. Consumer issues
	Max score: 22

Table 7: ICT Regulatory Tracker indicators, per pillar (continued)

ICT REGULATORY TRACKER	
Pillar 3: Regulatory Regime	22. Types of licenses
	23. License exempt
	24. Operators required to publish Reference Interconnection Offer
	25. Interconnection prices made public
	26. Quality of Service monitoring required
	27. Infrastructure sharing for mobile operators permitted
	28. Infrastructure sharing mandated
	29. Co-location/site sharing mandated
	30. Unbundled access to the local loop required
	31. Secondary spectrum trading allowed
	32. Band migration allowed
	33. Number portability required from fixed-line operators
	34. Number portability required from mobile operators
	35. Individual users allowed to use VoIP
	36. National plan that involves broadband
	Max score: 30
Pillar 4: Competition Framework	*Competition exists in the following market segments:* 37. Local and long distance (domestic and international) fixed line services
	38. IMT (3G, 4G, etc.) services
	39. Cable modem, DSL, fixed wireless broadband
	40. Leased lines
	41. International Gateways
	42. Status of the main fixed line operator (public, partially or fully private)
	43. Legal concept of dominance or SMP
	44. Criteria used in determining dominance or SMP
	Foreign participation/ownership in:
	45. Facilities-based operators
	46. Spectrum-based operators
	47. Local service operators/long-distance service operators
	48. International service operators
	49. Internet Service Providers (ISPs)
	50. Value-added service providers
	Max score: 28

Source: ITU

Figure 22: Generations of regulation in the ICT Regulatory Tracker



Source: ITU

Generations of regulation

To help analyse the evolution of ICT regulation worldwide, identify progress areas as well as gaps and measure those, the countries included in the Tracker are split into score thresholds that relate to generations of regulation, for any given year.

Using the concept of generations of regulation (see Figure 22), the Tracker can be used to showcase progress within the same country over time, compare between countries and regions or track the ICT regulatory trends in specific areas at the national, regional and global level.

Feedback & contact

If you are an ITU Member State Administration and you wish to provide recent or historic data for your country's ICT regulation, please write to us at treg[at]itu.int.

If you would like to know more about the Tracker or have queries or suggestions, please get back to us at treg[at]itu.int.

Appendix 2: Note on methodology, G5 Benchmark composition and scoring rationale

	Indicators	Coding guidelines	Remarks
*Track I: Institutional collaboration**			
1	Collaboration with competition authority	Memorandum of understanding or joint program/committee = 2 Semi-formal and informal collaboration = 1 No mechanism for collaboration/ No data = 0	When no separate regulator exists but the ICT regulator has explicit mandate to cover that area: - For spectrum, broadcasting and energy, score = 2; - For competition, consumer protection and data protection, score = 1; - For financial and Internet-related issues, score = 0.
2	Collaboration with consumer protection authority		
3	Collaboration with data protection authority		
4	Collaboration with spectrum agency		
5	Collaboration with broadcasting authority		
6	Collaboration with financial regulator		
7	Collaboration with energy regulator		
8	Collaboration with the agency in charge for Internet-related issues		
** Institutional collaboration, as defined here, refers to the collaboration between the ICT/communications regulator and, where those exist, the separate government agencies responsible for other sectors' or cross-sectoral regulation. A separate government agency is autonomous in their decision-making, financing and reporting requirements.*			
		Cluster score maximum	*Max score: 16*
Track II: Policy Design Principles			
9	Is there a digital strategy in place?	Yes = 2 Digital strategy is being planned, digital strategy is part of a broader development strategy, only specific plans such as e-government strategy existing or not clearly implemented = 1 No = 0	The research looked at evidence of a [policy] document containing a plan or strategy to develop the digital economy or sector.
10	Is the digital strategy SDG-oriented?	Has a digital transformation/ development strategy plan which explicitly mentions SDGs or other international development goals (e.g., MDGs, WSIS goals) = 2 No explicit mention of SDGs = 0	Mention of SDGs or other international development goals (e.g., MDGs, WSIS goals) in the digital strategy statement/ document is required.

	Indicators	Coding guidelines	Remarks
11	Does the digital strategy include multiple sectors of the economy?	Yes = 2 Not clearly expounded = 1 No = 0	E.g. government, health, education, finance etc.
12	Is there a formal requirement for Regulatory Impact Assessment (RIA) before regulatory decisions are made?	Yes = 2 No = 0	A score of 2 corresponds to a situation where all major regulatory decisions are preceded and informed by RIA; a score of 1 might be given if RIA process is established but not consistently applied to all decisions
13	Are there mechanisms for regulatory experimentation?	Yes = 2 No = 0	This includes the ICT regulator running a sandbox, allowing pilots of emerging tech and exploring new ways to regulate, e.g. AI, IoT, fintech.
14	Are there regulatory incentives targeted at network operators?	Regulatory incentives for all operators = 2 Regulatory incentives for specific operators = 1 No = 0	This includes reduced regulatory fees, tax holidays, longer/cheaper licences
15	Is there an innovation policy for the ICT sector?	Yes = 2 Planned or not clearly implemented = 1 No = 0	An holistic innovation policy referring explicitly to the use of ICTs is also considered relevant and corresponds to a score of 2.

	Indicators	Coding guidelines	Remarks
16	Does the regulator uses public consultations to guide regulatory decision-making?	Public consultation are required by law prior to major regulatory decisions, has clear timelines and process for undertaking public consultation, and the regulator incorporates results in their decision-making = 2 Public consultation is required by law prior to regulatory decisions but there is no requirement/ it is unclear what the timeline and process is and whether the regulator incorporates results in their decision-making/ It is required but the timeline is shorter than 3 months and there is no obligation to consider/ respond to all comments = 1 Public consultation is not undertaken or required by law/No data = 0	
17	Are spectrum licenses technology neutral?	Yes = 2 There are exceptions to which bands of the spectrum are technology neutral = 1 No = 0	
		Cluster score maximum	*Max score = 20*
	Track III: G5 Toolbox		
18	Is there a forward-looking competition policy applied to digital markets?	Yes = 2 No = 0	The research looked at whether competition policy is being applied not only to telcos but also to other digital markets like content providers and digital platforms. This could be ex ante and ex post, such as merger approval and investigation.

	Indicators	Coding guidelines	Remarks
19	Are there formal data protection rules (e.g., law, regulations)?	There is a general data protection law and a data protection agency has been established = 2 There is a data protection law but either: i) a data protection agency has not yet been established, ii) the data protection law is not yet implemented, or iii) the law covers only a limited number of activities = 1 No data protection law or regulations yet = 0	
20	Is there cybersecurity legislation or regulation?	Yes = 2 Partial coverage = 1 No = 0	A score of 2 corresponds to a wide-ranging, holistic legislation/ regulations covering multiple related topics (e.g., infrastructure security, cybercrime, child online protection)
21	Are there policies and regulations for e-commerce/e-transactions?	Yes = 2 Rules at regional level exist (e.g., EU) but has not yet formulated national rules to match or no monitoring and enforcement of rules or has limited provisions = 1 No policies rules = 0	
22	Are there policies and regulations for digital financial services/ electronic money?	Yes = 2 No policies or rules = 0	
23	Have you established a regulatory framework to ensure ICT accessibility for persons with disabilities?	Yes = 2 No clear evidence/enforcement or partial = 1 No = 0	
24	Are there specific taxes on Internet services?	Laissez faire/No taxes = 2 Yes = 0	Taxes can be interpreted as restrictions on Internet diffusion and innovation

	Indicators	Coding guidelines	Remarks
25	Does an official register or a mapping exist in your country of all telecommunication/ICT infrastructure?	Yes = 2 Yes, but only for some infrastructure or evidence is not clear = 1 No = 0	
		Cluste Cluster score maximum	*Max score = 18*
			Total score = 50

Appendix 3: List of countries and economies in the ICT Regulatory Tracker

Afghanistan
Albania
Algeria
Andorra
Angola
Antigua and Barbuda
Argentina
Armenia
Australia
Austria
Azerbaijan
Bahamas
Bahrain
Bangladesh
Barbados
Belarus
Belgium
Belize
Benin
Bhutan
Bolivia (Plurinational State of)
Bosnia and Herzegovina
Botswana
Brazil
Brunei Darussalam
Bulgaria
Burkina Faso
Burundi
Cabo Verde
Cambodia
Cameroon
Canada
Central African Rep.
Chad
Chile
China
Colombia
Comoros
Congo (Rep. of the)
Costa Rica
Côte d'Ivoire
Croatia
Cuba
Cyprus
Czech Republic
Dem. Rep. of the Congo
Denmark
Djibouti
Dominica
Dominican Rep.
Ecuador
Egypt
El Salvador
Equatorial Guinea
Eritrea
Estonia
Eswatini
Ethiopia
Fiji
Finland
France
Gabon
Gambia
Georgia
Germany
Ghana
Greece
Grenada
Guatemala
Guinea
Guinea-Bissau
Guyana
Haiti
Honduras
Hong Kong, China
Hungary
Iceland
India
Indonesia
Iran (Islamic Republic of)
Iraq
Ireland
Israel
Italy

Jamaica
Japan
Jordan
Kazakhstan
Kenya
Kiribati
Korea (Rep. of)
Kuwait
Kyrgyzstan
Lao P.D.R.
Latvia
Lebanon
Lesotho
Liberia
Libya
Liechtenstein
Lithuania
Luxembourg
Madagascar
Malawi
Malaysia
Maldives
Mali
Malta
Marshall Islands
Mauritania
Mauritius
Mexico
Micronesia
Moldova
Monaco
Mongolia
Montenegro
Morocco
Mozambique
Myanmar
Namibia
Nauru
Nepal (Republic of)
Netherlands
New Zealand
Nicaragua
Niger
Nigeria
North Macedonia
Norway
Oman
Pakistan
Palestine
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Poland
Portugal
Qatar
Romania
Russian Federation
Rwanda
Saint Kitts and Nevis
Saint Lucia
Saint Vincent and the Grenadines
Samoa
San Marino
Sao Tome and Principe
Saudi Arabia
Senegal
Serbia
Seychelles
Sierra Leone
Singapore
Slovakia
Slovenia
Solomon Islands
Somalia
South Africa
South Sudan
Spain
Sri Lanka
Sudan
Suriname
Sweden
Switzerland
Syrian Arab Republic
Tajikistan
Tanzania
Thailand
Timor-Leste
Togo
Tonga
Trinidad and Tobago
Tunisia
Turkey

Turkmenistan	Uzbekistan
Tuvalu	Vanuatu
Uganda	Venezuela
Ukraine	Viet Nam
United Arab Emirates	Yemen
United Kingdom	Zambia
United States	Zimbabwe
Uruguay	

Appendix 4: List of countries in the G5 Benchmark 2019

Column1	Country	Generation*
1	Albania	G3
2	Argentina	G4
3	Australia	G4
4	Austria	G4
5	Bahamas	G4
6	Bahrain	G4
7	Belgium	G4
8	Bosnia and Herzegovina	G4
9	Botswana	G4
10	Brazil	G4
11	Bulgaria	G4
12	Canada	G4
13	Chile	G3
14	China	G2
15	Colombia	G3
16	Costa Rica	G4
17	Croatia	G4
18	Cyprus	G4
19	Czech Republic	G4
20	Denmark	G4
21	Dominican Rep.	G4
22	Ecuador	G4
23	Egypt	G3
24	Estonia	G4
25	Finland	G4
26	France	G4
27	Georgia	G4
28	Germany	G4
29	Ghana	G4
30	Greece	G4
31	Honduras	G3
32	Hungary	G4
33	Iceland	G4
34	India	G3
35	Indonesia	G3
36	Iran (I.R.)	G3
37	Ireland	G4
38	Italy	G4
39	Jamaica	G3
40	Japan	G3
41	Jordan	G4
42	Kenya	G4

Column1	Country	Generation*
43	Korea (Rep.)	G3
44	Latvia	G4
45	Lithuania	G4
46	Malawi	G4
47	Malaysia	G4
48	Malta	G4
49	Mexico	G4
50	Moldova	G4
51	Monaco	G4
52	Mongolia	G2
53	Montenegro	G4
54	Morocco	G4
55	Netherlands	G4
56	New Zealand	G3
57	Nigeria	G3
58	Norway	G4
59	Oman	G4
60	Pakistan	G4
61	Panama	G4
62	Peru	G4
63	Poland	G4
64	Portugal	G4
65	Romania	G4
66	Rwanda	G3
67	Saudi Arabia	G4
68	Senegal	G4
69	Serbia	G4
70	Singapore	G4
71	Slovakia	G4
72	Slovenia	G4
73	South Africa	G3
74	Spain	G4
75	Sweden	G4
76	Switzerland	G4
77	Tanzania	G4
78	Thailand	G3
79	Trinidad and Tobago	G4
80	Turkey	G3
81	Uganda	G4
82	United Arab Emirates	G4
83	United Kingdom	G4
84	United States	G4

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